



Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

FREEDOM OF INFORMATION ACT/PRIVACY PROGRAM

September 16, 2024

In reply refer to: FOIA #BPA-2023-00855-F (Missel)

Andrew Missel
Advocates for the West
3701 SE Milwaukie Ave., Ste. B
Portland, OR 97202
Email: amissel@advocateswest.org

Dear Mr. Missel,

This communication is the Bonneville Power Administration's (BPA) second partial response to your request for records, submitted to the agency under the Freedom of Information Act, 5 U.S.C. § 552 (FOIA). Your request was received on April 20, 2023, and formally acknowledged on May 11, 2023, and a first partial release of records was provided to you on July 31, 2024.

Original Request

“...the records described below concerning the relationship between the Bonneville Power Administration (“BPA”) and Energy and Environmental Economics, Inc. (“E3”)—specifically, records pertaining to the Lower Snake River Dams Replacement Study (“LSRD Study”) commissioned by BPA and prepared by E3 that was released in July 2022:

1. All contracts, statements of work, and similar documents between BPA and E3 that were prepared or executed in connection with the LSRD Study;
2. All communications between BPA and E3 that relate in any way to the LSRD Study, including any communications concerning the LSRD Study’s release, press stories about the LSRD Study, etc.;
3. All records that document, memorialize, or refer to any meetings, conversations, or other communications between BPA and E3 concerning the LSRD Study; and
4. All internal BPA memos, emails, etc. that refer to the LSRD Study.”

Clarifications

Following email exchanges with the agency’s FOIA Public Liaison between June 22, 2023 and June 28, 2023, you amended the scope of your FOIA request to, “...limit the search ... to include only those communications that have someone from E3 on one end...” and “...re-scope the request to seek only ‘all emails from [DATE] to the date of search that include anyone from E3 in any address field (e.g., to, from, cc),’ where [DATE] is either January 1, 2019 or some later date that, according to knowledgeable BPA personnel, marks the start of BPA's efforts to commission the LSRD Study. Of course, I would like any attachments to responsive emails as well.” This was in addition to the records BPA had already collected.

Second Partial Response

To both accommodate the review of the large volume of responsive records and to provide the records expediently within the limitations of available agency resources, BPA is releasing responsive records to you in installments, as permitted by the FOIA. A second partial release of one Excel file and 814 pages accompany this communication with 190 redactions applied under 5 U.S.C. § 552(b)(6). A more detailed explanation of the applied exemptions follows.

Explanation of Exemptions

The FOIA generally requires the release of all agency records upon request. However, the FOIA permits or requires withholding certain limited information that falls under one or more of nine statutory exemptions (5 U.S.C. §§ 552(b)(1-9)).

Exemption 6

Exemption 6 serves to protect Personally Identifiable Information contained in agency records when no overriding public interest in the information exists. BPA does not find an overriding public interest in a release of the information redacted under Exemption 6—specifically, signatures, cell phone numbers, Webex numbers and access codes, and personal discussions not related to agency business. This information sheds no light on the executive functions of the agency and BPA finds no overriding public interest in its release. BPA cannot waive these redactions, as the protections afforded by Exemption 6 belong to individuals and not to the agency.

Certification

Pursuant to 10 C.F.R. § 1004.7(b)(2), I am the individual responsible for the partial release and exemption determinations described above.

Next Partial Release Target Date

BPA continues to review and process the remaining responsive records collected in response to your request. The agency estimates a next partial records release date of October 31, 2024.

If you have any questions about the content of this communication, please contact FOIA Public Liaison, James King, at jjking@bpa.gov or (503) 230-7621 or FOIA Program Lead, Jason Taylor, at jetaylor@bpa.gov or (503) 230-3537.

Sincerely,

Candice D. Palen
Freedom of Information/Privacy Act Officer

Responsive agency records accompany this communication.

From: Aaron Burdick <aaron.burdick@ethree.com>
Sent: Monday, August 1, 2022 9:51 AM
To: Koehler,Birgit G (BPA) - PG-5; Arne Olson
Cc: James,Eve A L (BPA) - PG-5
Subject: [EXTERNAL] RE: [EXTERNAL] RNW's Feedback on E3 LSRD Replacement Study for BPA

Thanks for sharing. Seems to mirror their Clearing Up article. We'll address these points in our forthcoming response.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Monday, August 1, 2022 7:04 AM
To: Arne Olson <arne@ethree.com>; Aaron Burdick <aaron.burdick@ethree.com>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: FW: [EXTERNAL] RNW's Feedback on E3 LSRD Replacement Study for BPA

Good morning Arne and Aaron,

This email reached me late on Friday. Thought you'd want to see it.

And I noticed the first footnote link goes to the White House where they posted the embargoed copy. That does not include the changes you made right before publishing. I'll track down if it is possible to replace that paper with the final version.

Cheers,
Birgit

From: Sashwat Roy <sashwat@renewablenw.org>
Sent: Friday, July 29, 2022 10:41 AM
To: Tech Forum <techforum@bpa.gov>
Cc: Warner,Joshua P (BPA) - AIR-7 <jpwarner@bpa.gov>
Subject: [EXTERNAL] RNW's Feedback on E3 LSRD Replacement Study for BPA

Hello,

Please find attached Renewable Northwest's comments on the recently released study of LSRD replacement conducted by E3 for BPA. Please feel free to reach out if you have any questions or concerns.

Thank you!

Best,

Sashwat

--

Sashwat Roy, Ph.D.

Technology & Policy Manager

Renewable Northwest

421 SW 6th Ave, Suite 1400, Portland, OR 97204

503.223.4544 Portland Office

(b)(6) (mobile)

www.RenewableNW.org

From: James,Eve A L (BPA) - PG-5
Sent: Thursday, June 30, 2022 2:20 PM
To: Arne Olson; Aaron Burdick
Subject: CEQ meeting

Importance: High

Deliberative, FOIA exempt

Hi Aaron and Arne-

There is a question for another potential meeting with CEQ for presenting E3 study. I don't know if that would be just Q&A or what exactly they want. They were thinking during a regularly scheduled meeting would be a good time which is July 11 6 AM – 8 AM PDT (9 – 11 AM EDT). Let me know if that works with your schedules otherwise we can find another time if it is needed.

They would like feedback ASAP on your availability. I am working on the email from Aaron about the NPV and coordinating with some of our finance/fed hydro staff and will get back to you on that soon.

Thanks,
Eve

From: James,Eve A L (BPA) - PG-5
Sent: Monday, May 2, 2022 3:02 PM
To: Aaron Burdick
Cc: Arne Olson; Koehler,Birgit G (BPA) - PG-5 (bgkoehler@bpa.gov)
Subject: Quick check-in

Deliberative; FOIA Exempt

Hi Aaron-

I wanted to touch base before the meeting with DOE this Friday. I think the project is probably getting to the point where I expect to start getting questions about the potential for a peer review of the study. I know last meeting DOE was quite eager to have some of their staff available for peer review or to provide any support for the qualitative study of additional services not captured in the RESOLVE model. Let us know how receptive E3 would be to any peer review and if you are okay if we reach out to DOE staff. I can touch base with our contracting group but I think there could be a simple contract modification where we could add a peer review task if you are open to one. If so, think about if you would like to initiate contacting potential peer reviewers or if you would like us to. At one point EFI was discussed as a potential peer-review source but I don't know if they have bandwidth. Before I get too far along on brain-storming peer review let me know your thoughts and we can coordinate on how best to proceed. I'm happy to have a quick check-in call or email works- whatever your preference.

Thanks,
Eve

From: James,Eve A L (BPA) - PG-5
Sent: Tuesday, July 12, 2022 5:03 PM
To: Arne Olson; Koehler,Birgit G (BPA) - PG-5
Cc: Aaron Burdick
Subject: RE: Anything you want to debreif about?

I thought you guys did a great job presenting and that it went well. I don't have anything to debrief.

From: Arne Olson <arne@ethree.com>
Sent: Tuesday, July 12, 2022 5:01 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Aaron Burdick <aaron.burdick@ethree.com>
Subject: [EXTERNAL] Anything you want to debreif about?

Arne Olson, Senior Partner

Energy and Environmental Economics, Inc. (E3)
44 Montgomery Street, Suite 1500 | San Francisco, CA 94104
415-391-5100, ext. 307 | (b)(6) mobile | arne@ethree.com
he/him/his

From: James,Eve A L (BPA) - PG-5
Sent: Monday, June 27, 2022 11:52 AM
To: Jennifer Light; Chad Madron; Egerdahl,Ryan J (BPA) - PGPR-5; Arne Olsen (arne@ethree.com)
Cc: Kendra Coles; Donahue,Scott L (BPA) - EWP-4; Walker,Danielle N (BPA) - EW-4; Moody,David F (BPA) - PEH-6
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

I will coordinate with Arne on materials and get back to you.

Thanks,
Eve

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Monday, June 27, 2022 11:49 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Chad Madron <CMadron@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>
Cc: Kendra Coles <kcoles@nwcouncil.org>; Donahue,Scott L (BPA) - EWP-4 <sldonahue@bpa.gov>; Walker,Danielle N (BPA) - EW-4 <dnwalker@bpa.gov>; Moody,David F (BPA) - PEH-6 <dfmoody@bpa.gov>
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Thanks Eve. We will put Arne down as presenter.

Is there a name for the study I can reference or any executive summary or other material we can share with the members in advance? I am working on a packet memo, and any information you can provide that will help the members prepare would be appreciated.

Thanks,
Jennifer

Jennifer Light (she/her)
Interim Director of Power Planning
Office: 503-222-5161 | Direct: (b)(6)
www.nwcouncil.org | [LinkedIn](#)



From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Monday, June 27, 2022 10:58 AM
To: Chad Madron <CMadron@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>
Cc: Jennifer Light <JLight@NWCouncil.org>; Kendra Coles <kcoles@nwcouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Thanks Chad- no one from BPA will be presenting. Arne will be presenting the E3 study results.

From: Chad Madron <CMadron@NWCouncil.org>

Sent: Monday, June 27, 2022 10:48 AM

To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjeagerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Cc: Jennifer Light <JLight@NWCouncil.org>; Kendra Coles <kcoles@nwcouncil.org>

Subject: [EXTERNAL] Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Ryan, Eve, and Arne,

I am working with Jenn on pulling together a memo and any other background material we can for Members ahead of the July 7 presentation on BPA's Snake River Dams study that is at 8:30am Pacific.

Can you confirm who from BPA and E3 will officially be presenting/speaking? Arne, I know you are giving the main presentation. Is there a report exec summary or any slides we could include with the memo to help them prepare? We will be sending them the prep memo THIS Wed by the middle of the day. Any info you can help us provide to help them be prepared is appreciated.

For July 7 – I will make sure you three all have calendar invites and panelist email/invites for the webinar.

Arne – speakers generally appear on camera, but it is not required. Our preference is for you to send me your slides and then I use our computer to present them, but give you “keyboard and mouse control” so you can advance them using your equipment. This makes it so you don't have to worry about presenting from your machine. If you are very comfortable presenting from your screen directly we can accommodate that, we just find we have more consistent results if we do it the other way as different folks have differing levels of comfort with different webinar technologies.

You should all get the GoToWebinar emails today! Those will have your UNIQUE entry links for the webinar. You will get the emails again 1 day and 1 hour before the meeting as reminders.

From: James,Eve A L (BPA) - PG-5
Sent: Tuesday, June 28, 2022 11:23 AM
To: Jennifer Light; Chad Madron; Egerdahl,Ryan J (BPA) - PGPR-5; Arne Olsen (arne@ethree.com)
Cc: Kendra Coles; Donahue,Scott L (BPA) - EWP-4; Walker,Danielle N (BPA) - EW-4; Moody,David F (BPA) - PEH-6
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Sounds good Jennifer- thank you. I know we are working to get the materials completed and they will be posted on our website at [Hydropower Impact - Bonneville Power Administration \(bpa.gov\)](https://www.bpa.gov) I will reach out to our website folks and get back to you on timing.

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Tuesday, June 28, 2022 11:14 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Chad Madron <CMadron@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>
Cc: Kendra Coles <kcoles@nwcouncil.org>; Donahue,Scott L (BPA) - EWP-4 <sldonahue@bpa.gov>; Walker,Danielle N (BPA) - EW-4 <dnwalker@bpa.gov>; Moody,David F (BPA) - PEH-6 <dfmoody@bpa.gov>
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Eve,

We can update that title.

For the presentation materials and report, when and where might you post that? I can track it and point the members to it when ready.

Thanks,
Jennifer

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, June 28, 2022 11:06 AM
To: Jennifer Light <JLight@NWCouncil.org>; Chad Madron <CMadron@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>
Cc: Kendra Coles <kcoles@nwcouncil.org>; Donahue,Scott L (BPA) - EWP-4 <sldonahue@bpa.gov>; Walker,Danielle N (BPA) - EW-4 <dnwalker@bpa.gov>; Moody,David F (BPA) - PEH-6 <dfmoody@bpa.gov>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Jennifer-

Could you call the study Energy and Environmental Economics (E3) study on Lower Snake River Dams Power Replacement? I want it to be clear that this analysis was completed by E3. We won't have materials to be distributed by Wednesday but will be posting the presentation materials and report on our website.

Thanks,
Eve

From: James,Eve A L (BPA) - PG-5
Sent: Monday, June 27, 2022 11:52 AM
To: Jennifer Light <JLight@NWCouncil.org>; Chad Madron <CMadron@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegeerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>
Cc: Kendra Coles <kcoles@nwcouncil.org>; Donahue,Scott L (BPA) - EWP-4 <sldonahue@bpa.gov>; Walker,Danielle N (BPA) - EW-4 <dnwalker@bpa.gov>; Moody,David F (BPA) - PEH-6 <dfmoody@bpa.gov>
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Sent: Monday, June 27, 2022 10:48 AM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegeerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>;

James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Cc: Jennifer Light <JLight@NWCouncil.org>; Kendra Coles <kcoles@nwcouncil.org>

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Arne – speakers generally appear on camera, but it is not required. Our preference is for you to send me your slides and then I use our computer to present them, but give you “keyboard and mouse control” so you can advance them using your equipment. This makes it so you don't have to worry about presenting from your machine. If you are very comfortable presenting from your screen directly we can accommodate that, we just find we have more consistent results if we do it the other way as different folks have differing levels of comfort with different webinar technologies.

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From: James,Eve A L (BPA) - PG-5
Sent: Monday, May 9, 2022 3:17 PM
To: Aaron Burdick
Cc: Koehler,Birgit G (BPA) - PG-5 (bgkoehler@bpa.gov); Arne Olson
Subject: Tx feedback

DELIBERATIVE FOIA EXEMPT

Hi Aaron-

I forwarded the BPA_RESOLVE Results + Qualitative Benefits_DRAFT_050422.pdf version of the materials you sent to some transmission staff and asked them to provide feedback on slides 49-52 that had the qualitative describe grid benefits information. Here is some information they provided:

Slide 48: Change "Hydropower is uniquely suited to overhead-dependent grid services like dynamic reactive power support" to "Hydropower is very well suited to overhead-dependent grid services like dynamic reactive power support". Also, if the presentation is going to use the phrase "dynamic reactive power support", it should probably define what is meant by the term "dynamic".

Slide 49: I do not like this slide. It implies that the reactive power production from the PNW is a resource that can be readily used or exported throughout the WECC. Unlike real power (MW), reactive power (MVAR) cannot be moved over long distances. We cannot rely on voltage support in Montana to maintain the voltage in Seattle. The reactive support from the hydro plants is very important on a more local level within the NW, so that is where the emphasis should be. Furthermore, if properly configured, inverter based resources can actually do a reasonably good job of providing reactive support. Again, there has to be some kind of source behind the inverter, so there are limitations. However, the point is that there are some complex technical subtleties that would have to be included rather than just one blanket statement that implies that inverter based resources cannot provide voltage support.

Slide 50: Instead of using the term "conventional power plants", it would be better to say "steam-driven and combustion turbine power plants".

Slide 51: Same comment regarding use of the word "conventional". Hydropower is a form of conventional generation.

Slide 52: The description under Remedial Action Schemes is not correct. We use hydro plants in RAS schemes not because they have "headroom". Rather, it is because they are very robust and can withstand being suddenly tripped off-line as part of a RAS action. An inverter-based resource would probably also work well in a RAS scheme. We have already hooked up a lot of the regional wind resources to our RAS. The plants that do not do well for RAS are conventional steam-driven and combustion turbine plants because they are spinning at such high rates of speed. Also on this slide, any synchronous generator, be it hydro or thermal driven, is a good source of grounding and ground current. Inverter based resources are not.

Let me know if you have any questions or concerns about the feedback- I am happy to set up a meeting with the transmission folks if needed.

Thanks,
Eve

From: Leary, Jill C (BPA) - LN-7
Sent: Tuesday, July 5, 2022 1:56 PM
To: Koehler, Birgit G (BPA) - PG-5; Johnson, G Douglas (BPA) - DK-7
Cc: Godwin, Mary E (BPA) - LN-7; James, Eve A L (BPA) - PG-5; Armentrout, Scott G (BPA) - E-4; Baskerville, Sonya L (BPA) - AIN-WASH; Zelinsky, Benjamin D (BPA) - E-4
Subject: RE: Next question: \$75 billion

I like it, thanks.

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 5, 2022 1:46 PM
To: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Johnson, G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Cc: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmtrout@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Subject: RE: Next question: \$75 billion

Confidential and privileged attorney client communication/FOIA-exempt

Based on info Eve and Doug shared, the below is correct.

If we want to add something for the TPs, here's an idea for this bullet,

- New resources to replace the existing lower Snake River dams' energy and capacity would cost between \$10.7 to 19.0 billion with at least one emerging technology and up to \$75.2 billion absent breakthroughs in not-yet-commercialized emerging technologies. If these costs are not paid for by an outside source, it would result in higher electric bills for millions of Northwest residents. **(These net present value costs were calculated using a 3% discount rate, consistent with the discount rate used in the Inslee/Murray draft report which is a reasonable rate for public financing of large utility projects.)**

From: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Tuesday, July 5, 2022 11:48 AM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson, G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Cc: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmtrout@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Subject: Next question: \$75 billion

Confidential and privileged attorney client communication/FOIA-exempt

Hi Birgit and Doug,

CEQ and DOE are asking about the change from \$45 billion to \$75 billion in the final report. It sounds like Eve and Doug talked through this issue on Friday, and it originates from the change in discount rate from 5% to 3% to be more consistent with the discount rate used by the Inslee/Murray report.

Is that correct?

Doug, if so, we should make sure that is clear in the talking points because I do not see this information updated in the latest version you sent earlier today.

Thanks,
Jill

From: Koehler,Birgit G (BPA) - PG-5
Sent: Wednesday, July 6, 2022 4:36 PM
To: Arne Olson
Cc: James,Eve A L (BPA) - PG-5
Subject: RE: latest update

DELIBERATIVE FOIA EXEMPT

I forgot the header again! And am including my phone below

.....
Birgit Koehler (she/her/hers)
Deputy Director of Power Generation Asset Management
[BONNEVILLE POWER ADMINISTRATION](https://www.bonnevillepoweradministration.com)
bgkoehler@bpa.gov | O: 503-230-4249



From: Koehler,Birgit G (BPA) - PG-5
Sent: Wednesday, July 6, 2022 4:34 PM
To: Arne Olson <arne@ethree.com>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: latest update

Hello Arne,

Here is the latest information I have.

“The E3 presentation to the Council tomorrow will **likely** be canceled. The current plan is to delay one week, potentially to the full Council meeting, but this still needs to be confirmed and coordinated.”

Once I hear that a decision is finalized, I’ll send you another email plus let the Council staff know. The Council Chair has already been contacted. On the Council website, I see that the next Council meeting is July 12 and 13th.

(Clearing Up will be an interesting read this weekend.)

Birgit

From: Baskerville, Sonya L (BPA) - AIN-WASH
Sent: Wednesday, May 25, 2022 7:37 AM
To: Koehler, Birgit G (BPA) - PG-5; James, Eve A L (BPA) - PG-5; Leary, Jill C (BPA) - LN-7
Subject: DOE review response edits needed

Short and sweet. Works for me!

Sonya Baskerville
BPA National Relations

(b)(6) m

On May 25, 2022 10:17 AM, "James, Eve A L (BPA) - PG-5" <ejames@bpa.gov> wrote:

Deliberative Process Privilege; FOIA-exempt

Good Morning- We are almost done addressing DOE/National Labs peer review. The only outstanding comment I took a stab at but please edit/comment as needed (I kept it short but can expand if needed):

- **External Review Process:** Does BPA anticipate issuing the final report without an opportunity for external stakeholder review of a draft? It may be productive to discuss the possible value, advantages, and disadvantages of offering regional stakeholders an opportunity to review and comment on the draft—recognizing that conducting such a review would entail time and budget.

o When the results are final, E3 will conduct a public webinar to review the results of the study and BPA will post the study to its website.

From: Armentrout,Scott G (BPA) - E-4
Sent: Friday, June 3, 2022 4:55 PM
To: Cooper,Suzanne B (BPA) - P-6; Koehler,Birgit G (BPA) - PG-5; Leady Jr,William J (BPA) - PG-5; Cook,Joel D (BPA) - K-7; Hairston,John L (BPA) - A-7; Zelinsky,Benjamin D (BPA) - E-4; Sullivan,Leah S (BPA) - EWP-4; James,Eve A L (BPA) - PG-5; Godwin,Mary E (BPA) - LN-7; Senters,Anne E (BPA) - LN-7; Leary,Jill C (BPA) - LN-7
Subject: E3 results presentations

Eve and all, thanks for your intense efforts. This reflects well all the feedback given - quite a feat!!!!

On Jun 3, 2022 4:05 PM, "James,Eve A L (BPA) - PG-5" <cajames@bpa.gov> wrote:

Deliberative, FOIA exempt

Hello-

Attached are the presentations sent to DOE for feedback- the E3 study results and BPA's perspective on the study results. DOE will be providing feedback by Wednesday and I believe there is coordination to schedule a time to present to CEQ.

Thanks,

Eve

From: Diffely,Robert J (BPA) - PGPL-5
Sent: Wednesday, May 4, 2022 9:31 AM
To: Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5
Subject: E3 study takeaway

The takeaway for me on the E3 study is that without replacing the LSRDs with long term dispatchable capacity (NG, Hydrogen, SMR) the costs are prohibitive (annual costs, renewable builds, and land use).

From: Bellcoff,Steve (BPA) - PGPR-5
Sent: Friday, July 29, 2022 7:55 PM
To: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5
Cc: Kukreti,Rahul (BPA) - B-3; Zimmerman,Nita M (BPA) - B-3
Subject: FW: [EXTERNAL] RNW's Feedback on E3 LSRD Replacement Study for BPA
Attachments: 07-29-2022 RNW Comments on E3 Lower Snake River Dam Replacement Study_To BPA.pdf

Eve/Birgit – I would image this comment really goes your way.

It ties in the WRAP with assumption that the 15% planning reserve margin used by E3 should be a lot less. I don't think any of the PRM numbers from the WRAP are public yet so that is an assumption.

Steve

From: Kukreti,Rahul (BPA) - B-3 <rxkukreti@bpa.gov>
Sent: Friday, July 29, 2022 6:25 PM
To: Zimmerman,Nita M (BPA) - B-3 <nmzimmerman@bpa.gov>; Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>
Subject: FW: [EXTERNAL] RNW's Feedback on E3 LSRD Replacement Study for BPA

Hi all,

I thought you should be aware of these comments that came into us from TechForum (from Renewable NW). They raise the issue that the E3 study did not consider WRAP in its analysis.

Thanks
Rahul

From: Tech Forum <techforum@bpa.gov>
Sent: Friday, July 29, 2022 12:24 PM
To: Truong,Mai N (BPA) - B-3 <mntruong@bpa.gov>; Kukreti,Rahul (BPA) - B-3 <rxkukreti@bpa.gov>; Mantifel,Russell (BPA) - PGL-5 <rxmantifel@bpa.gov>
Subject: FW: [EXTERNAL] RNW's Feedback on E3 LSRD Replacement Study for BPA

Morning all,

We received this comments this morning and are unsure of exactly who to forward to however there was mention of "resource adequacy" so checking with this team first.

Regards,
Tech Forum

From: Sashwat Roy <sashwat@renewablenw.org>
Sent: Friday, July 29, 2022 10:41 AM
To: Tech Forum <techforum@bpa.gov>
Cc: Warner,Joshua P (BPA) - AIR-7 <jpwarnar@bpa.gov>
Subject: [EXTERNAL] RNW's Feedback on E3 LSRD Replacement Study for BPA

Hello,

Please find attached Renewable Northwest's comments on the recently released study of LSRD replacement conducted by E3 for BPA. Please feel free to reach out if you have any questions or concerns.

Thank you!

Best,

Sashwat

--

Sashwat Roy, Ph.D.

Technology & Policy Manager

Renewable Northwest

421 SW 6th Ave, Suite 1400, Portland, OR 97204

503-223-4544 Portland Office

(b)(6) mobile)

www.RenewableNW.org

From: Koehler,Birgit G (BPA) - PG-5
Sent: Friday, August 5, 2022 11:19 AM
To: James,Eve A L (BPA) - PG-5
Subject: FW: [EXTERNAL] RNW's Feedback on E3 LSRD Replacement Study for BPA

FYI

From: Koehler,Birgit G (BPA) - PG-5
Sent: Monday, August 1, 2022 1:16 PM
To: Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>
Subject: RE: [EXTERNAL] RNW's Feedback on E3 LSRD Replacement Study for BPA

I was expecting them to close out most of the tasks, but not necessarily the last task since we might still receive requests for presentations

The written material is complete, presentation and report

From: Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>
Sent: Monday, August 1, 2022 1:02 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: [EXTERNAL] RNW's Feedback on E3 LSRD Replacement Study for BPA

Thanks!

Another question for you since Eve is out 😊

I received Final invoices from E3 on Friday... I need to check in and make sure that everything was completed before submitting them for payment.

I don't suppose you have any knowledge 😊 I can hold it for next Monday when Eve is back as well so no problem either way.

Steve

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Monday, August 1, 2022 10:54 AM
To: Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Kukreti,Rahul (BPA) - B-3 <rxkukreti@bpa.gov>; Zimmerman,Nita M (BPA) - B-3 <nmzimmerman@bpa.gov>; Warner,Joshua P (BPA) - AIR-7 <jpwarner@bpa.gov>
Subject: RE: [EXTERNAL] RNW's Feedback on E3 LSRD Replacement Study for BPA

Steve,

Thanks for forwarding this. The letter is similar to a piece RNW wrote in Clearing Up. I've forwarded the letter to E3 because E3 is preparing a technical reply to RNW's article for this Friday's Clearing Up. E3 tells us that there are miscommunications and misunderstandings.

Birgit

From: Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>
Sent: Friday, July 29, 2022 7:55 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Kukreti,Rahul (BPA) - B-3 <rxkukreti@bpa.gov>; Zimmerman,Nita M (BPA) - B-3 <nmzimmerman@bpa.gov>
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Sent: Friday, July 29, 2022 6:25 PM
To: Zimmerman,Nita M (BPA) - B-3 <nmzimmerman@bpa.gov>; Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>
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Thanks
Rahul

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Sent: Friday, July 29, 2022 12:24 PM
To: Truong,Mai N (BPA) - B-3 <mntruong@bpa.gov>; Kukreti,Rahul (BPA) - B-3 <rxkukreti@bpa.gov>; Mantifel,Russell (BPA) - PGL-5 <rxmantifel@bpa.gov>
Subject: FW: [EXTERNAL] RNW's Feedback on E3 LSRD Replacement Study for BPA

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Sent: Friday, July 29, 2022 10:41 AM
To: Tech Forum <techforum@bpa.gov>
Cc: Warner,Joshua P (BPA) - AIR-7 <jpwarner@bpa.gov>
Subject: [EXTERNAL] RNW's Feedback on E3 LSRD Replacement Study for BPA

Hello,

Please find attached Renewable Northwest's comments on the recently released study of LSRD replacement conducted by E3 for BPA. Please feel free to reach out if you have any questions or concerns.

Thank you!

Best,

Sashwat

--

Sashwat Roy, Ph.D.
Technology & Policy Manager
Renewable Northwest
421 SW 6th Ave, Suite 1400, Portland, OR 97204
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Comments on E3 Lower Snake River Dam Replacement Study

July 29, 2022

Renewable Northwest appreciates the opportunity to provide feedback to BPA on the E3 study on replacing the power and capacity of the Lower Snake River Dams. While we are not taking a position on whether or not the dams should be breached recognizing the fact that there are other underlying factors at play, we are extremely concerned about assertions in the E3 study which essentially portrays an alternate reality where only “firm or dispatchable” resources like natural-gas fired power plants and small modular nuclear reactors are able to replace the capacity provided by the LSRD. Hybrid and standalone energy storage projects (including long-duration energy storage resources) will be an important complementary resource to BPA’s hydro fleet in providing the necessary capacity and flexibility to the PNW electric grid. We share the following points to ensure that BPA is aware of the study assumptions used by E3 and recent developments in the Pacific Northwest region:

- 1. RESOLVE does not account for the full value of hybrid and standalone energy storage resources.**

As per E3¹, the Northwest RESOLVE model simulates the operations of the WECC system for 41 independent days sampled from the historical meteorological record of the period 2007-2009. Rather than make investment decisions based on a model of at least one full year, incumbent models design including RESOLVE create resource portfolios using a small sample of hours or days, and assume that this trimmed down time series accurately captures the full intra-year variability of renewable resources and storage. Thus, RESOLVE is not a direct replacement for a production cost model which can run sequentially for 8760 hours (hourly resolution) and can fully dispatch resources across hours, days and weeks to understand the system & resource

¹ E3, BPA LSRD Study.

<https://www.whitehouse.gov/wp-content/uploads/2022/07/E3-BPA-LSR-Dams-Report.pdf>

interactions and dispatch, and instead selects resources based on their capital costs (or capex) to fill the need instead of accounting for the value provided by other resources.

RESOLVE primarily replaces the carbon-free energy from the dams with additional wind power and the firm capacity with dual fuel natural gas and hydrogen combustion plants. Small amounts of additional energy efficiency and battery storage are also selected in some scenarios. The report mentions that “storage resources such as battery storage and pumped hydro support renewable integration but show limited capacity value given the large shares of hydro in the Northwest region.” This again highlights the limitations of relying on a capacity expansion model without complimenting a full-year production cost model because storage resources can provide both flexibility and capacity benefits and act as a complement to the NW hydro resources. In fact, the scenario in which E3 assumes a high battery ELCC due to higher summer demand, with the LSR dams intact, leads to 1.5 GW of batteries to be selected and 1.4 GW less dual fuel natural gas and hydrogen plants. In Scenario 2a, with the LSR dams intact, higher battery ELCCs cause another 2.4 GW of batteries and another 0.3 GW of wind to be selected, with 3.6 GW less dual fuel natural gas and hydrogen plants. The reason behind their exclusion in the case when LSRD is breached is primarily due to their rapidly declining capacity contribution which is hard to understand because if the region procures more renewable resources, the battery storage ELCCs should decline much less rapidly because they have the ability to absorb and provide energy during the higher demand hours.

It is also important to note that E3 does not explicitly model hybrid solar/wind + battery storage resources in the study. In fact, hybrid resources are not even mentioned in their study report. Although battery storage resources can be selected individually by the RECAP model, it seems that model cannot co-optimize its dispatch with solar or wind generation which leaves a lot of value on the table. The argument that states like Oregon, Washington and Idaho are not resource-rich which make hybrid resources not cost-effective is false because based on recent IRP modeling from PacifiCorp, Portland General Electric and Idaho Power, hybrid resources especially solar paired with 4-hour battery storage has over 80% ELCC value. In fact, Idaho Power’s recent portfolio modeling in their 2021 IRP² shows that ELCC values of hybrids and standalone storage exceed 85% with 8-hour battery storage assigned a 97% ELCC value. It is therefore implausible that a capacity expansion model would not select solar plus storage or even long-duration standalone storage resources like pumped hydro in the region unless the model does not fully realize its value. We recommend that E3 clarifies whether solar and battery storage resources are being co-optimized endogenously in the model. The co-optimization aspect is extremely important because if the model is not able to do that, it leads to overbuilding and over-curtailment in the resource portfolio because as E3 notes, the battery storage ELCCs decline sharply due to declining marginal contributions.

² Idaho Power 2021 IRP.

https://docs.idahopower.com/pdfs/AboutUs/PlanningforFuture/irp/2021/2021%20IRP_WEB.pdf

2. E3's modeling does not account for the impact of climate change-adjusted hydro and load in the changing demand pattern of the region.

According to the recent 2021 Secure Water Act Study by the Bureau of Reclamation³, increasing temperatures, earlier runoff and lower summer flows may reduce hydropower flexibility in the Pacific Northwest. This is particularly impactful for the summer peak hours. E3 states that “[t]he biggest cost drivers for replacement resources are the need to replace the lost firm capacity for regional resource adequacy” especially during multi-day events in the winter. E3 has been recently contracted by Puget Sound Energy to undertake a Resource Adequacy analysis for their 2023 Electric IRP wherein they would expressly consider downscaled climate data to understand the changing hydro flow patterns in the region. Specifically, the climate data suggests that the Pacific Northwest is increasingly moving towards more high-demand hours in the summer than winter due to lesser hydro availability in summer primarily due to higher temperatures. This was also concluded by the recently released 2021 Power Plan by the Northwest Power and Conservation Council. In fact in their review of PSE’s ELCC methodology, E3 themselves state that “moving forward, PSE’s winter peaks may be reduced relative to summer peaks based on more recent climate warming trends, which has the potential to impact PSE’s resource planning.” Thus, it is surprising that E3 does not consider downscaled climate data that BPA has worked on with Army Corp and other entities to undertake this regional analysis and instead relies on historical data which is outdated as can be seen from recent events in the summer months..

3. The region is moving towards clean, non-emitting capacity resources to meet capacity needs and state-policy targets.

Investor-owned utilities like PacifiCorp, PGE, Idaho Power and others will procure more than 3 GWs solar, wind, hybrid and energy storage resources over the next few years, owing their zero variable costs, increasingly lower capex and their operational characteristics which include flexibility as well as dispatchability. The resources selected for replacement of LSRD by the E3 study which includes dual-fuel natural gas and SMRs are extremely unlikely and speculative in the near-term due to practical concerns. In fact, Oregon PUC recently acknowledged⁴ PacifiCorp’s 2021 IRP only to the extent that the Natrium nuclear project is not included in the preferred portfolio thus showing the financial risk in such investments. While hydrogen-fired

³ 2021 SECURE Water Act Report. Bureau of Reclamation.
<https://www.usbr.gov/newsroom/#!/news-release/3807>

⁴ OPUC Acknowledges PacifiCorp's 2021 IRP, Minus SMR Project
https://www.newsdata.com/clearing_up/supply_and_demand/opuc-acknowledges-pacificcorps-2021-irp-minus-smr-project/article_42138672-b216-11ec-b339-4b0243066b08.html

combustion turbines may be cost-effective in the future, there is not enough supply or infrastructure including pipelines of clean hydrogen in the region to satisfy that need in the near-term. The study also does not account for the fact that a lot of additional solar and wind power plants would have to be constructed to produce that clean hydrogen in the first place. Additionally, the study also does not consider the electrolyzer load that would be added to the system and how it would interact with the generation portfolio in the Pacific Northwest. Thus, investing in natural gas-fired generation in the present with a hope that eventually they would be converted to burn hydrogen is a risky investment strategy.

4. The effect of the regional resource adequacy program (or western resource adequacy program) is not captured in the E3 study.

E3 states that “resource adequacy needs are captured in RESOLVE by ensuring that all resource portfolios have enough capacity to meet the peak Core Northwest median peak demand plus a 15% planning reserve margin.” The 15% planning reserve margin assumption would not be true in the near future when BPA along with major utilities across the northwest start participating in the program along with utilities in the southwest region creating a larger footprint. The load and resource diversity in the region would lead to a more efficient resource buildout and allocation going forward which essentially means lower PRMs for individual utilities.

To meet regional decarbonization goals and mandates irrespective of whether the lower Snake River dams are breached or not, load-serving entities will need to procure clean and non-emitting capacity resources like solar or wind, paired with battery storage and longer duration batteries and pumped-hydro resources. Investor-owned utilities in the region have already started on this energy transition. It is unhelpful to the region to continue to rely on speculative markets and outdated modeling assumptions which exclude existing capacity resources. The tools and analysis used to determine how to move forward on new procurements and generator replacements need to consider resources which are commercially available and consistent with our region's procurement mandates and decarbonization goals.

/s/ Sashwat Roy
Technology & Policy Manager
Renewable Northwest
421 SW Sixth Ave. #1400
Portland, OR 97204
(503) 223-4544

Subject:

FW: Council Spotlight: Lower Snake River Dams Replacement

From: Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>**Sent:** Tuesday, August 2, 2022 4:20 PM**To:** Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Kaseweter,Alisa D (BPA) - AI-7 <alkaseweter@bpa.gov>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; ADL_AIR_ONLY <adl_air_only@bpa.gov>; Klumpp,Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>**Subject:** Council Spotlight: Lower Snake River Dams Replacement Power Study, Spring Chinook Return Better than Forecast, Low-Income EE Programs, Lamprey Efforts

Yeah, folks are so scared of that truth that they just want to make it disappear. But, given what's happening in Europe, it will be hard to look away now and ignore what could happen.

Sonya Baskerville
BPA National Relations

(b)(6) m

On Aug 2, 2022 5:27 PM, "Klumpp,Elizabeth C (BPA) - AIR-WSGL" <ecklumpp@bpa.gov> wrote:
FYI – You may have all seen this?

Council staff did a decent job summarizing E3's LSRD report. My disappointment is that Washington State has multiple clean energy laws, and codes and laws that are pushing natural gas and petroleum use to the electricity grid. Yet the Council saved the real analysis and costs of removing the LSRs in such a decarbonized grid to the last bullet point. The Council's summary focuses on the \$11-\$19.6 billion cost figure.

- In the study's economy-wide deep decarbonization scenarios, replacement without any emerging technologies requires very large renewable resource additions at a very high cost; for example, 12,000 megawatts of wind and solar at a (net present value) cost of \$42 billion to \$77 billion

From: Northwest Power & Conservation Council <no-reply@nwcouncil.org>**Sent:** Tuesday, August 2, 2022 12:16 PM**To:** Klumpp,Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>**Subject:** [BULK EMAIL] Council Spotlight: Lower Snake River Dams Replacement Power Study, Spring Chinook Return Better than Forecast, Low-Income EE Programs, Lamprey Efforts

Council Spotlight

NEWS ABOUT ENERGY AND NATURAL RESOURCES IN THE PACIFIC NORTHWEST

Lower Snake River Dams Replacement Power Study

While it is possible to replace the output of the four lower Snake River dams while meeting aggressive clean-energy goals, the cost would be substantial, and the reliability of the system could depend on future technologies.

[Read more.](#)

Upcoming Meetings

[AUGUST 16-17: Council Meeting \(Webinar\)](#)

[More meetings](#)

Coronavirus update: The Council is starting to resume in-person meetings, with online participation always available. We encourage people to join our meetings and engage with our staff and members by phone, webinar and email.

More News



2022 Spring Chinook Salmon Return Better Than Forecast

Council members were briefed on spring Chinook salmon returns to the Columbia and Snake rivers, as well as the more sobering update on recovery efforts for Tucannon River spring Chinook. [Read more.](#)



Energy Efficiency Programs for Low-Income Households

In a challenging economy when costs seem to be rising constantly, low-income households face an increasing risk of being unable to afford basic necessities, including electricity. [Read more.](#)



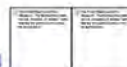
Efforts to Bring Back Pacific Lamprey Succeeding

Laurie Porter and Jon Hess of CRITFC briefed members on the current run of Pacific lamprey in the Columbia River Basin and tribal projects currently implemented through the Council's F&W Program. [Read more.](#)



Trout Creek Habitat Tour: Learning from the Place

This past spring, Oregon Council member Louie Pitt, Jr. and Council staff toured the Trout Creek Watershed Restoration Project located in Central Oregon. [Read more.](#)



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Northwest Power and Conservation Council · 851 SW Sixth Avenue · Suite 1100 · Portland, OR 97204 · USA

From: James,Eve A L (BPA) - PG-5
Sent: Tuesday, April 19, 2022 4:23 PM
To: Angineh Zohrabian; Riley,Erin A (BPA) - PGPR-5; Aaron Burdick
Cc: Koehler,Birgit G (BPA) - PG-5; Diffely,Robert J (BPA) - PGPL-5; Egerdahl,Ryan J (BPA) - PGPR-5; Sierra Spencer; Arne Olson; Jack Moore
Subject: FW: Data for E3
Attachments: 2022-04-19_RW_output_selectCYs_Big10_NS.xlsx

Deliberative; FOIA Exempt

This would be the “emergency capabilities” scenario set:

From: Riley,Erin A (BPA) - PGPR-5 <eariley@bpa.gov>
Sent: Wednesday, April 6, 2022 4:47 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: Data for E3

Deliberative; FOIA Exempt

Hi Eve,

I’ve attached the data removing spillway spill at the lower snakes.

Also made some plots for 2005 so you can see the difference, and added some hourly data from actual 2005 ([Dataquery 2.0 \(crohms.org\)](#))

Otherwise the run parameters are the same as before.

Data notes: The model was run on the FY, as indicated by the “trace” column. For CY I provided the Oct-Dec of the following FY trace. I did not correct the date to be continuous because this model simulation, generation is peaking during these dates in the datetime column:

Wednesday, December 6, 2023	Friday, December 8, 2023
Wednesday, January 3, 2024	Friday, January 5, 2024
Wednesday, February 7, 2024	Friday, February 9, 2024
Wednesday, July 3, 2024	Friday, July 5, 2024
Wednesday, August 21, 2024	Friday, August 23, 2024

Data dictionary:

“*.Power” = hourly generation in MW

“*.GN_Max_HK_ModelCap” = one hour capacity.

“*.Rsrv_DEC_Sim” = Dec reserves held at that project, or total if * is BPA

“*.Rsrv_INC_Sim” = Inc reserves held by that project, or total if * is BPA

Erin Riley
Operations Research Analyst
PGPR- Long Term Power Planning
Bonneville Power Administration
503-230-3717

From: Kaseweter,Alisa D (BPA) - AI-7
Sent: Thursday, June 30, 2022 9:47 AM
To: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5
Subject: RE: [EXTERNAL] [BULK EMAIL] Hydrology Digest for Monday June 27, 2022

I think we should note to E3 that while we wouldn't change the assumption, there does currently seem to be an open question on whether "retails sales" under CETA include transmission and distribution losses. The environmental groups, including some of the same groups advocating for breaching the LSRDs, have taken a stance that retails sales do include losses. If that sentiment prevails, then the "retail sales" scenario would understate costs.

I don't know if E3 has a list of some of the issues or cautions that would impact the likelihood of the retail sales scenarios (like technology breakthroughs) but this would be one item I would add to that list.

Thanks for giving me the opportunity to provide some input!

From: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Sent: Wednesday, June 29, 2022 1:52 PM
To: Kaseweter,Alisa D (BPA) - AI-7 <alkaseweter@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: [EXTERNAL] [BULK EMAIL] Hydrology Digest for Monday June 27, 2022

Deliberative, FOIA exempt

Hi Alisa- Here is what is in the draft report on the 100% clean retail sales:

Clean Energy Policy

Clean energy policy for the electric sector was modeled at either 100% clean retail sales or zero-carbon by 2045. A 100% clean retail sales policy requires serving 100% of electricity sold on an annual basis to be met by clean energy resources. This allows generation not used to serve retail sales (i.e., transmission and distribution losses) to be met by emitting resources. It also allows emitting generation or unspecified imports in one hour to be offset by exported generation in another hour of the year. In the baseline load scenario, reaching 100% clean retail sales requires ~85% carbon reduction compared to 1990 levels by 2045. The zero-carbon scenario ensures that all electricity generated in the Northwest or imported from other regions emits no carbon emissions in every hour of the year.

We are providing E3 with "light touch" comments so let me know if you feel strongly that we should provide any comments on this section.

From: Kaseweter,Alisa D (BPA) - AI-7 <alkaseweter@bpa.gov>
Sent: Tuesday, June 28, 2022 3:00 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Subject: RE: [EXTERNAL] [BULK EMAIL] Hydrology Digest for Monday June 27, 2022

It is really complicated. But if losses are ~7%, it's an important caveat. If WA doesn't implement CETA like E3 assumes, it would increase the assumed cost and challenges of decarbonization and replacing the LSRDs. I'll await some follow-up from Eve. Thanks.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, June 28, 2022 11:54 AM
To: Kaseweter,Alisa D (BPA) - AI-7 <alkaseweter@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: [EXTERNAL] [BULK EMAIL] Hydrology Digest for Monday June 27, 2022

Alisa,

These things are so complicated. I can't quite keep track. Eve pulled out a footnote from the slide deck that might be helpful. Eve is expecting a copy of their full report today, so let's take a look and loop back with you on this piece.

+ Scenario 1: 100% Clean Retail Sales

- Northwest resources produce enough clean energy to meet **100% of retail electricity sales** on an annual average basis
- Some gas generation is retained for reliability, but carbon emissions are reduced **85% below 1990 levels**
- **Business-as-usual** load growth

From: Kaseweter,Alisa D (BPA) - AI-7 <alkaseweter@bpa.gov>
Sent: Tuesday, June 28, 2022 8:19 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: FW: [EXTERNAL] [BULK EMAIL] Hydrology Digest for Monday June 27, 2022

Not sure on the timing on the E3 study, but perhaps something to pass along?

Also, someone at BPA (I won't name who because the presentation seems to be tightly held) got a copy of the E3 presentation and asked me about this footnote:

****A 100% clean retail sales target allows emissions for electric generation beyond that needed to serve "retail sales", i.e. losses during transmission to retail loads and exported energy**

It's not clear to us that this is true for CETA - it's a gray area that hasn't been answered - and it is not true for Oregon's clean energy standard. If E3's analysis assumes this, I'd suggest the footnote clarify that it is an assumption and to the extent not true would further raise costs, make standards more difficult to achieve, etc. I'm more than happy to talk to someone at E3 about it if it's helpful.

From: Pytlak,Erik S (BPA) - PGPW-5 <espytlak@bpa.gov>
Sent: Tuesday, June 28, 2022 6:42 AM
To: Duncan,Megan N (BPA) - PD-5 <MNDuncan@bpa.gov>; ADL_PGPW_ALL <ADL_PGPW_ALL@BPASite1.bpa.gov>
Cc: Kaseweter,Alisa D (BPA) - AI-7 <alkaseweter@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: FW: [EXTERNAL] [BULK EMAIL] Hydrology Digest for Monday June 27, 2022

Hello all. Just a quick FYI.

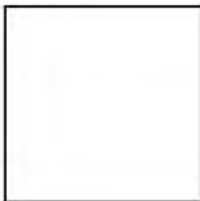
The Hydrology section at AGU is going to have a special session on hydropower and green energy integration (below) at the Fall (December) Meeting in Chicago. Unlike last year, I don't think we have anything to submit from PGPW, but it could be a very interesting session. Megan is already planning to attend (through her department), Ann is covering CEATI/HOPIG meetings, and the mets are probably going to other conferences (e.g. Mike is going to NWA in August; I'll be going to AMS in January). But this could be a good one for at least one of us to attend. We frequently send 2 hydrologists to AGU, either remotely or in person.

I grabbed this from the AGU website after logging in:

“Hydropower, historically, has been a major source of clean energy. However, it has also been controversial because of the impacts of dams on river ecosystems and the livelihoods of local communities. Further, its economic competitiveness is increasingly being challenged by advancements in other renewable technologies including solar and wind, and climate change can impact the productivity of hydropower systems. Yet, hydropower can play an important role in the integration of variable renewable resources to minimize reliance on fossil fuels for grid balancing and reliability. Other strategies such as pumped-storage hydropower, powering non-hydro dams, and floating solar on hydropower reservoirs can also be crucial in sustainable energy transitions. Thus, it is imperative to understand the full-scale costs, benefits, and impacts of hydropower in decarbonized futures. This session invites abstracts on hydropower’s operations, future expansions, costs, benefits, and impacts in the context of clean energy transitions at local to global scales.”

-Erik

From: American Geophysical Union <DoNotReply@ConnectedCommunity.org>
Sent: Tuesday, June 28, 2022 12:03 AM
To: Pytlak,Erik S (BPA) - PGPW-5 <espytlak@bpa.gov>
Subject: [EXTERNAL] [BULK EMAIL] Hydrology Digest for Monday June 27, 2022



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Jun 27, 2022

Discussions

started 17 hours ago, [A.F.M. Kamal Chowdhury](#) (0 replies)

[AGU 2022: Session GC075 – Role of Hydropower in Sustainable Clean Energy Transitions](#)

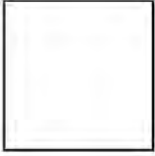


1. [Dear Colleagues, We would like to invite...](#) A.F.M. Kamal Chowdhury

1. [AGU 2022: Session GC075 – Role of Hydropower in Sustainable Clean Energy Transitions](#)

[Reply to Group](#)

[Reply to Sender](#)



Jun 27, 2022 9:49 AM

[A.F.M. Kamal Chowdhury](#)

Dear Colleagues,

We would like to invite you to submit an abstract to our AGU Fall Meeting 2022 session: **GC075 – Role of Hydropower in Sustainable Clean Energy Transitions**. We expect abstracts on a broad range of topics including but not limited to hydropower's operations, future expansions, costs, benefits, and impacts in the context of clean energy transitions at local to global scales. More details about the session and submission guidelines can be found in the link below.

Session link: <https://agu.confex.com/agu/fm22/prelim.cgi/Session/161099>

Abstract submission deadline: August 3, 2022

Conveners:

Dr. Kamal Chowdhury (University of Maryland)

Dr. Thomas B. Wild (Pacific Northwest National Laboratory)

Dr. Matthew Binsted (Pacific Northwest National Laboratory)

Dr. Ranjit Deshmukh (University of California Santa Barbara)

We look forward to seeing you in Chicago or virtually.

On behalf of all conveners,

Dr. Kamal Chowdhury

Email: kchy@umd.edu

A.F.M. Kamal Chowdhury

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From: Armentrout,Scott G (BPA) - E-4
Sent: Thursday, June 16, 2022 2:21 PM
To: Godwin,Mary E (BPA) - LN-7; Koehler,Birgit G (BPA) - PG-5; Zelinsky,Benjamin D (BPA) - E-4; James,Eve A L (BPA) - PG-5
Subject: RE: BPA slide deck

Concur – definitely don't want to do anything with the BPA deck though until we convene and do another run through of it. But as long as E3 gets the typo and is comfortable with theirs. Also please make sure it meets you marking needs and remind we are not releasing further till July Power council meeting TBA.

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C(b)(6)



From: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Sent: Thursday, June 16, 2022 12:23 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: RE: BPA slide deck

Thanks Eve.

On Jun 16, 2022 12:21 PM, "James,Eve A L (BPA) - PG-5" <eajames@bpa.gov> wrote:
I have one edit that I need to get from E3 on the NPV typo they brought up in the meeting. I'll do that and send it around.

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Subject: RE: BPA slide deck

CEQ has requested E3's slide deck. Are you okay if I clean it up and send to them?

On Jun 16, 2022 11:40 AM, "Armentrout,Scott G (BPA) - E-4" <sgarmentrout@bpa.gov> wrote:
I think in light of today's meeting, we need to revisit this deck again. Especially the key takeaways. Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C(b)(6)



From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Wednesday, June 15, 2022 9:52 AM

To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>;
Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>

Subject: BPA slide deck

Deliberative, FOIA exempt

Attached are the slides from this morning. I don't think this will change unless anyone sees red flag typo issues to fix. I will send the E3 deck after we meet with them at 2 PM today.

Thanks,
Eve

From: Godwin, Mary E (BPA) - LN-7
Sent: Friday, June 17, 2022 8:59 AM
To: James, Eve A L (BPA) - PG-5; Koehler, Birgit G (BPA) - PG-5; Zelinsky, Benjamin D (BPA) - E-4; Armentrout, Scott G (BPA) - E-4
Subject: RE: BPA slide deck

Thanks Eve – I will send this to CEQ and DOE folks.

Thanks,
Mary

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, June 17, 2022 7:08 AM
To: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmtrout@bpa.gov>
Subject: RE: BPA slide deck

Deliberative, FOIA exempt

Good Morning-

Attached is the updated slide deck that you can send to CEQ. E3 also provided this information in response to the questions but not sure if we want to share that as well or if we think it would be too confusing:

- The overnight and operating costs are removed and just the NPV costs are now shown on the summary slide
- RESOLVE accounts for both the overnight costs and the financing costs associated with financing those investments over the project lifecycle, in addition to fuel, O&M, and other ongoing fixed and variable costs
- These financing costs are a key difference between reporting overnight capital costs vs. actual all-in modeled NPV costs
- As deemed useful for our final public report, E3 can explore more detailed ways to break out both the overnight capital costs, ongoing O&M and fuel costs, and the ongoing financing costs associated with resources and transmission
- Regarding the specific question on the \$11 billion overnight costs, we did find this value was an error, as it did not capture the significant transmission costs in Scenario 2c needed to deliver the remote renewable energy resources selected into the Northwest zone (these transmission costs were very large given that RESOLVE had already built out all of the local resource potential even with the dams remaining in that case), the transmission costs increase the overnight costs by nearly 3x and the costs of financing the renewables and transmission assets make up the difference versus the \$46 billion NPV (which we confirmed is the correct value)
- We've also noted the use of a 5% discount rate assuming IPP financing of new resources, which leads to a lower NPV than if we used the 3% rate assumed in the Inslee + Murray study

From: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Sent: Thursday, June 16, 2022 12:23 PM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmtrout@bpa.gov>
Subject: RE: BPA slide deck

Thanks Eve.

On Jun 16, 2022 12:21 PM, "James,Eve A L (BPA) - PG-5" <ejames@bpa.gov> wrote:
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Sent: Thursday, June 16, 2022 12:20 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
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I think in light of today's meeting, we need to revisit this deck again. Especially the key takeaways. Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

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From: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Sent: Wednesday, June 15, 2022 9:52 AM
To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Subject: BPA slide deck

Deliberative, FOIA exempt

Attached are the slides from this morning. I don't think this will change unless anyone sees red flag typo issues to fix. I will send the E3 deck after we meet with them at 2 PM today.

Thanks,
Eve

From: Leary,Jill C (BPA) - LN-7
Sent: Wednesday, May 25, 2022 7:39 AM
To: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5; Baskerville,Sonya L (BPA) - AIN-WASH
Subject: RE: DOE review response edits needed

Looks great, thanks.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, May 25, 2022 7:18 AM
To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: DOE review response edits needed

Deliberative Process Privilege; FOIA-exempt

Good Morning- We are almost done addressing DOE/National Labs peer review. The only outstanding comment I took a stab at but please edit/comment as needed (I kept it short but can expand if needed):

- **External Review Process:** Does BPA anticipate issuing the final report without an opportunity for external stakeholder review of a draft? It may be productive to discuss the possible value, advantages, and disadvantages of offering regional stakeholders an opportunity to review and comment on the draft—recognizing that conducting such a review would entail time and budget.

◦ When the results are final, E3 will conduct a public webinar to review the results of the study and BPA will post the study to its website.

From: Koehler,Birgit G (BPA) - PG-5
Sent: Monday, February 7, 2022 4:10 PM
To: James,Eve A L (BPA) - PG-5; Diffely,Robert J (BPA) - PGPL-5
Cc: Petty,Robert J (BPA) - PGP-5
Subject: RE: E3 Proposal - BPA Lower Snake River Power Study 2022-02-07 Rob Comment.pdf

Deliberative; FOIA-exempt

One thing we forgot to talk about today was the Treaty. Eve and I discussed with Trevor on Friday what it might mean for our study if the Treaty were terminated: no more CE but also no proportional draft. Would that change the E3 study materially?

From a pure 1-for-1 standpoint, it doesn't change the LSN capabilities. But it could make a difference in the E3 approach.

From: Koehler,Birgit G (BPA) - PG-5
Sent: Monday, February 7, 2022 3:05 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: Petty,Robert J (BPA) - PGP-5 <rjpetty@bpa.gov>
Subject: RE: E3 Proposal - BPA Lower Snake River Power Study 2022-02-07 Rob Comment.pdf

Deliberative; FOIA-exempt

Well, I have it on my list of things not to forget. Let's see if they have an idea for adding this 1-for-1 completeness.

And I'm keeping for reminder Rob D's sentence:

Incremental to replace LSN is getting closer and closer to full replacement as other resources come out.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Monday, February 7, 2022 2:30 PM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Petty,Robert J (BPA) - PGP-5 <rjpetty@bpa.gov>
Subject: RE: E3 Proposal - BPA Lower Snake River Power Study 2022-02-07 Rob Comment.pdf

I also noticed the one-pager they copied from might not have included the capabilities of the LSN projects that impacts the Transmission system:

- **Voltage and reactive support**
- **Frequency and inertial response**
- **Blackstart capability**
- **Short-circuit and grounding contribution**
- **Ability to ride-through voltage and frequency excursions**
- **Ability to participate in gen drop as part of Remedial Action Schemes**

Not sure how we want to incorporate that into the discussion tomorrow with E3.

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Sent: Monday, February 7, 2022 12:00 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Petty,Robert J (BPA) - PGP-5 <rjpetty@bpa.gov>
Subject: RE: E3 Proposal - BPA Lower Snake River Power Study 2022-02-07 Rob Comment.pdf

The second sections seems to address the one-for-one concept – replacing all attributes in a carbon constrained world. Starting what we did in the EIS...

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Monday, February 7, 2022 11:42 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: Petty,Robert J (BPA) - PGP-5 <rjpetty@bpa.gov>
Subject: RE: E3 Proposal - BPA Lower Snake River Power Study 2022-02-07 Rob Comment.pdf

Those were exactly my initial thoughts. We can discuss at noon.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Monday, February 7, 2022 11:20 AM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Petty,Robert J (BPA) - PGP-5 <rjpetty@bpa.gov>
Subject: RE: E3 Proposal - BPA Lower Snake River Power Study 2022-02-07 Rob Comment.pdf

Deliberative; FOIA-exempt

Adding Mr. Petty,

And this approach seems more in line with replacing the reliability, but not guaranteeing that it is a 1-for-1 for all of the capabilities of the lower Snakes.

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Sent: Monday, February 7, 2022 11:08 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: E3 Proposal - BPA Lower Snake River Power Study 2022-02-07 Rob Comment.pdf

Deliberative; FOIA-exempt

My high level comments. We need to get this proposal more in line with a post CETA / Clean Energy for All incremental removal of the LSDR removal and needs more land use discussion.

Rob

From: Leady Jr,William J (BPA) - PG-5
Sent: Monday, June 6, 2022 11:41 AM
To: James,Eve A L (BPA) - PG-5
Cc: Koehler,Birgit G (BPA) - PG-5
Subject: RE: E3 results presentations

Very nice work !!!!!!!!!!!!!

See your getting a few comments, I don't think I can improve your work.

Bill Leady P.E.

(acting) Vice President, Generation Asset Management | PG

BONNEVILLE POWER ADMINISTRATION

bpa.gov | Office 503-230-4270 | Cell (b)(6)

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, June 3, 2022 4:06 PM
To: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>; Leady Jr,William J (BPA) - PG-5 <wjleady@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmtrout@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Senters,Anne E (BPA) - LN-7 <aesenters@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <ssullivan@bpa.gov>
Subject: E3 results presentations

Deliberative, FOIA exempt

Hello-

Attached are the presentations sent to DOE for feedback- the E3 study results and BPA's perspective on the study results. DOE will be providing feedback by Wednesday and I believe there is coordination to schedule a time to present to CEQ.

Thanks,
Eve

From: Cook,Joel D (BPA) - K-7
Sent: Monday, June 6, 2022 9:31 AM
To: Armentrout,Scott G (BPA) - E-4; James,Eve A L (BPA) - PG-5; Hairston,John L (BPA) - A-7; Cooper,Suzanne B (BPA) - P-6; Leady Jr,William J (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5; Leary,Jill C (BPA) - LN-7; Godwin,Mary E (BPA) - LN-7; Senters,Anne E (BPA) - LN-7; Zelinsky,Benjamin D (BPA) - E-4; Sullivan,Leah S (BPA) - EWP-4
Subject: RE: E3 results presentations

First I think these slides are much improved.

A couple of comments or recommended changes on the slides. For E3, I think it would be important to pull slide 16 forward by putting it after slide #3). I view this slide strategically important (i.e. the money slide). Also, although we included it in the BPA slides, the fact that E3's study does not include cost for new transmission or distribution infrastructure needs to be better highlighted.

From: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Monday, June 6, 2022 7:10 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>; Leady Jr,William J (BPA) - PG-5 <wileady@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Senters,Anne E (BPA) - LN-7 <aesenters@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>
Subject: RE: E3 results presentations
Importance: High

A couple thoughts on the BPA portion of this. Suggest modification of the slides to eliminate any indication of defensiveness, etc. Make if very fact based. Example – Eliminate “No, in fact the E3 study reinforces the decision” to “There is no new information that fundamentally changes the basis for the decision”. Also eliminate the “not cheap, fast or easy” language. If we are quoting some other study that said that, we should attribute it. Otherwise state it as facts, e.g. “expensive, spanning many years and complex”. Anyway that is a start – but overall it is to make it straightforward but not tone based. Scott

SCOTT G ARMENTROUT
Executive Vice President, Environment, Fish & Wildlife, SES | E-4
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-3076 | C (b)(6)



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<jsullivan@bpa.gov>

Subject: E3 results presentations

Deliberative, FOIA exempt

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Thanks,
Eve

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To: James, Eve A L (BPA) - PG-5; Godwin, Mary E (BPA) - LN-7; Greene, Richard A (BPA) - LP-7; Chan, Allen C (BPA) - LT-7
Cc: Koehler, Birgit G (BPA) - PG-5; Pruder Scruggs, Kathryn M (BPA) - E-4; Welch, Dorothy W (BPA) - E-4
Subject: RE: E3-BPA presentation deck for DOE

Deliberative, FOIA exempt

My advice is they should be separate, so we can focus DOE's review:

- E3 draft slides, including more technical information
- BPA's thoughts after reviewing E3's analysis

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, June 3, 2022 12:09 PM
To: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Greene, Richard A (BPA) - LP-7 <ragreene@bpa.gov>; Chan, Allen C (BPA) - LT-7 <acchan@bpa.gov>
Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Welch, Dorothy W (BPA) - E-4 <dwwelch@bpa.gov>
Subject: RE: E3-BPA presentation deck for DOE

Deliberative, FOIA exempt

Thanks Jill- there are 2 sets of slides- the E3 presentation of results and then BPA's perspective on the study. The way the BPA slides go before the appendix it might have looked like 3 but it is really just the 2. Should I leave E3 and BPA perspective decks separate? We were sort of thinking like how OR presented with ODOE and had their key takeaways before and after the presentation- though we focused on just having key takeaways at the end.

From: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Friday, June 3, 2022 11:47 AM
To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Greene, Richard A (BPA) - LP-7 <ragreene@bpa.gov>; Chan, Allen C (BPA) - LT-7 <acchan@bpa.gov>
Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Welch, Dorothy W (BPA) - E-4 <dwwelch@bpa.gov>
Subject: RE: E3-BPA presentation deck for DOE

Deliberative, FOIA exempt

Hi,
Attached are my quick edits on the various PPTs.

Is the plan to separate these out to send to DOE or can you remind me why we have three different (separate?) PPTs in one?

Thanks,
Jill

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, June 3, 2022 10:17 AM
To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Greene,Richard A (BPA) - LP-7 <ragreene@bpa.gov>; Chan,Allen C (BPA) - LT-7 <acchan@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: E3-BPA presentation deck for DOE

Deliberative, FOIA exempt

Attached is the PPT version. Adding Allen and Rich as well.

Thanks,
Eve

From: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Friday, June 3, 2022 10:09 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: E3-BPA presentation deck for DOE

Eve, there are definitely some language changes I would like to make.

Could you resend a non-PDF version and also include Rich Greene and Allen Chan in the review?

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Thursday, June 2, 2022 5:11 PM
To: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: E3-BPA presentation deck for DOE

Deliberative, FOIA exempt

Hi Jill and Mary-

Attached is a slide deck of the E3 study for DOE review. Please let me know if you see any red flag issues and I can fix them quickly. If you don't see any issues we can send this to DOE to get comments from them for a CEQ presentation. I am still waiting to hear from TX to confirm some language I added on TX build timing but DOE can still review if I haven't heard back from them. I'm not sure who works on the scheduling for the CEQ presentation but we would like to incorporate DOE feedback.

Thanks,
Eve

From: Welch,Dorothy W (BPA) - E-4
Sent: Friday, June 3, 2022 12:00 PM
To: Leary,Jill C (BPA) - LN-7
Cc: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5
Subject: RE: E3-BPA presentation deck for DOE
Attachments: E3RESOLVE_BPA_PublicDeck dww.pptx

Deliberative, FOIA exempt

I included a small edit for clarification. In case you need it, the FY22 budget for BPA's LSRCP direct funding agreement is \$33M.

From: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Friday, June 3, 2022 10:28 AM
To: Welch,Dorothy W (BPA) - E-4 <dwwelch@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: FW: E3-BPA presentation deck for DOE

Deliberative, FOIA exempt

Hi Dorie,

Could you look at the LSRCP language on Slide 16? Eve and Birgit are on a tight timeline and need to send this to DOE today, so hoping you can take a quick peek.

Thanks,
Jill

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, June 3, 2022 10:17 AM
To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Greene,Richard A (BPA) - LP-7 <ragreene@bpa.gov>; Chan,Allen C (BPA) - LT-7 <acchan@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: E3-BPA presentation deck for DOE

Deliberative, FOIA exempt

Attached is the PPT version. Adding Allen and Rich as well.

Thanks,
Eve

From: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Friday, June 3, 2022 10:09 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: E3-BPA presentation deck for DOE

Eve, there are definitely some language changes I would like to make.

Could you resend a non-PDF version and also include Rich Greene and Allen Chan in the review?

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Thursday, June 2, 2022 5:11 PM

To: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>

Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>

Subject: E3-BPA presentation deck for DOE

Deliberative, FOIA exempt

Hi Jill and Mary-

Attached is a slide deck of the E3 study for DOE review. Please let me know if you see any red flag issues and I can fix them quickly. If you don't see any issues we can send this to DOE to get comments from them for a CEQ presentation. I am still waiting to hear from TX to confirm some language I added on TX build timing but DOE can still review if I haven't heard back from them. I'm not sure who works on the scheduling for the CEQ presentation but we would like to incorporate DOE feedback.

Thanks,
Eve

From: Chan,Allen C (BPA) - LT-7
Sent: Friday, June 3, 2022 1:06 PM
To: Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5; Leary,Jill C (BPA) - LN-7; Godwin,Mary E (BPA) - LN-7; Greene,Richard A (BPA) - LP-7
Cc: Pruder Scruggs,Kathryn M (BPA) - E-4
Subject: RE: E3-BPA presentation deck for DOE

I don't have any concerns with the presentation..

Allen C. Chan

Office of General Counsel
Bonneville Power Administration
P.O. Box 3621, LT-7
Portland, OR 97208-3621
Phone: (503) 230-3551
Cell: (b)(6)
Email: acchan@bpa.gov

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Friday, June 3, 2022 10:20 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Greene,Richard A (BPA) - LP-7 <ragreene@bpa.gov>; Chan,Allen C (BPA) - LT-7 <acchan@bpa.gov>
Cc: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: E3-BPA presentation deck for DOE

Deliberative, FOIA exempt

Rich and Allen, need to let you know that we are trying to get this to DOE today. Sorry for the fast turn-around.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, June 3, 2022 10:17 AM
To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Greene,Richard A (BPA) - LP-7 <ragreene@bpa.gov>; Chan,Allen C (BPA) - LT-7 <acchan@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: E3-BPA presentation deck for DOE

Deliberative, FOIA exempt

Attached is the PPT version. Adding Allen and Rich as well.

Thanks,
Eve

From: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Friday, June 3, 2022 10:09 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>

Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: E3-BPA presentation deck for DOE

Eve, there are definitely some language changes I would like to make.

Could you resend a non-PDF version and also include Rich Greene and Allen Chan in the review?

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Thursday, June 2, 2022 5:11 PM

To: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>

Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>

Subject: E3-BPA presentation deck for DOE

Deliberative, FOIA exempt

Hi Jill and Mary-

Attached is a slide deck of the E3 study for DOE review. Please let me know if you see any red flag issues and I can fix them quickly. If you don't see any issues we can send this to DOE to get comments from them for a CEQ presentation. I am still waiting to hear from TX to confirm some language I added on TX build timing but DOE can still review if I haven't heard back from them. I'm not sure who works on the scheduling for the CEQ presentation but we would like to incorporate DOE feedback.

Thanks,
Eve

From: Leary, Jill C (BPA) - LN-7
Sent: Thursday, May 19, 2022 1:39 PM
To: Johnson, G Douglas (BPA) - DK-7; James, Eve A L (BPA) - PG-5; Godwin, Mary E (BPA) - LN-7; Koehler, Birgit G (BPA) - PG-5
Cc: Goodwin, Summer G (BPA) - DKS-7
Subject: RE: Final Responses to Follow up Questions on the E3 Analysis
Attachments: 2022-05-19-2ndRoundEarthJusticeQ_finalscrub.pdf

Here is the revised version, thanks.

From: Leary, Jill C (BPA) - LN-7
Sent: Thursday, May 19, 2022 12:37 PM
To: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: Final Responses to Follow up Questions on the E3 Analysis

We found a few missing words we want to fix, so will send a fixed version shortly, thanks for checking.

From: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Thursday, May 19, 2022 12:32 PM
To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: FW: Final Responses to Follow up Questions on the E3 Analysis

Are these final? If so, I'll get them to our web team to post. Just confirming. Thanks.

From: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Sent: Friday, May 13, 2022 11:07 AM
To: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: Final Responses to Follow up Questions on the E3 Analysis

Here it is!

Thanks,
Mary

From: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Friday, May 13, 2022 10:38 AM
To: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: Final Responses to Follow up Questions on the E3 Analysis

All good. Let us know when these are OK to post.

From: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Sent: Friday, May 13, 2022 10:37 AM
To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Cc: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Final Responses to Follow up Questions on the E3 Analysis

Oh gees. Thanks. I'm a mess without Jill! Hold on this for now.

Thanks,
Mary

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, May 13, 2022 10:31 AM
To: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Cc: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Final Responses to Follow up Questions on the E3 Analysis

Mary- could you send this to Michael Connolly first to get a PDF scrubbed of metadata?

From: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Sent: Friday, May 13, 2022 10:28 AM
To: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Cc: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: Final Responses to Follow up Questions on the E3 Analysis

Hi Doug,

We received a number of follow up questions during and after our meeting with the NWF-led coalition. We would like to post these in the same place as the last round. It would be great to get your expertise on how to organize this.

Thanks,
Mary

Mary E. Godwin
Attorney-Adviser
Office of General Counsel
Bonneville Power Administration
905 NE 11th Avenue
Portland, OR 97232
(503) 230-4750

NOTICE: This electronic message contains personal and confidential information for the intended recipients and may contain pre-decisional advice, attorney work product or attorney/client privileged material, which is protected from disclosure under the Freedom of Information Act, 5 U.S.C. § 552. Do not forward, copy or release without prior authorization from the sender. Any review or distribution by others is strictly prohibited. If you have received this message in error, please notify the sender immediately by reply e-mail and delete this message.

Additional Questions Regarding Analysis of Potential Replacement Resources for the Services Provided by the Four Lower Snake River Dams and Bonneville's Answers

The Bonneville Power Administration (BPA) provided the following answers to additional questions from interested entities regarding its ongoing analysis of potential replacement resources for the services provided by the four lower Snake River dams.

- 1. *Will the E3 analysis include one or more “clean” replacement portfolios that draw on wind, solar, battery storage, demand response, energy efficiency and the ability of other FCRPS projects to meet system requirements in a system without the lower Snake River dams (LSRDs)?***

Yes, the E3 analysis will examine multiple scenarios with various levels of decarbonization policy and technology availability - one of which will not include fossil-combustion generation. As the Columbia River System Operations (CRSO) Environmental Impact Statement (EIS) Record of Decision noted, the Columbia River System (CRS) projects¹ have many non-power constraints that impact operations, including flood risk management, fish operations, navigation, irrigation, and recreation. Project generation modeled in the E3 analysis will reflect those constraints. The CRS projects operate differently under the low/middle/high water conditions as the flood risk management and biological constraints vary depending on flow volumes and runoff shape. The resource replacement model does not change CRS operations to meet system requirements differently in the runs with and without the four lower Snake River dams.

- 2. *Will E3 develop a “base case” to describe the services LSRDs currently actually provide in the context of the various water year/fish operation information BPA has given them? If not, how will E3 know what services need to be replaced?***

Yes. The Hydro operating data in the E3 RESOLVE model uses representative water conditions for low/middle/high historical years (2001, 2005, 2011) for all regional resources with the Columbia River System project generation, adjusted to be consistent with the fish passage spill operations from the CRSO EIS Record of Decision. For each scenario, two versions of the CRS hydro generation for each low/middle/high water condition will be run – one with LSRD generation, and one without.

- 3. *Will E3 look only at a one-to-one replacement portfolio, e.g., same generation profile over the course of a year, for the services the LSRDs provide?***

No, the resource portfolio optimizer in the RESOLVE model selects resources with certain attributes to meet a planning reserve margin and not to replace the four lower Snake River dams' attributes one-for-one. These attributes include energy, sustained capacity, reserves, and fast ramping. Resource Adequacy is the primary driver of the

¹ The term “Columbia River System” or “CRS” is used to refer to the coordinated operation of 14 specific federal projects in the Columbia River Basin. These 14 federal projects, however, are a subset of the 31 federal projects that compose the Federal Columbia River Power System. This term is intended to eliminate past confusion with the FCRPS terminology.

resource portfolios selected. E3 will also address the replacement of any attributes not covered by the RESOLVE model qualitatively.

4. ***Will E3 draw on the work it did for BPA in its EIM analyses and if so, how?***
No, the EIM analysis was a static analysis specifically looking at redispatching the existing system. The LSRD removal study is a dynamic analysis about how to replace the energy and capacity.
5. ***How is the analysis E3 is doing different from the analysis of replacing the services of the LSRDs in the CRSO EIS?***
BPA received some comments from the public on the CRSO EIS that specified that the analysis should use a replacement resource portfolio optimizer. E3's study uses a resource optimizer.

Additional Follow-up Questions:

1. What other models is E3 using?

E3's RESOLVE model is the primary model for this analysis. They will use supplemental information for qualitative analysis of the replacement of specific grid services.

2. What is the time horizon for breaching and for the analysis?

The study goes through 2045 when the 100% Clean Retail Sales requirement goes into effect. The study will examine LSRD breaching in 10 years and in 2 years, consistent with the approach used in the CRSO EIS.

3. How is climate change affecting the analysis?

The study is modeling scenarios with and without incorporation of state climate change policies. Scenarios will include deep decarbonization and electrification of transportation and buildings. Hydropower generation assumes water conditions from the last 20 years, so incorporates recent potential impacts of climate change to water supply.

4. How are the state emission standards factoring in to market purchases?

The study is modeling scenarios with and without incorporation of state climate change policies. The emissions associated with energy production in the model and hence any surplus energy from non-Federal generation that is available for market purchases will vary accordingly.

5. Is the model daily, hourly, etc... can it follow load ramps?

The RESOLVE capacity expansion model has an operational module that simulates hourly conditions over 40 representative days. This module dispatches hydro and other resources hourly to meet hourly demand. An additional module captures extreme conditions to ensure no blackouts occur during periods of high load and low hydro conditions.

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, July 12, 2022 2:45 PM
To: Aaron Burdick
Cc: James,Eve A L (BPA) - PG-5; Arne Olson
Subject: RE: Updated PPT and Report

I am familiar with the challenges of last minute edits. I press “go” on over 600 pages in the EIS related to power and didn’t notice an error that was introduced during file processing. Ugh.

From: Aaron Burdick <aaron.burdick@ethree.com>
Sent: Tuesday, July 12, 2022 1:56 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Arne Olson <arne@ethree.com>
Subject: [EXTERNAL] Updated PPT and Report

Birgit,

Per the email I just sent on the NWPC thread, we found a small error in slide 14 of the PPT and figures 1/14 in the report. One of the stacked bars did not copy over properly.

Updated final versions attached.

I apologize we caught this today instead of last night, but please replace the posted versions with these.

Aaron Burdick, Associate Director
Energy and Environmental Economics, Inc. (E3)
44 Montgomery Street, Suite 1500 | San Francisco, CA 94104
818-807-6499 | aaron.burdick@ethree.com

From: Brown II,George L (BPA) - PGA-6
Sent: Thursday, June 9, 2022 1:48 PM
To: James,Eve A L (BPA) - PG-5; Bellcoff,Steve (BPA) - PGPR-5; Egerdahl,Ryan J (BPA) - PGPR-5; Koehler,Birgit G (BPA) - PG-5; Johnson,Kimberly O (BPA) - PGAF-6
Subject: RE: White book question need quick response if possible

We do not consider the end of life of the dam structure in our asset management processes, for any of the dams. We assume the dam structure will remain serviceable at the end of our asset management or business case study periods. For the most part, I think this is a reasonable assumption for the FCRPS dams, because the dams have a design life of 100 years, but the life expectancy is greater than that. For the LSN projects, they were completed between 1962 and 1979, so their age ranges from 43 to 60 years. It is reasonable to assume that their structures would still be serviceable 50 years from now.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Thursday, June 9, 2022 1:29 PM
To: Brown II,George L (BPA) - PGA-6 <glbrown@bpa.gov>; Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson,Kimberly O (BPA) - PGAF-6 <kojohnson@bpa.gov>
Subject: RE: White book question need quick response if possible

Thanks George. Do you have any thoughts on this comment specific to LSN projects:
Slide 4: Replacement. What is not mentioned is end of life of the generating units or the dam. **These were units installed in the mostly in the 70's and some in the 60's.** Considering the renewable resource, perhaps the end of life should be considered as well.

We supplied the SAMP numbers for cost of generation which includes the O&M costs, I don't know what end of life means on maintained hydro turbines so if you could supply thoughts on if there are time estimates for major turbine overhaul or something that might be helpful.

From: Brown II,George L (BPA) - PGA-6 <glbrown@bpa.gov>
Sent: Thursday, June 9, 2022 12:29 PM
To: Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson,Kimberly O (BPA) - PGAF-6 <kojohnson@bpa.gov>
Subject: RE: White book question need quick response if possible

Or "maximum capacity"

We use the term "sustained capacity", with the definition that it is the output that can be sustained on a generator unit without causing overheating. So the term works for an individual unit, but I can see the reluctance to use that term for the whole plant, since it implies that it can be sustained for the whole plant indefinitely. In Fast Facts we simply sum the sustained capacity of each unit to get the plant sustained capacity.

It's also common in the industry to use the term "continuous rating", but that has the same pitfalls as sustained capacity.

From: Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>
Sent: Thursday, June 9, 2022 12:07 PM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Brown II,George L (BPA) - PGA-6 <glbrown@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson,Kimberly O (BPA) - PGAF-6 <kojohnson@bpa.gov>
Subject: RE: White book question need quick response if possible

How about something on the line of 'Rated Capacity'??

From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Thursday, June 9, 2022 12:03 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Brown II,George L (BPA) - PGA-6 <glbrown@bpa.gov>; Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson,Kimberly O (BPA) - PGAF-6 <kojohnson@bpa.gov>
Subject: RE: White book question need quick response if possible

Thanks George. Thanks Eve. I agree, Eve, that the term sustained will be taken as a longer term sustained capability with fuel to boot. I don't have a good way around this yet, but some thoughts. Would it be fair to call it (for the external audience in current situation) a 1 hour sustained capacity? I know this is tricky since maybe there is almost always enough fuel to run at "overload" for 2 hours, 3 or 4 hours or something like that for different projects in different seasons. We know how variable the output is for FCRPS in many ways, but we don't normally forecast individual project capability that is informed by all constraints like water. We can do that now with Riverware, but the nameplate or "overload rating" or "sustained capacity" is supposed to be more static and like a maximum feasible....which is easier said than done.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Thursday, June 9, 2022 9:16 AM
To: Brown II,George L (BPA) - PGA-6 <glbrown@bpa.gov>; Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Johnson,Kimberly O (BPA) - PGAF-6 <kojohnson@bpa.gov>
Subject: RE: White book question need quick response if possible

So for the LSN projects specifically which phrase is appropriate? I'm a little worried about sustained capacity since that signals the fuel is available to run at those levels. George any thoughts about this comment:

Slide 4: Replacement. What is not mentioned is end of life of the generating units or the dam. These were units installed in the mostly in the 70's and some in the 60's. Considering the renewable resource, perhaps the end of life should be considered as well.

From: Brown II,George L (BPA) - PGA-6 <glbrown@bpa.gov>
Sent: Thursday, June 9, 2022 8:38 AM
To: Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Johnson,Kimberly O (BPA) - PGAF-6 <kojohnson@bpa.gov>
Subject: RE: White book question need quick response if possible

There is some nuance here. For any generators that have been rewound since the 1990s, they did away with the 115% continuous max capacity, which we've often termed "sustained capacity". Instead for the newer generator windings, the nameplate = sustained capacity. So the FCRPS has a mix of these two rating philosophies. So I'd recommend the term "sustained capacity" instead of "overload capacity".

From: Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>

Sent: Wednesday, June 8, 2022 3:08 PM

To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Johnson,Kimberly O (BPA) - PGAF-6 <kojohnson@bpa.gov>; Brown II,George L (BPA) - PGA-6 <glbrown@bpa.gov>

Subject: RE: White book question need quick response if possible

I would say Identifying as 'Overload Capacity' would be correct.

The Corp will use Nameplate because that is what was congressionally approved..

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Wednesday, June 8, 2022 3:03 PM

To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Johnson,Kimberly O (BPA) - PGAF-6 <kojohnson@bpa.gov>; Brown II,George L (BPA) - PGA-6 <glbrown@bpa.gov>

Subject: RE: White book question need quick response if possible

So it is still called "nameplate capacity" in the White Book and I don't want to get out of synch- do we need to put a footnote about the overload numbers or should we use the phrase "overload capacity"?

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Sent: Wednesday, June 8, 2022 3:02 PM

To: Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Johnson,Kimberly O (BPA) - PGAF-6 <kojohnson@bpa.gov>; Brown II,George L (BPA) - PGA-6 <glbrown@bpa.gov>

Subject: RE: White book question need quick response if possible

Thanks for that info. Then we need to change our wording. We've been calling it nameplate, and it sounds like that is quite wrong

From: Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>

Sent: Wednesday, June 8, 2022 2:56 PM

To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Johnson,Kimberly O (BPA) - PGAF-6 <kojohnson@bpa.gov>; Brown II,George L (BPA) - PGA-6 <glbrown@bpa.gov>

Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Subject: RE: White book question need quick response if possible

This is the difference between Nameplate and Overload capacities.

Corps websites list both Nameplate and overload (or they did),

We simply use overload.

Hydro facilities traditionally operate above nameplate and closer to overload.

FERC actually recognized this many years ago (20+ probably) with Licensed hydro facilities and made many hydro facilities adjust ratings to overload or peak generation numbers.

Overload is traditionally ~15% above nameplate.

Steve

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Wednesday, June 8, 2022 2:30 PM

To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>;

Johnson, Kimberly O (BPA) - PGAF-6 <kojohnson@bpa.gov>; Brown II, George L (BPA) - PGA-6 <glbrown@bpa.gov>

Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Subject: RE: White book question need quick response if possible

Confidential and privileged attorney client communication/FOIA-exempt

Adding George Brown on LSN questions below (added one):

From: James, Eve A L (BPA) - PG-5

Sent: Wednesday, June 8, 2022 2:14 PM

To: Egerdahl, Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Bellcoff, Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>

Cc: Koehler, Birgit G (BPA) - PG-5 (<bgkoehler@bpa.gov>) <bgkoehler@bpa.gov>

Subject: White book question need quick response if possible

Importance: High

Confidential and privileged attorney client communication/FOIA-exempt

Hi Ryan and Steve-

We received this comment from DOE about the E3 study results. Do you know why there is a discrepancy between the Corps site and the BPA white book values for the LSN nameplate? Maybe that is a question for PGA?

BPA Lower Snake River Dams Power Replacement:

Slide 3: Not to be a stickler for detail but I looked up the LSR dams on the USACE website and they rate the generators as follows:

- Lower Granite – 810MW
- Little Goose – 810MW
- Lower Monumental – 810MW, and
- Ice Harbor – 603MW
- For a total of 3,033MW *not* 3,483MW, they may be using nameplate but that doesn't account for age, field currents, and power factor.

Slide 4: Replacement. What is not mentioned is end of life of the generating units or the dam. These were units installed in the mostly in the 70's and some in the 60's. Considering the renewable resource, perhaps the end of life should be considered as well.

From: Communications
Sent: Wednesday, August 3, 2022 2:54 PM
To: Communications Outreach
Subject: Situational awareness: Council Spotlight includes Lower Snake River Dams Replacement Study, Spring Chinook returns and others

Internal outreach guidance

Power AEs, CAEs, TAEs and D.C.: Bringing to your attention for situational awareness. You may share this public information with any of your customers, tribes or constituents.

Transmission AEs: FYI, you may forward in response to questions from customers.

BPA managers and EERs: Share with your teams as appropriate.

External information



Council Spotlight

NEWS ABOUT ENERGY AND NATURAL RESOURCES IN THE PACIFIC NORTHWEST

Lower Snake River Dams Replacement Power Study



While it is possible to replace the output of the four lower Snake River dams while meeting aggressive clean-energy goals, the cost would be substantial, and the reliability of the system could depend on future technologies. [Read more.](#)

Upcoming Meetings

AUGUST 16-17: Council Meeting (Webinar)

[More meetings](#)

Coronavirus update: The Council is starting to resume in-person meetings, with online participation always available. We encourage people to join our meetings and engage with our staff and members by phone, webinar and email.

More News



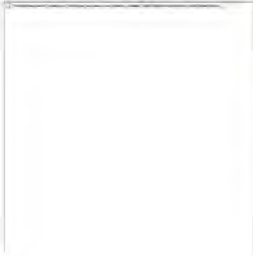
2022 Spring Chinook Salmon Return Better Than Forecast

Council members were briefed on spring Chinook salmon returns to the Columbia and Snake rivers, as well as the more sobering update on recovery efforts for Tucannon River spring Chinook. [Read more.](#)



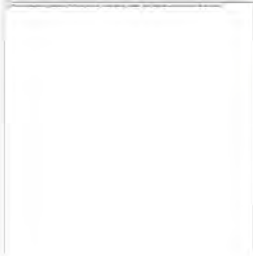
Energy Efficiency Programs for Low-Income Households

In a challenging economy when costs seem to be rising constantly, low-income households face an increasing risk of being unable to afford basic necessities, including electricity. [Read more.](#)



Efforts to Bring Back Pacific Lamprey Succeeding

Laurie Porter and Jon Hess of CRITFC briefed members on the current run of Pacific lamprey in the Columbia River Basin and tribal projects currently implemented through the Council's F&W Program. [Read more.](#)



Trout Creek Habitat Tour: Learning from the Place

This past spring, Oregon Council member Louie Pitt, Jr. and Council staff toured the Trout Creek Watershed Restoration Project located in Central Oregon. [Read more.](#)

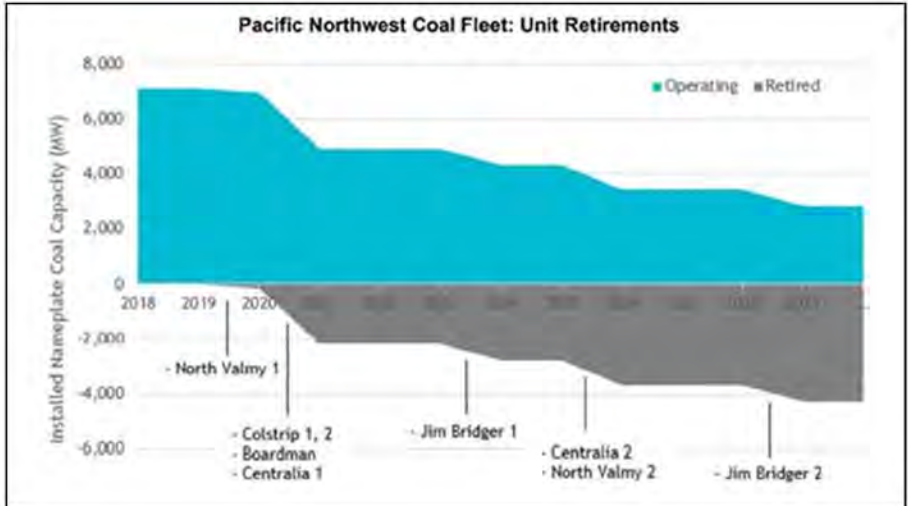
503.222.5161 | info@nwcouncil.org | www.nwcouncil.org

Subscribe or view in a browser

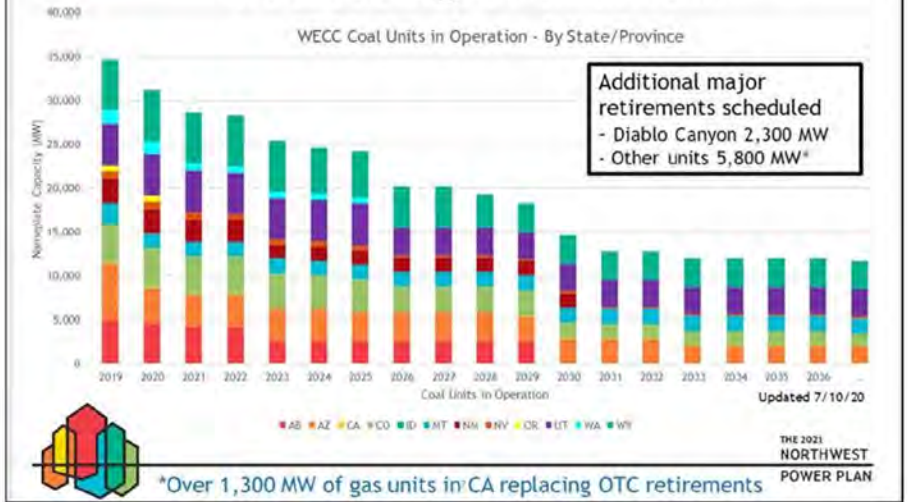


From: James,Eve A L (BPA) - PG-5
Sent: Wednesday, May 25, 2022 3:24 PM
To: Koehler,Birgit G (BPA) - PG-5

Categories: CRSO

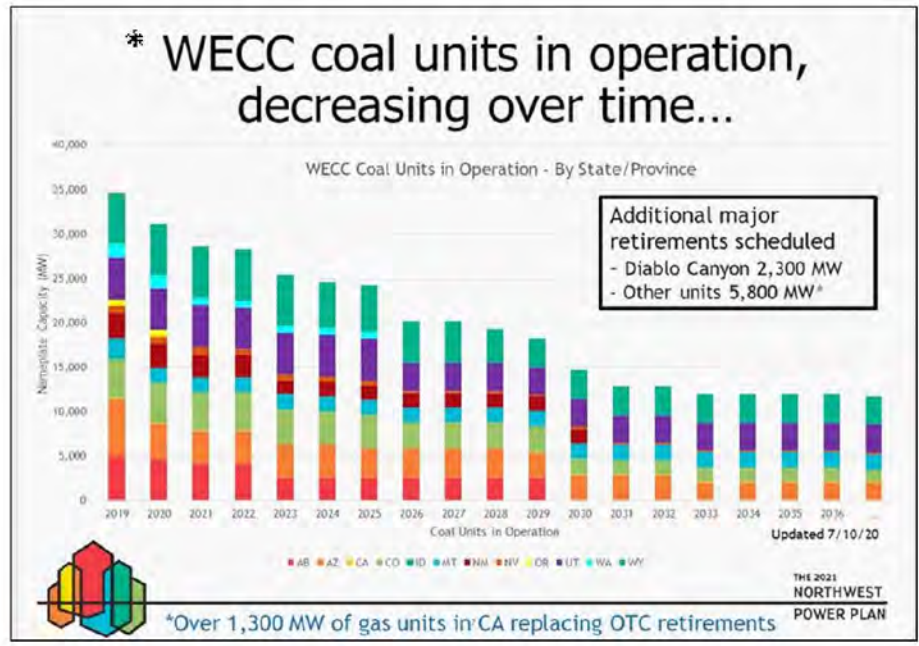


*** WECC coal units in operation, decreasing over time...**



***Over 1,300 MW of gas units in CA replacing OTC retirements**

* WECC coal units in operation, decreasing over time...



*Over 1,300 MW of gas units in CA replacing OTC retirements

From: Koehler,Birgit G (BPA) - PG-5
Sent: Thursday, August 4, 2022 1:58 PM
To: Aaron Burdick; Arne Olson
Cc: James,Eve A L (BPA) - PG-5
Subject: did you see the Council summary of your study?

You probably saw this already, but just in case...

[Lower Snake River Dams Replacement Power Study by E3 \(nwcouncil.org\)](https://www.nwcouncil.org/energy/energy-projects/energy-projects-2022/lower-snake-river-dams-replacement-power-study-by-e3)

From: Chad Madron <customer@gotowebinar.com>
Sent: Tuesday, July 5, 2022 12:19 PM
To: Koehler,Birgit G (BPA) - PG-5
Subject: [EXTERNAL] Council Meeting - July 7, 2022 Confirmation

Follow Up Flag: Follow up
Due By: Thursday, July 7, 2022 8:00 AM
Flag Status: Completed



Northwest Power and Conservation Council

Thank you for registering for "Council Meeting - July 7, 2022".

Please send your questions, comments and feedback to: cmadron@nwcouncil.org

How To Join The Webinar

Thu, Jul 7, 2022 8:30 AM - 10:00 AM PDT

Add to Calendar: [Outlook® Calendar](#) | [Google Calendar™](#) | [iCal®](#)

1. Click the link to join the webinar at the specified time and date:

Join Webinar

Note: This link should not be shared with others; it is unique to you.

Before joining, be sure to [check system requirements](#) to avoid any connection issues.

2. Choose one of the following audio options:

TO USE YOUR COMPUTER'S AUDIO:

and speakers (VoIP). A headset is recommended.

--OR--

TO USE YOUR TELEPHONE:

If you prefer to use your phone, you must select "Use Telephone" after joining the webinar and call in using the numbers below.

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Audio PIN: Shown after joining the webinar

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From: Goodwin,Summer G (BPA) - DKS-7
Sent: Wednesday, June 1, 2022 9:01 AM
To: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5
Cc: Johnson,G Douglas (BPA) - DK-7
Subject: Draft release plan for E3 LSRD study
Attachments: release plan -E3 LSRD study - June 2022_draft.doc

Hi Eve and Birgit

In anticipation of the final study, I put this draft rollout plan together. Ignore the dates, that doesn't seem to be the correct timeline. Once I know more about when we want to release or whether the DC briefing has occurred, I can update it. If you see any additional steps that should be added, please add or shoot back to me and Doug. Thanks.

Best

Summer

E3 LSRD REPLACEMENT STUDY ROLLOUT

June 2022

Background: Earlier this year, BPA engaged electric industry research firm Energy and Environmental Economics (E3) to build on the analysis performed in the Columbia River System Operations (CRSO) Environmental Impact Statement (EIS) regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future.

The CRSO EIS analysis examined a series of resource replacement portfolios using the Northwest Power and Conservation Council's latest resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. E3 will include a resource portfolio optimizer model using their data sets and their criteria and objectives to create least cost replacement portfolios.

The objective of the current analysis is to provide BPA with an independent study of lower Snake River dam breaching and potential replacement resources from a realistic analytic, operational, and resource characteristic perspective, so that BPA can enhance its understanding of the complexity and expense involved in replacing those assets.

Goal: Increase understanding of the costs and complexity of dam breaching.

Objectives:

- Earn media in Northwest and national media markets
- Provide materials that all audiences can consume.

Target audiences:

- DC agency and elected officials
- Northwest delegation members and staff
- customer utilities
- ratepayers
- the general public

Timeline (to be adjusted)

Date	Action Item	Responsible party
May 30	One pager and final slides received (tentative)	E3
May 31	DOE or CEQ briefing (tentative)	Eve James Sonya Baskerville
By June 3	Develop talking points	Communications

June 3	Friday AE call briefing	Eve James
June 8	Briefing at AE/CAT meeting	Eve James
June 8 (after AE/CAT)	Post materials to webpage and possibly social media <ul style="list-style-type: none"> • One pager • PPT slides in PDF 	Communications
June 8	Press release <ul style="list-style-type: none"> • Outreach Email to AEs 	Doug Johnson Summer Goodwin

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, July 5, 2022 9:56 AM
To: Leary,Jill C (BPA) - LN-7
Subject: FW: E3 rollout

From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Sent: Tuesday, July 5, 2022 9:50 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: E3 rollout

Here is the instant message Eve sent me:

[6/30/2022 7:09 AM] James,Eve A L (BPA) - PG-5:

Hi Doug- I just got a new version of the PPT presentation from E3. The biggest change is that they are now using a 3% discount rate to calculate the NPV instead of 5%. This puts the information more in line with the Inslee/Murray report and our actual 2.81% WACC. Do you want me to update the version of the talking points I have with the new numbers and graphics or do you want to maintain version control and I can send you the new PPT and graphics?

IOU's use closer to 5% and that was what the original numbers were based on. Public power (don't need rate of return on capital and use lower cost financing are closer to 3%)

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 5, 2022 9:35 AM
To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Subject: RE: E3 rollout

Great

From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Sent: Tuesday, July 5, 2022 9:33 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: E3 rollout

It is the change to the discount rate from 5% (more commonly used for IOUs) to 3% more in line with how we calculate things. I think I have an email from Eve that explains it. Let me send it to you. We don't need a Q&A in the TPs. I think Jill needs to explain it to DOE. I'll forward Eve's explanation. Sound good?

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 5, 2022 9:31 AM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: FW: E3 rollout

Doug, I just noticed this email and have not included that yet. Let me see what's going on with this new number

From: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Tuesday, July 5, 2022 8:01 AM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: RE: E3 rollout

Hello,

When you have updated talking points later today, will you share with Sonya and me so one of us can send over to DOE?

I flagged this for Birgit, but CEQ/DOE noticed a "new" \$75 billion number in the E3 report, so I am hoping we can track down if that number changed from the \$45 billion number or is something different and add a talking point.

Birgit, can help draft this, and if not, would you reach out to E3 for assistance?

Thanks,

Jill

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Friday, July 1, 2022 11:42 AM
To: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Subject: RE: E3 rollout

Send me the charts. I'll get it done later today or over the weekend. Thanks! Enjoy the 4th.

On Jul 1, 2022 11:28 AM, "James,Eve A L (BPA) - PG-5" <eajames@bpa.gov> wrote:

I'll be out of the office next week but if you send me the updated version today I can replace the charts and email back late today- otherwise I'll send the chart to you and Summer to replace them on Tuesday.

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Friday, July 1, 2022 11:19 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Cc: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Subject: RE: E3 rollout

I will get an updated version of the talking points to you early Tuesday morning. Please replace the existing charts with the new ones. We can share Tuesday and finalize Wednesday and get to our external communicators ahead of the Thursday morning session.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, July 1, 2022 11:14 AM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Cc: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Subject: RE: E3 rollout

The updated table with the new NPV's may come in late today so probably will need to circulate on Tuesday. Even if my out of office pops up I will log on to send those and the updated PPT deck to the website staff for posting July 7.

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Friday, July 1, 2022 10:57 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Cc: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Subject: RE: E3 rollout

Thanks for sharing! Yes. We can add a Q&A. I'll likely add that one and others we have discussed Tuesday and circulate. That work?

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, July 1, 2022 10:51 AM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Cc: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Subject: E3 rollout

Confidential and privileged attorney client communication/FOIA-exempt

Hi Doug and Summer- DOE has been coordinating with CEQ on the E3 rollout plan we provided. This is the schedule with all the rollout events so please let me know if anything is missing. Since the posting of the report will be July 15 I was going to provide E3 with this talking point if they are asked at the Council meeting. Could you add a similar type statement on the internal talking points you are working on? I will send out the updated slides with the final NPV values when I get them later today.

When will the final E3 study be publicly available?

E3 is conducting a series of presentations over the next week, in addition to this presentation, and BPA plans to post the report after those conversations are complete.

- July 1 – Final Study delivered to BPA; study shared with CEQ for distribution to Deputies
- July 5 – Talking points for NWPPCC and congressional briefings circulated for review
- July 6 – Media advisory for press
- July 7 – Post slides to BPA webpage and conduct social media outreach
- July 7 – Northwest Power and Conservation Council briefing
 - Press availability by phone
- July 8 – afternoon – Congressional briefing with Northwestern congressional staff
- July 8 – afternoon – Congressional briefing with Senator Murray’s staff
- July 11 – morning – E3 Study presentation to Deputies
- July 15 – Post final Report on BPA’s website

From: Leary,Jill C (BPA) - LN-7
Sent: Wednesday, June 29, 2022 4:40 PM
To: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5; Senters,Anne E (BPA) - LN-7
Cc: Godwin,Mary E (BPA) - LN-7
Subject: FW: E3 study release plan
Attachments: E3 LSRD replacement cost analysis TPs v3.docx; release plan -E3 LSRD study - June 2022 _draft4.doc

Confidential and privileged attorney client communication/FOIA-exempt
FYI

From: Leary,Jill C (BPA) - LN-7
Sent: Wednesday, June 29, 2022 4:39 PM
To: 'Daly, Gabriel' <gabriel.daly@hq.doe.gov>; 'Ardis, Melissa' <melissa.ardis@hq.doe.gov>
Cc: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: FW: E3 study release plan

Confidential and privileged attorney client communication/FOIA-exempt

Hi Gabe and Melissa,

Attached are the materials BPA folks put together for the E3 rollout. As you will notice below, these are still under review and neither Mary nor I have reviewed, but we wanted to get this information to you ASAP.

I will update you as information is revised, thanks.

Jill

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, June 29, 2022 4:27 PM
To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: E3 study release plan

Confidential and privileged attorney client communication/FOIA-exempt

Hi Jill-

Attached is a draft version of the E3 study release plan and talking points. I know there are still a few BPA staff that have comments to these drafts but haven't sent them to me so there might be some slight adjustments. The major tasks and framework won't change though so feel free to share with DOE.

Thanks,
Eve

From: Habibi, Maryam A (BPA) - DKP-7
Sent: Tuesday, July 12, 2022 5:23 PM
To: James, Eve A L (BPA) - PG-5; Koehler, Birgit G (BPA) - PG-5
Subject: RE: A few more typos caught...

BPA customers would be PGE, PAC and PUDs...
End users would be their retail customers.

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C (b)(6)

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, July 12, 2022 5:06 PM
To: Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: A few more typos caught...

Good catch on the typos. For Q/A 7 the edit is correct to add per household. I guess I don't know the difference between a customer and an end-user. I don't see a need to rewrite the question but will defer if anyone feels strongly about the terms.

From: Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 4:11 PM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: A few more typos caught...

I had Kristel Turner review the talking points – because I'm no longer clear-headed about them. 😊

She caught a few typos and has a question regarding Q/A 7 on the last page.

Edits are mostly on pages 2, 5 and 6.

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
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bpa.gov | P 503-230-4413 | C (b)(6)



FOR INTERNAL USE ONLY

BPA talking points

E3 lower Snake River dam replacement costs analysis

June 2022

What this is

Earlier this year, BPA contracted with electric industry research firm Energy and Environmental Economics, also known as E3, to conduct an independent analysis of the electricity system value of the four lower Snake River (LSR) dams. This new analysis builds on the analysis performed in the Columbia River System Operations Environmental Impact Statement regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future. BPA anticipates E3's study to contribute to the regional dialogue about the future of these publicly-owned assets and help elevate regional understanding of the complexities and expenses involved in exploring replacement resources for the LSR dams.

Key messages and storyline

- As states move forward with clean energy policies, fossil-fuel generated power is being removed from the grid. Reducing hydropower would require the region to build new generation just to get the system back to its current state. Until all fossil-fuel power plants are retired, reducing hydropower means more CO2 emissions in the region, which is a step backward from the region's carbon reduction goals. Some of the lower-cost options for replacing lost hydropower rely on emerging technologies that are not yet developed or available at large-scale.
- Replacing the dams' hydropower energy and capacity services with existing renewable technology and no technological breakthroughs is projected to create 65% upward rate pressure. This is much higher than the other scenarios evaluated. prohibitively expensive.
- The E3 study evaluates what is required to maintain current reliability standards. Assuming different risk levels for reliability, as is done in other studies of LSN dam power replacement, is a policy decision outside the scope of this analysis.
- New resources to replace the existing lower Snake River dams' energy and capacity would cost between \$7 to 11.5 billion with at least one emerging technology and up to \$46 billion absent breakthroughs in not-yet-commercialized emerging technologies. If these costs are not paid for by an outside source, it would result in higher electric bills for millions of Northwest residents.
- The replacement of the dams' hydropower could take up to approximately 20 years to complete after Congressional approval assuming Transmission builds were needed but there was not litigation or other major delay on siting.

Background

With multiple reviews of the future of the lower Snake River dams being conducted by the Council on Environmental Quality, the Columbia Basin Collaborative and Senator Patty Murray (D-WA) and Washington Governor Jay Inslee, BPA felt it necessary to update the potential costs of replacing the energy services from these facilities.

The CRSO EIS analysis examined a series of resource replacement portfolios using the Northwest Power and Conservation Council's latest forecasts and updated Energy Commodities resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. E3 used a resource portfolio optimizer model with their data sets and their criteria and objectives to create least-cost replacement portfolios.

E3's independent analysis includes several scenarios for replacement resources, including some with emerging technologies such as small modular nuclear reactors (SMRs) and gas plants with carbon capture or hydrogen burning capability that are not available yet. It also includes use of traditional renewable resources, such as wind, solar, storage and demand response. All of the scenarios present moderate to significant upward rate pressure for BPA's customers if not paid for by an outside source.

For more information, contact: Eve James, 503-230-5558 or Birgit Koehler, 503-230-4249

Questions and answers

1. What was the scope of the study and what questions did it address?

BPA contracted with E3 to answer what resources (one or more portfolios of resources) would be needed to maintain reliability, which is close to replacing the energy and other grid services provided by the lower Snake River dams. This includes modeling regional grid scenarios with and without the dams. The model is designed to identify one or more replacement resource portfolio(s) and provide a comparison of the forecasted costs associated with each scenario. The analysis also discusses the timeline under which a build-out of replacement resources could occur.

E3's key study questions are:

- What additional resources would be needed to replace the power services provided by the LSR Dams through 2045?
- What is the net cost to BPA ratepayers?
- How do costs and resource needs change under different types of clean energy futures?
- How much does replacing the dams rely on emerging, not-yet commercialized technologies?

2. What power benefits do the four LSRDs currently provide?

These facilities first and foremost provide reliable electricity to help the western interconnection and the Pacific Northwest avoid blackouts. They also provide carbon-free energy. More specifically, they are capable of providing a short-term peaking capacity of more than 3,000 MWs. They can provide more than 2,000 MW of longer term peaking capacity during cold snaps when Pacific Northwest electricity use is at its highest as well as provide important reserves and essential grid reliability services, including voltage support, reactive power and black start ability.

3. What resources does the study recommend to replace the output of the lower Snake River dams?

The study recommends a combination of renewable generation (wind and solar) and “clean firm” resources (such as dual fuel natural gas + hydrogen plants, advanced small modular nuclear reactors (SMR), or gas with carbon capture and storage), and energy efficiency.

4. What are the replacement resource scenarios E3 evaluated?

Scenario	Replacement Resources Selected, Cumulative by 2045 (GW*)
<p>Scenario 1: 100% Clean Retail Sales</p>	<p>+ 2.1 GW dual fuel NG/H2 CCGT + 0.5 GW wind</p>
<p>Scenario 2a: Deep Decarb. (Baseline Technologies)</p>	<p>+ 2.0 GW dual fuel NG/H2 CCGT + 0.3 GW li-ion battery + 0.4 GW wind + 0.05 GW advanced energy efficiency + additional H2 generation**</p>
<p>Scenario 2b: Deep Decarb. (Emerging Technologies)</p>	<p>+ 1.5 GW dual fuel NG/H2 CCGT + 0.7 GW nuclear SMR</p>

Scenario 2c: Deep Decarb.
(No New Combustion)

+ 10.6 GW wind
+ 1.4 GW solar

- In scenarios that assume new combustion generation may be permitted in the Northwest, firm capacity is mostly replaced with ~2 GW of dual fuel natural gas + hydrogen turbines. These turbines may initially burn natural gas when needed during reliability challenged periods, but would transition to green hydrogen by 2045 to reach zero-emissions.
- If advanced nuclear is available, it is selected in lieu of renewables and some of the gas plants.
- The “no new combustion” scenario with decarbonization of the broader economy (e.g. electric vehicles and electric heating) requires an impractically large (12 GW) buildout of renewable energy to replace the dams’ firm capacity contributions and GHG-free energy. This is required because the wind and solar power are not as reliable for serving load as would be firm combustion generation, and thus large quantities are needed to ensure that some generation may be available during the critical periods like winter cold spells.

5. What does each option cost?

	Total Costs (real 2022 \$)	Annual Cost Increase (real 2022 \$)			Incremental Public Power Costs [% increase vs. -8.5 cents/kWh NW average retail rates]
	Net Present Value in year of breaching	2025	2035	2045	2045
Scenario 1: 100% Clean Retail Sales	\$7.5 billion		\$434 million	\$478 million	0.8 cents/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$11 billion	\$495 million	\$466 million	\$509 million	0.8 cents/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$11.5 billion		\$496 million	\$860 million	1.5 cents/kWh [+18%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$7 billion		\$415 million	\$428 million	0.7 cents/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$46 billion	n/a	\$1,953 million	\$3,199 million	5.5 cents/kWh [+65%]

- Cost increases account for replacement energy, capacity, and reserves as well as avoided LSR capital + expense, but do not include any costs for breaching the dams, which would be an additional cost.

- NPV and annual cost increase are shown for the Northwest Region as a whole, but the incremental costs are calculated relative to the BPA Tier I annual sales for public power customers.

- % increase versus average retail rates assumes ~8.5 cents/kWh retail rates (estimated from OR and WA average retail rates). This does not account for any other rate increases that will be driven by higher loads or clean energy needs that increase regional rates.

- Annual residential customer cost impact assumes 1,280 kWh/month for average residential customers in Oregon and Washington (current ~1,000 kWh/month average + 28% from electrification load growth).

- New federal tax credits for hydrogen plants/fuels or ITC/PTC extension for renewables would provide a cost reduction to public power customers from taxpayers

6. How do the replacement costs compare to the current costs of the lower Snake River dams?

The lower Snake River dams cost between \$13 and \$17/MWh to operate and maintain. Replacement resources, depending on those chosen, are projected to cost between \$77 and \$139/MWh. Replacement costs rise to more than \$500 MWh in the deep economy-wide decarbonization scenario that includes only existing technologies (wind, solar, etc.) and no emerging technology, such as hydrogen and small modular nuclear.

7. What is the projected rate impact to BPA customers?

In scenarios 1, 2a and 2b, the rate impact would be between 8% and 18% or ~\$100 to \$230 per year. In a deep economy-wide decarbonization scenario (2c) with no emerging technologies, the cost would be approximately a 65% increase or \$850 per year per household.

Note: Scenario 2c required increases in the supply of wind on new transmission (Northwest, Montana, Wyoming, and off-shore wind) to enable a feasible solution which drives the costs impractically high.

8. What is the timeline necessary to add the resources that would be required?

E3 estimates that adding additional renewable energy and firm capacity additions would take approximately five to seven years after Congressional approval to breach the dams and possibly up to 10 to 20 years assuming additional new large-scale transmission was required but there was not litigation or other major delay on siting.

E3 LSRD REPLACEMENT STUDY ROLLOUT

June 2022

Updated 06/29/2022

Background: Earlier this year, BPA engaged electric industry research firm Energy and Environmental Economics (E3) to build on the analysis performed in the Columbia River System Operations (CRSO) Environmental Impact Statement (EIS) regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future.

The CRSO EIS analysis examined a series of resource replacement portfolios using the Northwest Power and Conservation Council's latest resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. E3 will include a resource portfolio optimizer model using their data sets and their criteria and objectives to create least cost replacement portfolios.

The objective of the current analysis is to provide BPA with an independent study of lower Snake River dam breaching and potential replacement resources from a realistic analytic, operational, and resource characteristic perspective, so that BPA can enhance its understanding of the complexity and expense involved in replacing those assets.

Goal: Increase understanding of the costs and complexity of dam breaching.

Objectives:

- Earn media in Northwest and national media markets
- Provide materials that all audiences can consume.

Target audiences:

- DC agency and elected officials
- Northwest delegation members and staff
- customer utilities
- ratepayers
- the general public

Timeline (to be adjusted, all dates tentative)

Date	Action item	Responsible party
Mid June	Final slides briefing for DOE or CEQ (completed)	Eve James Sonya Baskerville
June 30	Friday AE call briefing	Eve James

July 1	Final Report delivered to BPA	E3 and Eve James
By July 5	Finalize talking points	Communications
July 6	Issue media advisory for press availability <ul style="list-style-type: none"> • Arrange ATT phone line 	Doug Johnson
7:00 a.m. July 7	Post materials to webpage and possibly social media <ul style="list-style-type: none"> • Study Executive Summary • PPT slides in PDF • <i>Materials posted to NWPCC website (F&W Committee Meeting and Council Meeting Northwest Power and Conservation Council (nwcouncil.org))</i> 	Communications
7:30 a.m. July 7	Send a Communications Outreach email requesting outreach <ul style="list-style-type: none"> • Talking Points • Link to NWPCC meeting webpage with presentation and exec summary 	Communications
8-9:30 a.m. July 7	Council Briefing <ul style="list-style-type: none"> • Study Executive Summary • PPT slides in PDF 	Communications
July 7 1 p.m.	Press Availability by phone <ul style="list-style-type: none"> • E3 representative and a BPA Power Services rep 	Doug Johnson
July 7	Congressional Briefing <ul style="list-style-type: none"> • <i>E3 representative and a BPA Power Services rep</i> 	<i>Sonya Baskerville</i>

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, July 12, 2022 5:25 PM
To: Habibi,Maryam A (BPA) - DKP-7; James,Eve A L (BPA) - PG-5
Subject: RE: A few more typos caught...

I suspect we want end-users, but households might be a better term depending on who these talking points are used for

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 5:23 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: A few more typos caught...

I'll update the posted talking points tomorrow morning. 😊

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C(b)(6)

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 12, 2022 5:21 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Subject: RE: A few more typos caught...

I don't have an opinion on whether we say customer or household in the question.

And yeah for good writers and people helping each other. I know I can always proofread someone else's work better than my own.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, July 12, 2022 5:06 PM
To: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: A few more typos caught...

Good catch on the typos. For Q/A 7 the edit is correct to add per household. I guess I don't know the difference between a customer and an end-user. I don't see a need to rewrite the question but will defer if anyone feels strongly about the terms.

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 4:11 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: A few more typos caught...

I had Kristel Turner review the talking points – because I'm no longer clear-headed about them. 😊

She caught a few typos and has a question regarding Q/A 7 on the last page.

Edits are mostly on pages 2, 5 and 6.

Maryam Habibi

Manager | Media Relations, Policy Communications and Writing

BONNEVILLE POWER ADMINISTRATION

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From: Scruggs,Joel L (BPA) - DK-7
Sent: Tuesday, July 12, 2022 2:05 PM
To: Koehler,Birgit G (BPA) - PG-5
Cc: James,Eve A L (BPA) - PG-5; Baskerville,Sonya L (BPA) - AIN-WASH; Habibi,Maryam A (BPA) - DKP-7; Goodwin,Summer G (BPA) - DKS-7
Subject: RE: BPA E3 talking points for review (DRAFT)

Hey, Birgit. I have had a few requests for E3's contact info. Should we note that the E3 team is directly responding to questions about their study in our talking points? Could include their email addresses.

Arne Olson, arne@ethree.com
Aaron Burdick, aaron.burdick@ethree.com

Joel Scruggs (He/Him)
Director of Communications | Communications (DK)
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-5511 | C (b)(6)



From: Goodwin,Summer G (BPA) - DKS-7 <ssgoodwin@bpa.gov>
Sent: Tuesday, July 12, 2022 1:51 PM
To: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

They will be very happy.

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 11:16 AM
To: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Cc: Goodwin,Summer G (BPA) - DKS-7 <ssgoodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

Excellent. I've taken final edits which included reordering the key messages, moving a couple of details to Q/A and hopefully addressing the remaining comments.

I'll finalize this version and we should be able to distribute to AEs, CAEs, D.C., etc., by 2 p.m. today.

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C (b)(6)

From: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>
Sent: Tuesday, July 12, 2022 9:58 AM
To: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

Thanks Maryam,

No additional comments from me.

John

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 8:41 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

Here is a cleaner version. In the interest of time, I think we should send the Comms outreach email now, without the talking points. We can send a link to final talking points later this morning.

Summer, you can send the outreach message without TPs. Thank you!

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C (b)(6)

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, July 12, 2022 8:02 AM
To: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

The talking points look good if they already went out- I made a few small tweaks to Q7.

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 7:43 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

Thank you, Birgit. Appreciate your swift review.

Others, please let us know if you are comfortable with the content in these talking points.

We hope to be able to send a Communications Outreach message around 8 a.m. today and would love to include these for internal folks to use when answering questions.

Many thanks,

Maryam Habibi

Manager | Media Relations, Policy Communications and Writing

BONNEVILLE POWER ADMINISTRATION

P 503-230-4413 | C (b)(6)

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Sent: Monday, July 11, 2022 8:18 PM

To: Scruggs, Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston, John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Subject: RE: BPA E3 talking points for review (DRAFT)

I updated numbers from the latest power point and made a few other edits to account for the changes that E3 made today. There were also prior track changes.

For everyone's information:

Scenario 2c now has a range. Here's how question 7 now describes this. Note, I could definitely use Eve to ground-truth my logic and anyone to help with wording if we have time before releasing these TPs

Note: Scenario 2c required increases in the supply of wind on new transmission in Northwest, Montana, Wyoming, as well as offshore wind, to enable a feasible solution that drives costs extremely high. This is largely a result of the model assuming that the best sites, with less new transmission needed, would largely be chosen for new resources to replace the coal and natural gas plants that the region to meet decarbonization goals without the loss of lower Snake River dam generation. If new resources to replace the generation of the lower Snake River dams were built on the preferred sites with less new transmission needs, then the cost would be lower, as indicated in the lower range for Scenario 2c. In this case, Scenario 2c would be less expensive, but in turn the region would need to build transmission to more distance sites for replacement resources for retiring coal and natural gas plants.

And E3 added Scenario 1b. The first version of Scenario 1 (100% Clean Retail Sales Scenario i.e. net zero carbon energy-sector only) bothered E3. In an oddity that I can't describe succinctly, changing how the model meets the carbon goals can be cheaper one way but lower emissions the other way, so E3 wanted to show both. Given how fast things were changing today, we didn't have a long time to discuss and still have E3 able to meet today's deadline for the 6 am release tomorrow.

Note about the embargoed release (compared to what is in the final study)

- It included the range on Scenario 2c.
- It did not include minor changes from correcting rounding errors

- It did not include Scenario 1b

Birgit

From: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>

Sent: Monday, July 11, 2022 6:07 PM

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Subject: BPA E3 talking points for review (DRAFT)

Importance: High

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Birgit - Should the change to scenario 2c be noted?

Thanks,

Joel Scruggs (He/Him)

Director of Communications | Communications (DK)

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-5511 | C(b)(6)



From: Habibi, Maryam A (BPA) - DKP-7
Sent: Tuesday, July 12, 2022 2:08 PM
To: Koehler, Birgit G (BPA) - PG-5
Subject: RE: BPA E3 talking points for review (DRAFT)

I agree, for all the crazy, our part has been fairly smooth.

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C(b)(6)

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 12, 2022 2:03 PM
To: Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

I skimmed through it lightly, and that one change had caught my eye. I think the rest is good. Send it out!

We're doing darn well on such a sudden roll out!

From: Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
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Subject: RE: BPA E3 talking points for review (DRAFT)

Any other changes before I proceed?

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Director of Communications | Communications (DK)
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-5511 | C (b)(6)



From: Goodwin,Summer G (BPA) - DKS-7
Sent: Tuesday, July 12, 2022 1:51 PM
To: Habibi,Maryam A (BPA) - DKP-7; Hairston,John L (BPA) - A-7; James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5; Scruggs,Joel L (BPA) - DK-7; Baskerville,Sonya L (BPA) - AIN-WASH; Armentrout,Scott G (BPA) - E-4; Zelinsky,Benjamin D (BPA) - E-4; Godwin,Mary E (BPA) - LN-7
Subject: RE: BPA E3 talking points for review (DRAFT)

They will be very happy.

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 11:16 AM
To: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

Excellent. I've taken final edits which included reordering the key messages, moving a couple of details to Q/A and hopefully addressing the remaining comments.

I'll finalize this version and we should be able to distribute to AEs, CAEs, D.C., etc., by 2 p.m. today.

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C (b)(6)

From: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>
Sent: Tuesday, July 12, 2022 9:58 AM
To: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

Thanks Maryam,

No additional comments from me.

John

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 8:41 AM
To: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA)

- A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>

Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>

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Maryam Habibi

Manager | Media Relations, Policy Communications and Writing

BONNEVILLE POWER ADMINISTRATION

P 503-230-4413 | C (b)(6)

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Tuesday, July 12, 2022 8:02 AM

To: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>

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From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>

Sent: Tuesday, July 12, 2022 7:43 AM

To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Subject: RE: BPA E3 talking points for review (DRAFT)

Thank you, Birgit. Appreciate your swift review.

Others, please let us know if you are comfortable with the content in these talking points.

We hope to be able to send a Communications Outreach message around 8 a.m. today and would love to include these for internal folks to use when answering questions.

Many thanks,

Maryam Habibi

Manager | Media Relations, Policy Communications and Writing

BONNEVILLE POWER ADMINISTRATION

P 503-230-4413 | C (b)(6)

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Sent: Monday, July 11, 2022 8:18 PM

To: Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; James,Eve A L (BPA) -

PG-5 <eajames@bpa.gov>

Subject: RE: BPA E3 talking points for review (DRAFT)

I updated numbers from the latest power point and made a few other edits to account for the changes that E3 made today. There were also prior track changes.

For everyone's information:

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And E3 added Scenario 1b. The first version of Scenario 1 (100% Clean Retail Sales Scenario i.e. net zero carbon energy-sector only) bothered E3. In an oddity that I can't describe succinctly, changing how the model meets the carbon goals can be cheaper one way but lower emissions the other way, so E3 wanted to show both. Given how fast things were changing today, we didn't have a long time to discuss and still have E3 able to meet today's deadline for the 6 am release tomorrow.

Note about the embargoed release (compared to what is in the final study)

- It included the range on Scenario 2c.
- It did not include minor changes from correcting rounding errors
- It did not include Scenario 1b

Birgit

From: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>

Sent: Monday, July 11, 2022 6:07 PM

To: Baskerville,Sonya L (BPA) - AIN-WASH <sjbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>

Subject: BPA E3 talking points for review (DRAFT)

Importance: High

Hey, all. Please give the set of talking points that we had reviewed last week another look. Note: While this is an internal-facing document, leaders and staff will refer to it in response to any questions they receive about the study.

Please review and provide any edits with track changes on. If you don't have any suggested edits, please provide your concurrence.

Birgit - Should the change to scenario 2c be noted?

Thanks,

Joel Scruggs (He/Him)

Director of Communications | Communications (DK)

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Sent: Tuesday, July 12, 2022 8:42 AM
To: Habibi,Maryam A (BPA) - DKP-7; James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5; Scruggs,Joel L (BPA) - DK-7; Baskerville,Sonya L (BPA) - AIN-WASH; Hairston,John L (BPA) - A-7; Armentrout,Scott G (BPA) - E-4; Zelinsky,Benjamin D (BPA) - E-4; Godwin,Mary E (BPA) - LN-7
Subject: RE: BPA E3 talking points for review (DRAFT)

Ok. Will do.

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 8:41 AM
To: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
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Birgit

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Director of Communications | Communications (DK)

BONNEVILLE POWER ADMINISTRATION

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Sent: Monday, July 11, 2022 8:18 PM
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Subject: RE: BPA E3 talking points for review (DRAFT)
Attachments: Talking points - E3 LSRD replacement cost analysis TPs v10 bk.docx

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Director of Communications | Communications (DK)

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From: Habibi, Maryam A (BPA) - DKP-7
Sent: Tuesday, July 12, 2022 2:32 PM
To: Koehler, Birgit G (BPA) - PG-5; Scruggs, Joel L (BPA) - DK-7
Cc: James, Eve A L (BPA) - PG-5; Baskerville, Sonya L (BPA) - AIN-WASH; Goodwin, Summer G (BPA) - DKS-7
Subject: RE: BPA E3 talking points for review (DRAFT)

I can easily make that change.

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C (b)(6)

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 12, 2022 2:31 PM
To: Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs, Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

Eve, is it worth changing this? I'd move the paragraph break so the two sentences on Scenario 2c are together.

the four LSR dams were breached. Thus, it is the average cost of generation that should be used for comparison to potential replacement resources. The 50-year forecasted values are expected to be in a similar range with a 50-year Cost of Generation of \$12.50/MWh and a 50-year Fully Loaded Cost of \$27.22/MWh. Replacement resources, depending on those chosen, are projected to cost between \$77 and \$139/MWh. Replacement costs rise to more than \$500 MWh in the deep economy-wide decarbonization scenario that includes only existing technologies (wind, solar, etc.) and no emerging technology, such as hydrogen and nuclear SMR.

The replacement options, presently and in the near term, combined with the rising costs of installing new energy infrastructure, contribute to this projected cost being double to quadruple the other scenarios evaluated.

From: Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 2:24 PM
To: Scruggs, Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

Link to final internal talking points: <https://connection.bud.bpa.gov/news/current-messages/talkingpoints/E3%20analyzes%20potential%20replacement%20resources%20and%20costs%20of%20lower%20Snake%20River%20dams.docx>

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
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P 503-230-4413 | C(b)(6)

From: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>
Sent: Tuesday, July 12, 2022 2:19 PM
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Subject: RE: BPA E3 talking points for review (DRAFT)

We could provide their contact info upon request. Will E3 eventually post this study on their website?

[Projects Archive - E3 \(ethree.com\)](#)

Joel Scruggs (He/Him)
Director of Communications | Communications (DK)
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-5511 | C(b)(6)



From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 2:15 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

The talking points may not be the best place to put their contact information anyway. I'm about to finalize and post those for distribution.

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C(b)(6)

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Sent: Tuesday, July 12, 2022 2:11 PM
To: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>
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Hey, Birgit. I have had a few requests for E3's contact info. Should we note that the E3 team is directly responding to questions about their study in our talking points? Could include their email addresses.

Arne Olson, arne@ethree.com
Aaron Burdick, aaron.burdick@ethree.com

Joel Scruggs (He/Him)
Director of Communications | Communications (DK)
BONNEVILLE POWER ADMINISTRATION
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Subject: RE: BPA E3 talking points for review (DRAFT)

They will be very happy.

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Excellent. I've taken final edits which included reordering the key messages, moving a couple of details to Q/A and hopefully addressing the remaining comments.

I'll finalize this version and we should be able to distribute to AEs, CAEs, D.C., etc., by 2 p.m. today.

Maryam Habibi

Manager | Media Relations, Policy Communications and Writing

BONNEVILLE POWER ADMINISTRATION

P 503-230-4413 | C(b)(6)

From: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>

Sent: Tuesday, July 12, 2022 9:58 AM

To: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>

Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>

Subject: RE: BPA E3 talking points for review (DRAFT)

Thanks Maryam,

No additional comments from me.

John

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>

Sent: Tuesday, July 12, 2022 8:41 AM

To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>

Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>

Subject: RE: BPA E3 talking points for review (DRAFT)

Here is a cleaner version. In the interest of time, I think we should send the Comms outreach email now, without the talking points. We can send a link to final talking points later this morning.

Summer, you can send the outreach message without TPs. Thank you!

Maryam Habibi

Manager | Media Relations, Policy Communications and Writing

BONNEVILLE POWER ADMINISTRATION

P 503-230-4413 | C(b)(6)

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Tuesday, July 12, 2022 8:02 AM

To: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>

Subject: RE: BPA E3 talking points for review (DRAFT)

The talking points look good if they already went out- I made a few small tweaks to Q7.

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>

Sent: Tuesday, July 12, 2022 7:43 AM

To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>

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Subject: RE: BPA E3 talking points for review (DRAFT)

Thank you, Birgit. Appreciate your swift review.

Others, please let us know if you are comfortable with the content in these talking points.

We hope to be able to send a Communications Outreach message around 8 a.m. today and would love to include these for internal folks to use when answering questions.

Many thanks,

Maryam Habibi

Manager | Media Relations, Policy Communications and Writing

BONNEVILLE POWER ADMINISTRATION

P 503-230-4413 | C (b)(6)

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Sent: Monday, July 11, 2022 8:18 PM

To: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>;
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PG-5 <eajames@bpa.gov>

Subject: RE: BPA E3 talking points for review (DRAFT)

I updated numbers from the latest power point and made a few other edits to account for the changes that E3 made today. There were also prior track changes.

For everyone's information:

Scenario 2c now has a range. Here's how question 7 now describes this. Note, I could definitely use Eve to ground-truth my logic and anyone to help with wording if we have time before releasing these TPs

Note: Scenario 2c required increases in the supply of wind on new transmission in Northwest, Montana, Wyoming, as well as offshore wind, to enable a feasible solution that drives costs extremely high. This is largely a result of the model assuming that the best sites, with less new transmission needed, would largely be chosen for new resources to replace the coal and natural gas plants that the region to meet decarbonization goals without the loss of lower Snake River dam generation. If new resources to replace the generation of the lower Snake River dams were built on the preferred sites with less new transmission needs, then the cost would be lower, as indicated in the lower range for Scenario 2c. In this case, Scenario 2c would be less expensive, but in turn the region would need to build transmission to more distance sites for replacement resources for retiring coal and natural gas plants.

And E3 added Scenario 1b. The first version of Scenario 1 (100% Clean Retail Sales Scenario i.e. net zero carbon energy-sector only) bothered E3. In an oddity that I can't describe succinctly, changing how the model meets the carbon goals can be cheaper one way but lower emissions the other way, so E3 wanted to show both. Given how fast things were changing today, we didn't have a long time to discuss and still have E3 able to meet today's deadline for the 6 am release tomorrow.

Note about the embargoed release (compared to what is in the final study)

- It included the range on Scenario 2c.
- It did not include minor changes from correcting rounding errors
- It did not include Scenario 1b

Birgit

From: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>

Sent: Monday, July 11, 2022 6:07 PM

To: Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>

Subject: BPA E3 talking points for review (DRAFT)

Importance: High

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Please review and provide any edits with track changes on. If you don't have any suggested edits, please provide your concurrence.

Birgit - Should the change to scenario 2c be noted?

Thanks,

Joel Scruggs (He/Him)

Director of Communications | Communications (DK)

BONNEVILLE POWER ADMINISTRATION

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From: Baskerville,Sonya L (BPA) - AIN-WASH
Sent: Monday, July 11, 2022 8:28 PM
To: Koehler,Birgit G (BPA) - PG-5; Hairston,John L (BPA) - A-7; Zelinsky,Benjamin D (BPA) - E-4; James,Eve A L (BPA) - PG-5; Godwin,Mary E (BPA) - LN-7; Leary,Jill C (BPA) - LN-7; Armentrout,Scott G (BPA) - E-4; Scruggs,Joel L (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7
Subject: RE: BPA E3 talking points for review (DRAFT)

They should be able to discuss it during their presentation and indicate they intend to post an updated document. I think that would be their prerogative? Thanks.

Sonya Baskerville
BPA National Relations

(b)(6) m

On Jul 11, 2022 11:18 PM, "Koehler,Birgit G (BPA) - PG-5" <bgkoehler@bpa.gov> wrote:
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Cc: Baskerville,Sonya L (BPA) - AIN-WASH; Goodwin,Summer G (BPA) - DKS-7
Subject: RE: BPA E3 talking points for review (DRAFT)

It would make sense for the Sc sentences to be together.

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Sent: Tuesday, July 12, 2022 2:31 PM
To: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

Eve, is it worth changing this? I'd move the paragraph break so the two sentences on Scenario 2c are together.

the four LSR dams were breached. Thus, it is the average cost of generation that should be used for comparison to potential replacement resources. The 50-year forecasted values are expected to be in a similar range with a 50-year Cost of Generation of \$12.50/MWh and a 50-year Fully Loaded Cost of \$27.22/MWh. Replacement resources, depending on those chosen, are projected to cost between \$77 and \$139/MWh. Replacement costs rise to more than \$500 MWh in the deep economy-wide decarbonization scenario that includes only existing technologies (wind, solar, etc.) and no emerging technology, such as hydrogen and nuclear SMR.

The replacement options, presently and in the near term, combined with the rising costs of installing new energy infrastructure, contribute to this projected cost being double to quadruple the other scenarios evaluated.

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 2:24 PM
To: Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
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Subject: RE: BPA E3 talking points for review (DRAFT)

Link to final internal talking points: <https://connection.bud.bpa.gov/news/current-messages/talkingpoints/E3%20analyzes%20potential%20replacement%20resources%20and%20costs%20of%20lower%20Snake%20River%20dams.docx>

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing

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Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>

Subject: RE: BPA E3 talking points for review (DRAFT)

We could provide their contact info upon request. Will E3 eventually post this study on their website?

[Projects Archive - E3 \(ethree.com\)](#)

Joel Scruggs (He/Him)

Director of Communications | Communications (DK)

BONNEVILLE POWER ADMINISTRATION

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P 503-230-4413 | C(b)(6)

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Subject: RE: BPA E3 talking points for review (DRAFT)

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I think it would be polite to ask them before publishing their email. But wait, the emails on the "Thank you slide", right before the appendix, so it seems that they are open to fielding email inquiries. So with that, I say go ahead and include them.

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From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 11:16 AM
To: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

Excellent. I've taken final edits which included reordering the key messages, moving a couple of details to Q/A and hopefully addressing the remaining comments.

I'll finalize this version and we should be able to distribute to AEs, CAEs, D.C., etc., by 2 p.m. today.

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C (b)(6)

From: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>
Sent: Tuesday, July 12, 2022 9:58 AM
To: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>;

Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

Thanks Maryam,

No additional comments from me.

John

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 8:41 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

Here is a cleaner version. In the interest of time, I think we should send the Comms outreach email now, without the talking points. We can send a link to final talking points later this morning.

Summer, you can send the outreach message without TPs. Thank you!

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C (b)(6)

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, July 12, 2022 8:02 AM
To: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

The talking points look good if they already went out- I made a few small tweaks to Q7.

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Tuesday, July 12, 2022 7:43 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: BPA E3 talking points for review (DRAFT)

Thank you, Birgit. Appreciate your swift review.

Others, please let us know if you are comfortable with the content in these talking points.

We hope to be able to send a Communications Outreach message around 8 a.m. today and would love to include these for internal folks to use when answering questions.

Many thanks,

Maryam Habibi

Manager | Media Relations, Policy Communications and Writing

BONNEVILLE POWER ADMINISTRATION

P 503-230-4413 | C (b)(6)

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Sent: Monday, July 11, 2022 8:18 PM

To: Scruggs, Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston, John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Subject: RE: BPA E3 talking points for review (DRAFT)

I updated numbers from the latest power point and made a few other edits to account for the changes that E3 made today. There were also prior track changes.

For everyone's information:

Scenario 2c now has a range. Here's how question 7 now describes this. Note, I could definitely use Eve to ground-truth my logic and anyone to help with wording if we have time before releasing these TPs

Note: Scenario 2c required increases in the supply of wind on new transmission in Northwest, Montana, Wyoming, as well as offshore wind, to enable a feasible solution that drives costs extremely high. This is largely a result of the model assuming that the best sites, with less new transmission needed, would largely be chosen for new resources to replace the coal and natural gas plants that the region to meet decarbonization goals without the loss of lower Snake River dam generation. If new resources to replace the generation of the lower Snake River dams were built on the preferred sites with less new transmission needs, then the cost would be lower, as indicated in the lower range for Scenario 2c. In this case, Scenario 2c would be less expensive, but in turn the region would need to build transmission to more distance sites for replacement resources for retiring coal and natural gas plants.

And E3 added Scenario 1b. The first version of Scenario 1 (100% Clean Retail Sales Scenario i.e. net zero carbon energy-sector only) bothered E3. In an oddity that I can't describe succinctly, changing how the model meets the carbon goals can be cheaper one way but lower emissions the other way, so E3 wanted to show both. Given how fast things were changing today, we didn't have a long time to discuss and still have E3 able to meet today's deadline for the 6 am release tomorrow.

Note about the embargoed release (compared to what is in the final study)

- It included the range on Scenario 2c.
- It did not include minor changes from correcting rounding errors
- It did not include Scenario 1b

Birgit

From: Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>

Sent: Monday, July 11, 2022 6:07 PM

To: Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>

Subject: BPA E3 talking points for review (DRAFT)

Importance: High

Hey, all. Please give the set of talking points that we had reviewed last week another look. Note: While this is an internal-facing document, leaders and staff will refer to it in response to any questions they receive about the study.

Please review and provide any edits with track changes on. If you don't have any suggested edits, please provide your concurrence.

Birgit - Should the change to scenario 2c be noted?

Thanks,

Joel Scruggs (He/Him)

Director of Communications | Communications (DK)

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-5511 | C (b)(6)



From: Diffely,Robert J (BPA) - PGPL-5
Sent: Tuesday, July 5, 2022 10:00 AM
To: Koehler,Birgit G (BPA) - PG-5
Subject: RE: Council E3 presentation, I think it's a go

Rob Petty – I can make him aware of this.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 5, 2022 9:58 AM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Subject: Council E3 presentation, I think it's a go

Rob,

It looks like we are a go for the Thursday E3 presentation. I have to remember to register, but that's probably routine for you.

Eve is out all week, as is Ryan. Is there anyone else from power who should attend? Suzanne would want to, but she is out. Rob Petty?

Birgit

From: James,Eve A L (BPA) - PG-5
Sent: Wednesday, June 1, 2022 11:39 AM
To: Goodwin,Summer G (BPA) - DKS-7; Johnson,G Douglas (BPA) - DK-7; Koehler,Birgit G (BPA) - PG-5
Subject: RE: Draft release plan for E3 LSRD study

Deliberative, FOIA exempt

Thanks Summer- I think the placeholder you have is good for now and we can delete if needed. Though we aren't sure when the study is going to be released publicly yet I think it's a good idea to have a communication plan in place to be prepared. As Doug pointed out we have the Q&A for the assumptions already so at some point the study will most likely follow.

From: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Sent: Wednesday, June 1, 2022 11:31 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Draft release plan for E3 LSRD study

Updated timeline.

Not sure what to do with the peer review step.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, June 1, 2022 11:24 AM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Draft release plan for E3 LSRD study

Yep- the timeline is pushed out. The meeting that was scheduled May 31 was pushed to mid-June. We still don't have the one-pager and are hopefully finishing slides this week.

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Wednesday, June 1, 2022 11:21 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Draft release plan for E3 LSRD study

Sounds good – but talking points and other materials are not going to be done by June 3. I haven't even seen the one-pager yet. Can't start talking points without seeing final stuff ...

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, June 1, 2022 11:20 AM
To: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: Draft release plan for E3 LSRD study

Due to litigation issues affecting the timing of the DC briefings I think peer review would go after DC briefings but before public release.

From: Goodwin,Summer G (BPA) - DKS-7 <[sggoodwin@bpa.gov](mailto:sgoodwin@bpa.gov)>
Sent: Wednesday, June 1, 2022 11:17 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: Draft release plan for E3 LSRD study

Ok will do.

Assuming that will go before the DC briefing, but if not, then where in the sequence?

Date	Action item	Responsible party
May 30	One pager and final slides received (tentative)	E3
	Peer review	Which groups?
May 31	DOE or CEQ briefing (tentative)	Eve James Sonya Baskerville
By June 3	Develop talking points	Communications
June 3	Friday AE call briefing	Eve James
June 8	Briefing at AE/CAT meeting	Eve James
June 8 (after AE/CAT)	Post materials to webpage and possibly social media <ul style="list-style-type: none">• One pager• PPT slides in PDF	Communications
June 8	Press release <ul style="list-style-type: none">• Outreach Email to AEs	Doug Johnson Summer Goodwin

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, June 1, 2022 11:05 AM
To: Goodwin,Summer G (BPA) - DKS-7 <[sggoodwin@bpa.gov](mailto:sgoodwin@bpa.gov)>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: Draft release plan for E3 LSRD study

Hi Summer-

This looks good except potentially a peer-review step might need to get added. There is some desire from Execs for one though some of our outreach to potential reviewers has not gone well. If you want to put a placeholder for that step and we can delete if it doesn't work out.

Thanks,
Eve

From: Goodwin,Summer G (BPA) - DKS-7 <[sggoodwin@bpa.gov](mailto:sgoodwin@bpa.gov)>
Sent: Wednesday, June 1, 2022 9:01 AM

To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: Draft release plan for E3 LSRD study

Hi Eve and Birgit

In anticipation of the final study, I put this draft rollout plan together. Ignore the dates, that doesn't seem to be the correct timeline. Once I know more about when we want to release or whether the DC briefing has occurred, I can update it. If you see any additional steps that should be added, please add or shoot back to me and Doug. Thanks.

Best

Summer

FOR INTERNAL USE ONLY

High-level talking points

E3 lower Snake River dam replacement costs analysis

July 2022

Background:

Earlier this year, Bonneville Power Administration (BPA) contracted with electric industry research firm Energy and Environmental Economics (E3), to conduct an independent analysis of the electricity system value of the four lower Snake River (LSR) dams. This new analysis builds on the analysis performed in the Columbia River System Operations Environmental Impact Statement regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future. BPA anticipates E3's study will contribute to the regional dialogue about the future of these publicly owned assets and help elevate regional understanding of the complexities and expenses involved in exploring replacement resources for the LSR dams.

Key messages:

- BPA contracted with E3 to analyze the resources that would be needed to maintain reliability, which would be close to replacing the power generated from the LSR Dams. BPA commissioned the E3 study to provide additional information that may help regional stakeholders.
- E3's study modeled several scenarios, all of which envisioned increased electricity demand on the regional grid, with and without the dams. As the Northwest decarbonizes its heating and transportation sectors, electricity demand is set to increase. E3's study takes that increase as a given [in one of its two scenarios](#).
- The study then looks at what would be necessary to replace the power services currently provided by the four [Lower Snake River dams](#).
- E3's analysis shows that, under realistic scenarios of technological improvement, replacing the energy and grid services provided by the four [Lower Snake River dams](#) is possible.
 - Under E3's modeling assumptions, in scenarios in which one or more new technology becomes commercially viable, new resources to replace the existing lower Snake River dams' energy and capacity would cost between \$10.7 to [\\$19.0 Billion](#).
- In some scenarios, E3 anticipates emerging technologies, such as small modular nuclear reactors (SMRs) and gas plants with carbon capture or hydrogen-burning capability, which are not yet commercially available. In all scenarios, E3's model includes use of traditional renewable resources, such as wind, solar, storage and demand response.

Comment [A1]: Per CEQ question, can we rephrase this in terms of studying pathways to replacement? Is that accurate?

Comment [A2]: It was more "potential" replacement resources. If there was a decision to breach a more in-depth study would be needed for transmission and replacement resources.

Comment [A3]: I'm not sure I understand this phrase.

Comment [A4]: See revision.

- In scenarios that assume new combustion generation may be permitted in the Northwest, firm capacity is mostly replaced with ~2 GW of dual fuel natural gas + hydrogen turbines. These turbines may initially burn natural gas when needed during reliability challenged periods, but would transition to green hydrogen by 2045 to reach zero-emissions.
- If advanced nuclear is available, it is selected in lieu of renewables and some of the gas plants.
- E3 also modeled a scenario in which *no* new technologies become available, and the entirety of the dams' energy services are replaced by solar and wind power. DOE does not believe that scenario is realistic; the costs associated with that scenario should not be taken as representative. However, the scenario presents the worst-case situation should emerging technology development and commercialization be slower than anticipated.
- E3's report attempts to estimate the costs to ratepayers from replacing the energy services currently provided by the Lower Snake River dams. While these cost-estimates are reasonable, DOE cautions that they may-could be misleadingoverstated. It is exceedingly unlikely that the costs of replacement power resources would fall on BPA's customers alone.
- Replacing the power services currently provided by the LSR dams would take time. The replacement of the dams' hydropower could take up five to seven years after Congressional approval to breach the dams and possibly up to 10 to 20 years assuming additional new large-scale transmission was required and successfully sited without litigation delays.

Additional relevant information:

E3's Study looked at the following:

- What additional resources would be needed to replace the power services provided by the LSR Dams through 2045?
- What is the net cost to BPA ratepayers?
- How do costs and resource needs change under different types of clean energy futures?
- How much does replacing the dams rely on emerging, not-yet commercialized technologies?

Resource scenarios E3 evaluated:

Scenario	Replacement Resources Selected, Cumulative by 2045 (GW*)
Scenario 1: 100% Clean Retail Sales	+ 2.1 GW dual fuel NG/H2 CCGT + 0.5 GW wind

Comment [A5]: Birgit?

Comment [A6]: It's pretty hard to refute the statement that DOE doesn't think it is a realistic scenario. That's their opinion and we can't change it.

I tried tacking on a statement that might be OK with DOE.

I would like to say that utilities are charged with keeping the lights on, and are therefore inclined to be risk averse, but I don't think we can.

And realistically, if breaching wouldn't happen for at least 20 years, it is quite likely that there will be progress on emerging technology. We just don't know how much.

Comment [A7]: I don't like how they worded this at all. I would not have said "misleading." See what you think of my edits, but I wouldn't be surprised if you just reject them.

Scenario 2a: Deep Decarb. (Baseline Technologies)	+ 2.0 GW dual fuel NG/H2 CCGT + 0.3 GW li-ion battery + 0.4 GW wind + 0.05 GW advanced energy efficiency + additional H2 generation**
Scenario 2b: Deep Decarb. (Emerging Technologies)	+ 1.5 GW dual fuel NG/H2 CCGT + 0.7 GW nuclear SMR
Scenario 2c: Deep Decarb. (No New Combustion)	+ 10.6 GW wind + 1.4 GW solar

* 1 GW = 1,000 MW

** Replacing LSR dams GHG-free energy at least-cost leads RESOLVE model to generate an additional 1.2 TWh of hydrogen generation during low renewable conditions (or 0.14 average GW).

Resource option cost:

	Total Costs (real 2022 \$)	Annual Cost Increase (real 2022 \$)			Incremental Public Power Costs [% increase vs. -8.5 cents/kWh NW average retail rates]
	Net Present Value in year of breaching	2025	2035	2045	2045
Scenario 1: 100% Clean Retail Sales	\$11.8 billion	n/a	\$434 million	\$478 million	0.8 cents/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$12.8 billion	\$495 million	\$466 million	\$509 million	0.8 cents/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$19.0 billion	n/a	\$496 million	\$860 million	1.5 cents/kWh [+18%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$10.7 billion	n/a	\$415 million	\$428 million	0.7 cents/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$75.2 billion	n/a	\$1,953 million	\$3,199 million	5.5 cents/kWh [+65%]

•Cost increases account for replacement energy, capacity, and reserves as well as avoided LSR capital + expense, but do not include any costs for breaching the dams, which would be an additional cost.

•NPV and annual cost increase are shown for the Northwest Region as a whole, but the incremental costs are calculated relative to the BPA Tier I annual sales for public power customers.

•% increase versus average retail rates assumes ~8.5 cents/kWh retail rates (estimated from OR and WA average retail rates). This does not account for any other rate increases that will be driven by higher loads or clean energy needs that increase regional rates.

•Annual residential customer cost impact assumes 1,280 kWh/month for average residential customers in Oregon and Washington (current ~1,000 kWh/month average + 28% from electrification load growth).

•New federal tax credits for hydrogen plants/fuels or Investor Tax Credit/Production Tax Credit extension for renewables would provide a cost reduction to public power customers from taxpayers

From: Johnson,G Douglas (BPA) - DK-7
Sent: Wednesday, June 1, 2022 11:27 AM
To: Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5; Goodwin,Summer G (BPA) - DKS-7
Subject: RE: Draft release plan for E3 LSRD study

I think when we started posting interest group Q&As on BPA.gov, we figured the cat was out of the bag and people would expect us to share the results publicly.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, June 1, 2022 11:24 AM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: Draft release plan for E3 LSRD study

Deliberative, FOIA exempt

Hi Summer, nice to be working with you again.

Peer review would take weeks. It would likely require contracting. We did get peer review from DOE, but the execs are looking for independent peer review and don't consider DOE independent enough. We might launch peer review, but ultimately decide we can't wait that long.

Also not clear to me is when we want the public release. There are compelling reasons to get it out as soon as possible. But there are also compelling reasons to wait, such as leaving it under the confidentiality of the litigation process. I'm not sure who/when/how BPA will make the decision on when they'd like to release it.

And finally, we've been talking about having E3 do a public web-ex to present the results. (And we probably don't want that before CEQ and DOE have had a chance to "digest" the E3 information, so that we get to craft the message.

Birgit

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Wednesday, June 1, 2022 11:21 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Draft release plan for E3 LSRD study

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Sent: Wednesday, June 1, 2022 11:20 AM
To: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Cc: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: Draft release plan for E3 LSRD study

Due to litigation issues affecting the timing of the DC briefings I think peer review would go after DC briefings but before public release.

From: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Sent: Wednesday, June 1, 2022 11:17 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: Draft release plan for E3 LSRD study

Ok will do.

Assuming that will go before the DC briefing, but if not, then where in the sequence?

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	<i>Peer review</i>	<i>Which groups?</i>
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June 3	Friday AE call briefing	Eve James
June 8	Briefing at AE/CAT meeting	Eve James
June 8 (after AE/CAT)	Post materials to webpage and possibly social media <ul style="list-style-type: none">• One pager• PPT slides in PDF	Communications
June 8	Press release <ul style="list-style-type: none">• Outreach Email to AEs	Doug Johnson Summer Goodwin

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, June 1, 2022 11:05 AM
To: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: Draft release plan for E3 LSRD study

Hi Summer-
This looks good except potentially a peer-review step might need to get added. There is some desire from Execs for one though some of our outreach to potential reviewers has not gone well. If you want to put a placeholder for that step and we can delete it if it doesn't work out.

Thanks,
Eve

From: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>

Sent: Wednesday, June 1, 2022 9:01 AM

To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Cc: Johnson,G Douglas (BPA) - DK-7 <gdijohnson@bpa.gov>

Subject: Draft release plan for E3 LSRD study

Hi Eve and Birgit

In anticipation of the final study, I put this draft rollout plan together. Ignore the dates, that doesn't seem to be the correct timeline. Once I know more about when we want to release or whether the DC briefing has occurred, I can update it. If you see any additional steps that should be added, please add or shoot back to me and Doug. Thanks.

Best

Summer

FOR INTERNAL USE ONLY

BPA talking points

E3 analyzes potential replacement resources and costs of lower Snake River dams replacement-costs analysis

June/July 2022

What this is

Earlier this year, BPA contracted with electric industry research firm Energy and Environmental Economics, also known as E3, to conduct an independent analysis of the electricity system value of the four lower Snake River dams. This new analysis builds on the analysis performed for the Columbia River System Operations Environmental Impact Statement regarding replacement resources and costs associated with a scenario where the four LSR dams may be breached in the future. BPA anticipates E3’s study to contribute to the regional dialogue about the future of these publicly owned assets and help elevate regional understanding of the complexities and expenses involved in exploring replacement resources for the LSR dams.

Key messages and storyline

- As states move forward with clean energy policies, fossil fuel-generated power is being removed from the grid. Reducing hydropower would require the region to build new generation just to get the system back to its current state. Until all fossil fuel power plants are retired in the Northwest, reducing hydropower means an increase in more carbon dioxide emissions in the region, which is a step backward from the region’s carbon reduction goals. Some of the lower-cost options for replacing lost hydropower rely on emerging technologies that are not yet developed or available at large-scale.
- Replacing the dams’ hydropower energy and capacity services with existing renewable energy technologies and without additional technological breakthroughs creates a projected 34% to 65% upward rate pressure. The lack comparable replacement options, both presently and in the near term, combined with the rising costs of installing new energy infrastructure, contribute to this projected cost being much higher than double to quadruple the other scenarios evaluated.
- The E3 study evaluates what is required to maintain current reliability standards. Assuming different risk levels for reliability, as is done in other studies of LSR dam power replacement, is a policy decision outside the scope of this analysis.
- New resources to replace the existing lower Snake River dams’ energy and capacity would cost between \$10.711.2 to and \$19.60 billion with at least one emerging technology and cost up to \$42 to \$775.2 billion without breakthroughs in not-yet-commercialized emerging technologies. If these costs are not paid for by an outside source, it would result in higher electricity bills for millions of Northwest residents. These net present value costs were calculated using a 3% discount rate, consistent with

Comment [A1]: Birgit updating to numbers. E3 did a range around Scenario 2c to account for the possibility of finding cheaper ways to site new generation without building so much long-distance transmission, i.e. if some of the better wind/solar sites go to LSN replacement rather than fossil-fuel replacement getting first dibs on all good sites.

Comment [A2]: Birgit: this phrase doesn't sit well with me, but don't have a good alternative phrase popping out at me.

Comment [A3]: Is it worth saying about how much higher? Otherwise, this is more of a subjective statement.

Comment [A4]: How about emphasizing this with italics?

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Comment [A5]: I believe this might need to be updated with a range, if I followed our conversations today correctly.

the discount rate used in the Inslee/Murray draft report, which is a reasonable rate for public financing of large utility projects.

- The replacement of the LSR dams' hydropower could take up to approximately 20 years to complete after congressional approval, assuming new large-scale transmission would be required and successfully sited without litigation delays.
- Breaching the LSR dams creates unreasonably high costs for Northwest electric ratepayers and introduces power system reliability issues.
- While the regional conversation about the future management of the Columbia River system continues to evolve, without any practical present and near-term replacement options to the LSR dams, the region as a whole must continue to advance collaborative long-term strategies that prioritize the protection and enhancement of salmon and steelhead in balance with the other critical and essential services the system provides.

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Comment [A6]: Offering some boiled down points for consideration.

Background

With multiple reviews of the future of the LSR dams being conducted by the Council on Environmental Quality, the Columbia Basin Collaborative, and Washington's Democratic Senator, Patty Murray and Governor, Jay Inslee, BPA felt it necessary to review the potential costs of replacing the energy services from these facilities.

The CRSO EIS analysis examined a series of resource replacement portfolios, using the Northwest Power and Conservation Council's latest forecasts and updated Energy Commodities resource cost estimates, to reflect reasonable replacement resource alternatives and associated costs. E3 used a resource portfolio optimizer model with their data sets, criteria and objectives to create least-cost replacement portfolios.

E3's independent analysis includes several scenarios for replacement resources, including some with emerging technologies, such as small modular nuclear reactors, or nuclear SMRs, and gas plants with carbon capture or hydrogen burning capability that are not yet available. It also includes use of traditional renewable resources, such as wind, solar, storage and demand response. All of the scenarios present lead to significant upward rate pressure for BPA's customers if not paid for by an outside source.

For more information, contact: Eve James, 503-230-5558 or Birgit Koehler, 503-230-4249

Questions and answers

1. What was the scope of the study and what questions did it address?

BPA contracted with E3 to answer what resources (one or more portfolios of resources) would be needed to maintain reliability and fully replace the energy and other grid services provided by the four LSR dams. This includes modeling regional grid scenarios with and without the dams. The model is designed to identify one or more replacement resource portfolio(s) and provide a comparison of the forecasted costs associated with each scenario. The analysis also discusses the timeline under which a build-out of replacement resources

could occur.

E3's key study questions are:

- What additional resources would be needed to replace the power services provided by the LSR dams through 2045?
- What is the net cost of replacement resources to BPA ratepayers?
- How do costs and resource needs change under different types of clean energy futures?
- How much does replacing the dams rely on emerging, not-yet commercialized technologies?

2. What power benefits do the four LSR dams currently provide?

These facilities provide reliable, carbon-free electricity that help the Western Interconnection and the Pacific Northwest avoid blackouts. More specifically, they are capable of providing a short-term peaking capacity of more than 3,000 MWs. They can provide more than 2,000 MW of longer-term peaking capacity during cold snaps when Pacific Northwest electricity use is at its highest as well as provide important reserves and essential grid reliability services, including voltage support, reactive power and black start capability.

3. What resources does the study recommend to replace the output of the LSR dams?

The study recommends a combination of renewable generation (wind and solar) and "clean firm" resources (such as dual fuel natural gas with hydrogen plants, advanced nuclear SMRs, or gas with carbon capture and storage), and energy efficiency.

4. What are the replacement resource scenarios E3 evaluated?

Scenario	Replacement Resources Selected, Cumulative by 2045 (GW*)
Scenario 1: 100% Clean Retail Sales	+ 2.1 GW dual fuel NG/H2 CCGT + 0.5 GW wind
<u>Scenario 1b: 100% Clean Retail Sales (binding CES target)**</u>	<u>+ 1.8 GW dual fuel NG/H2 CCGT</u> <u>+ 1.3 GW solar</u> <u>+ 1.2 GW wind</u>

Comment [A7]: From Birgit: Please clean up the formatting for the new row that I added. That's hard to see in track changes.

Scenario 2a: Deep Decarb. (Baseline Technologies)	+ 2.0 GW dual fuel NG/H2 CCGT + 0.3 GW li-ion battery + 0.4 GW wind + 0.05 GW advanced energy efficiency + additional H2 generation***
Scenario 2b: Deep Decarb. (Emerging Technologies)	+ 1.5 GW dual fuel NG/H2 CCGT + 0.7 GW nuclear SMR
Scenario 2c: Deep Decarb. (No New Combustion)	+ 10.6 GW wind + 1.4 GW solar

* 1 GW = 1,000 MW

** In scenario 1b, the 100% Clean Energy Standard (CES) target is binding in 2045, causing the need to fully replace the GHG-free energy output of the LSR dams. In scenario 1, the high carbon price assumed drives the region higher than the 100% CES target, making it a non-binding constraint in the model.

*** Replacing LSR dams GHG-free energy at least-cost leads RESOLVE to generate an additional 1.2 TWh of hydrogen generation during low renewable conditions (or 0.14 average GW).

* 1 GW = 1,000 MW

** Replacing LSR dams GHG-free energy at least-cost leads RESOLVE model to generate an additional 1.2 TWh of hydrogen generation during low renewable conditions (or 0.14 average GW).

- In scenarios that assume new combustion generation may be permitted in the Northwest, firm capacity is mostly replaced with about 2 GW of dual fuel natural gas with hydrogen turbines. These turbines may initially burn natural gas when needed during reliability challenged periods, but would transition to green hydrogen by 2045 to reach zero emissions.
- If advanced nuclear is available, it is selected in lieu of renewables and some of the gas plants.
- The “no new combustion” scenario with decarbonization of the broader economy (e.g. electric vehicles and electric heating) requires an unprecedented large buildout of renewable energy, about 12 GW, to replace the dams’ firm capacity contributions and greenhouse gas emissionGHG-free energy. This would be required because wind and solar power are not as reliable for serving load as firm combustion generation; thus, large quantities are needed to ensure that some generation may be available during critical periods like winter cold spells.

Comment [A8]: Please spell out.

5. What does each option cost?

	Total Costs (real 2022 \$)	Annual Cost Increase (real 2022 \$)			Incremental Public Power Costs [% increase vs. -8.5 cents/kWh NW average retail rates]
	Net Present Value in year of breaching	2025	2035	2045	2045
Scenario 1: 100% Clean Retail Sales	\$11.8 billion	n/a	\$434 million	\$478 million	0.8 cents/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$12.8 billion	\$495 million	\$466 million	\$509 million	0.8 cents/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$19.0 billion	n/a	\$496 million	\$860 million	1.5 cents/kWh [+18%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$10.7 billion	n/a	\$415 million	\$428 million	0.7 cents/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$75.2 billion	n/a	\$1,953 million	\$3,199 million	5.5 cents/kWh [+60%]

	Total Costs (real 2022 \$)	Annual Cost Increase (real 2022 \$)			Incremental Public Power Costs [% increase vs. -8.5 cents/kWh NW average retail rates]
	Net Present Value in year of breaching	2025	2035	2045	2045
Scenario 1: 100% Clean Retail Sales	\$12.4 billion	n/a	\$434 million	\$478 million	0.8 cents/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$12.8 billion	\$495 million	\$466 million	\$509 million	0.8 cents/kWh [+9%]
Scenario 1b: 100% Clean Retail Sales (binding CES target)	\$12.0 billion	n/a	\$445 million	\$473 million	0.8 cents/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$19.6 billion	n/a	\$496 million	\$860 million	1.5 cents/kWh [+18%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$11.2 billion	n/a	\$415 million	\$428 million	0.7 cents/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$42 – 77 billion	n/a	\$1,045 – 1,953 million	\$1,711 – 3,199 million	2.9 – 5.5 cents/kWh [+34 – 65%]

*Cost increases account for replacement energy, capacity and reserves as well as avoided LSR capital plus expense, but do not include any costs for breaching the dams, which would be an additional cost.

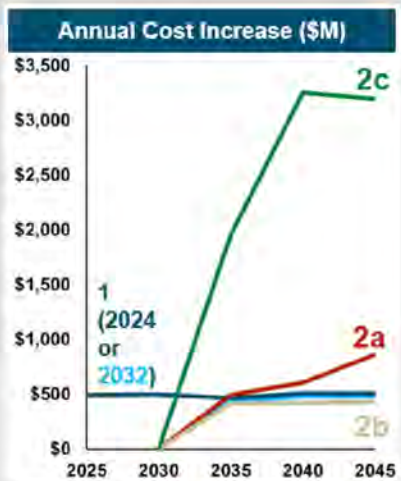
*NPV and annual cost increase are shown for the Northwest as a whole, but the incremental costs are calculated relative to the BPA Tier I annual sales for public power customers.

*Percentage increase versus average retail rates assumes about 8.5 cents/kWh retail rates, estimated from Oregon and Washington average retail rates. This does not account for any other rate increases that will be driven by higher loads or clean energy needs that increase regional rates.

*Annual residential customer cost impact assumes 1,280 kWh/month for average residential customers in Oregon and Washington (current is about 1,000 kWh/month average plus 28% from electrification load growth).

*New federal tax credits for hydrogen plants/fuels or Investor Tax Credit/Production Tax Credit extension for renewables would provide a cost reduction to public power customers from taxpayers.

*Lower end of range for scenario 2c assumes limited transmission build out (based on replacement resource additions' marginal ELCC instead of delivering the full nameplate capacity), annual cost plot shows only high end of range



E3 2022 study results: These are not the total costs to the Northwest of decarbonizing the electricity grid or its economy; these costs reflect the incremental costs of replacing the lost generation from the four LSR dams in each of those scenarios.

6. How do the replacement costs compare to the current costs of the four LSR dams?

The four LSR dams' average cost of generation, which includes Lower Snake River Compensation Plan fish hatcheries and satellite facilities, between fiscal year 2018 and fiscal year 2020 was \$14.63/MWh to operate and maintain. The average fully loaded cost, which includes allocations for system-wide costs BPA incurs such as the Fish and Wildlife Program and Residential Exchange, was \$27.42/MWh. The additional expenses in the fully loaded costs would be reallocated to the remaining resource and would not be eliminated if the four LSR dams were breached. Thus, it is the average cost of generation that should be used for comparison to potential replacement resources. The 50-year forecasted values are expected to be in a similar range with a 50-year Cost of Generation of \$12.50/MWh and a 50-year Fully Loaded Cost of \$27.22/MWh. Replacement resources, depending on those chosen, are projected to cost between \$77 and \$139/MWh. Replacement costs rise to more than \$500/MWh in the deep economy-wide decarbonization scenario that includes only existing technologies (wind, solar, etc.) and no emerging technology, such as hydrogen and nuclear SMR.

7. What is the projected rate impact to BPA customers?

In scenarios 1, 2a and 2b, the rate impact would be between 8% and 18% or about \$100 to \$230 per year. In scenario 2c, deep economy-wide decarbonization with no emerging technologies, the cost would be approximately a 34% to 65% increase or \$450 to \$850 per year per household.

Note: Scenario 2c required increases in the supply of wind on new transmission in Northwest, Montana, Wyoming, as well as offshore wind, to enable a feasible solution that drives costs extremely high. This is largely a result of the model assuming that the best sites, with less new transmission needed, would largely be chosen for new resources to replace the coal and natural gas plants that the region to meet decarbonization goals without the loss of

lower Snake River dam generation. If new resources to replace the generation of the lower Snake River dams were built on the preferred sites with less new transmission needs, then the cost would be lower, as indicated in the lower range for Scenario 2c. In this case, Scenario 2c would be less expensive, but in turn the region would need to build transmission to more distance sites for replacement resources for retiring coal and natural gas plants.

8. What is the timeline necessary to add the resources that would be required?

E3 estimates that adding additional renewable energy and firm capacity additions would take approximately five to seven years after congressional approval to breach the dams and possibly up to 10 to 20 years, assuming additional new large-scale transmission was required and successfully sited without litigation delays.

Comment [A9]: I imagine there's a more elegant way to say this. Also, so far Birgit is the only one at BPA who has discussed the range in Scenario 2c with E3. I hope we have time for Eve to look at this on Tuesday.

From: Goodwin,Summer G (BPA) - DKS-7
Sent: Wednesday, June 29, 2022 5:12 PM
To: Koehler,Birgit G (BPA) - PG-5; Johnson,G Douglas (BPA) - DK-7; James,Eve A L (BPA) - PG-5; Scruggs,Joel L (BPA) - DK-7
Subject: RE: Draft release plan for E3 LSRD study
Attachments: release plan -E3 LSRD study - June 2022_draft4.doc

Ooops. Sorry boss. Left you off of it by accident.

From: Goodwin,Summer G (BPA) - DKS-7
Sent: Wednesday, June 29, 2022 4:23 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: Draft release plan for E3 LSRD study

Deliberative, FOIA exempt

This is the rollout as discussed and planned. Will adjust as needed.

Summer Gadsby Goodwin (she/her/hers)
Strategic Communications and Engagement
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-3158



Guy Norman
Chair
Washington

KC Golden
Washington

Jim Yost
Idaho

Jeffery C. Allen
Idaho



Northwest Power and Conservation Council

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Vice Chair
Montana

Mike Milburn
Montana

Ginny Burdick
Oregon

Louie Pitt, Jr.
Oregon

June 29, 2022

MEMORANDUM

TO: Council Members

FROM: Jennifer Light, Interim Director of Power Planning

SUBJECT: Energy and Environmental Economics Study on the Lower Snake River Dams Power Replacement

BACKGROUND:

Presenter: Arne Olson, Energy and Environmental Economics

Summary:

Bonneville engaged Energy and Environmental Economics (E3) to conduct an analysis of potential replacement resources for the services provided by the four lower Snake River dams. Arne Olson, E3, will present on the findings of this analysis.

This analysis builds on the Columbia River System Operations Environmental Impact Statement (CRSO EIS). Using the E3 RESOLVE model (a resource portfolio optimization tool), this study examines multiple scenarios to inform what resources would be needed to replace the energy and other grid services provided by these projects. This study will also provide a comparison of forecasted costs and discuss timelines for potential buildout of replacement resources.

More Info:

- This webpage provides a brief description of the analysis:
<https://www.bpa.gov/energy-and-services/power/hydropower-impact>
Note, the report and a related presentation will be posted on this website when available

851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204-1348
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Bill Edmonds
Executive Director

503-222-5161
800-452-5161

- Also available from that page are two documents that provide response to questions with more details on the scope of the analysis:
 - <https://www.bpa.gov/-/media/Aep/power/hydropower-data-studies/20220428-earth-justice-qa-bpa.pdf>
 - <https://www.bpa.gov/-/media/Aep/power/hydropower-data-studies/2022-05-19-2nd-round-earth-justice-qa.pdf>

From: Goodwin,Summer G (BPA) - DKS-7
Sent: Thursday, July 7, 2022 8:19 AM
To: Koehler,Birgit G (BPA) - PG-5; Johnson,G Douglas (BPA) - DK-7; Leary,Jill C (BPA) - LN-7; Habibi,Maryam A (BPA) - DKP-7; Baskerville,Sonya L (BPA) - AIN-WASH; Scruggs,Joel L (BPA) - DK-7
Cc: Chong Tim,Marcus H (BPA) - L-7; Hairston,John L (BPA) - A-7; Zelinsky,Benjamin D (BPA) - E-4; Sullivan,Leah S (BPA) - EWP-4; James,Eve A L (BPA) - PG-5; Godwin,Mary E (BPA) - LN-7; Senters,Anne E (BPA) - LN-7; Armentrout,Scott G (BPA) - E-4
Subject: RE: E3 Study Update

Thanks Birgit

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, July 7, 2022 8:19 AM
To: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Cc: Chong Tim,Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Senters,Anne E (BPA) - LN-7 <aesenters@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: RE: E3 Study Update

They sent an email to all registered attendees



Northwest Power and Conservation Council

The Council meeting webinar on Thu, Jul 7, 2022 at 8:30 AM PDT is CANCELED: The only agenda item - a study presentation - has been postponed to a later date. It is now tentatively set for Tuesday afternoon July 12th.

<https://www.nwcouncil.org/meeting/council-meeting-july-12-2022/>

Chad Madron
Project Analyst
cmadron@nwcouncil.org



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From: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>

Sent: Thursday, July 7, 2022 8:09 AM

To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>

Cc: Chong Tim,Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Senters,Anne E (BPA) - LN-7 <aesenters@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>

Subject: RE: E3 Study Update

Council website doesn't have a message on it about the cancellation until you look at the calendar:

UPCOMING MEETINGS

PREVIOUS MEETINGS

Jul 2022

06
WED

F&W Committee Meeting. Coun
Canceled

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>

Sent: Thursday, July 7, 2022 6:45 AM

To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>

Cc: Chong Tim,Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Sinters,Anne E (BPA) - LN-7 <aesenters@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>

Subject: RE: E3 Study Update

More from Dan Catchpole.

From: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>

Sent: Wednesday, July 6, 2022 6:25 PM

To: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>

Cc: Chong Tim,Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Sinters,Anne E (BPA) - LN-7 <aesenters@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>

Subject: RE: E3 Study Update

I will run this by DOE and let you know tomorrow, thanks.

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>

Sent: Wednesday, July 6, 2022 6:24 PM

To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Goodwin,Summer

G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>
Cc: Chong Tim,Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>;
Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; James,Eve
A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Senter,Ane E (BPA) - LN-7
<aesenters@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: RE: E3 Study Update

Jill, let us know if this works for DOE. Proposed statement to share with media and account executives (who will get questions about the presentation):

E3's presentation to the Council on analysis of potential replacement resources and costs for the lower Snake River dams is being rescheduled. We continue to coordinate with other federal agencies and officials on the broader release plan for the presentation and final study. We expect to have more information next week.

You may reach me this evening at 971-226-6073.

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C(b)(6)

From: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Wednesday, July 6, 2022 4:33 PM
To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>;
Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7
<sggoodwin@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs,Joel L (BPA) - DK-7
<jlsruggs@bpa.gov>
Cc: Chong Tim,Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>;
Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; James,Eve
A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Senter,Ane E (BPA) - LN-7
<aesenters@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: RE: E3 Study Update

Confidential and privileged attorney client communication/FOIA-exempt

Thanks, Doug - please continue to forward all media requests to me, so I can coordinate with DOE.

From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Sent: Wednesday, July 6, 2022 4:31 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>;
Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Habibi,Maryam A
(BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>
Cc: Chong Tim,Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>;
Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; James,Eve
A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Senter,Ane E (BPA) - LN-7
<aesenters@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: E3 Study Update

So far we only need to let Clearing Up and Hal Bernton with the Seattle Times know.

On Jul 6, 2022 4:21 PM, "Leary,Jill C (BPA) - LN-7" <jcleary@bpa.gov> wrote:

Confidential and privileged attorney client communication/FOIA-exempt

Good afternoon,

The E3 presentation to the Council tomorrow will **likely** be canceled. The current plan is to delay one week, potentially to the full Council meeting, but this still needs to be confirmed and coordinated.

John Hairston is speaking with Bill Edmonds at the Council about the delay, and Birgit will contact Chad at the Council and Arne at E3 once we have final confirmation from John after his conversation with Deputy Secretary Turk.

The reason for the delay is to allow more coordination with DC leadership.

Communications folks, please use the highlighted language if the media contacts you.

Thanks, and let me know if you have any questions,

Jill

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, July 5, 2022 9:30 AM
To: Johnson,G Douglas (BPA) - DK-7
Subject: RE: E3 Updated Charts
Attachments: E3 LSRD replacement cost analysis TPs v6 LSRD costs expanded, July 5.docx

OK, I made the updates. You'll see my notes in the first line specifically what I updated.

From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Sent: Tuesday, July 5, 2022 7:59 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: E3 Updated Charts

That is in PDF format. I can't pull things from a PDF. If you can have someone send the materials in another format, we can handle it. We just need to get it done some time before noon today.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 5, 2022 7:57 AM
To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Subject: RE: E3 Updated Charts

Doug,

I think Eve sent you the information on Friday at 9:15 pm. I need to focus on a meeting at 8, but if you aren't able to do the copying-over, I might have time after 9

Birgit

From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Sent: Tuesday, July 5, 2022 7:09 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: E3 Updated Charts

Birgit,

Eve was going to send me the new charts reflecting the changes in the report as they relate to question 5. Can you have someone plug those in? Please let me know. Thanks.

DRAFT 6/30/22 v4 July 5 Birgit updating graphics from E3 from their July 1 final version. For question 5, I updated the table. NPV values changed. For question 4, I added the footnotes that go with the table

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FOR INTERNAL USE ONLY

BPA talking points

E3 lower Snake River dam replacement costs analysis

June 2022

What this is

Earlier this year, BPA contracted with electric industry research firm Energy and Environmental Economics, also known as E3, to conduct an independent analysis of the electricity system value of the four lower Snake River (LSR) dams. This new analysis builds on the analysis performed in the Columbia River System Operations Environmental Impact Statement regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future. BPA anticipates E3's study to contribute to the regional dialogue about the future of these publicly-owned assets and help elevate regional understanding of the complexities and expenses involved in exploring replacement resources for the LSR dams.

Key messages and storyline

- As states move forward with clean energy policies, fossil-fuel generated power is being removed from the grid. Reducing hydropower would require the region to build new generation just to get the system back to its current state. Until all fossil-fuel power plants are retired, reducing hydropower means more CO2 emissions in the region, which is a step backward from the region's carbon reduction goals. Some of the lower-cost options for replacing lost hydropower rely on emerging technologies that are not yet developed or available at large-scale.
- Replacing the dams' hydropower energy and capacity services with existing renewable technology and no technological breakthroughs is projected to create 65% upward rate pressure. This is much higher than the other scenarios evaluated—~~prohibitively expensive~~.
- The E3 study evaluates what is required to maintain current reliability standards. Assuming different risk levels for reliability, as is done in other studies of LSRN dam power replacement, is a policy decision outside the scope of this analysis.
- New resources to replace the existing lower Snake River dams' energy and capacity would cost between \$8.7 to 15.1 billion with at least one emerging technology and up to \$61 billion absent breakthroughs in not-yet-commercialized emerging technologies. If these costs are not paid for by an outside source, it would result in higher electric bills for millions of Northwest residents.
- The replacement of the dams' hydropower could take up to approximately 20 years to complete after Congressional approval assuming Transmission builds were ~~needed but~~

~~there was not litigation or other major delay on siting~~ [successfully sited without litigation delays.](#)

Background

With multiple reviews of the future of the lower Snake River dams being conducted by the Council on Environmental Quality, the Columbia Basin Collaborative and Senator Patty Murray (D-WA) and Washington Governor Jay Inslee, BPA felt it necessary to update the potential costs of replacing the energy services from these facilities.

The CRSO EIS analysis examined a series of resource replacement portfolios using the Northwest Power and Conservation Council's latest forecasts and updated Energy Commodities resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. E3 used a resource portfolio optimizer model with their data sets and their criteria and objectives to create least-cost replacement portfolios.

E3's independent analysis includes several scenarios for replacement resources, including some with emerging technologies such as small modular nuclear reactors (SMRs) and gas plants with carbon capture or hydrogen burning capability that are not available yet. It also includes use of traditional renewable resources, such as wind, solar, storage and demand response. All of the scenarios present moderate to significant upward rate pressure for BPA's customers if not paid for by an outside source.

For more information, contact: Eve James, 503-230-5558 or Birgit Koehler, 503-230-4249

Questions and answers

1. What was the scope of the study and what questions did it address?

BPA contracted with E3 to answer what resources (one or more portfolios of resources) would be needed to maintain reliability, which is close to replacing the energy and other grid services provided by the [four](#) lower Snake River dams. This includes modeling regional grid scenarios with and without the dams. The model is designed to identify one or more replacement resource portfolio(s) and provide a comparison of the forecasted costs associated with each scenario. The analysis also discusses the timeline under which a build-out of replacement resources could occur.

E3's key study questions are:

- What additional resources would be needed to replace the power services provided by the LSR Dams through 2045?
- What is the net cost to BPA ratepayers?
- How do costs and resource needs change under different types of clean energy futures?
- How much does replacing the dams rely on emerging, not-yet commercialized technologies?

2. What power benefits do the four LSRDs currently provide?

These facilities first and foremost provide reliable electricity to help the western interconnection and the Pacific Northwest avoid blackouts. They also provide carbon-free energy. More specifically, they are capable of providing a short-term peaking capacity of more than 3,000 MWs. They can provide more than 2,000 MW of longer term peaking capacity during cold snaps when Pacific Northwest electricity use is at its highest as well as provide important reserves and essential grid reliability services, including voltage support, reactive power and black start ability.

3. What resources does the study recommend to replace the output of the lower Snake River dams?

The study recommends a combination of renewable generation (wind and solar) and “clean firm” resources (such as dual fuel natural gas + hydrogen plants, advanced small modular nuclear reactors (SMR), or gas with carbon capture and storage), and energy efficiency.

4. What are the replacement resource scenarios E3 evaluated?

Scenario	Replacement Resources Selected, Cumulative by 2045 (GW*)
<p>Scenario 1: 100% Clean Retail Sales</p>	<p>+ 2.1 GW dual fuel NG/H2 CCGT + 0.5 GW wind</p>
<p>Scenario 2a: Deep Decarb. (Baseline Technologies)</p>	<p>+ 2.0 GW dual fuel NG/H2 CCGT + 0.3 GW li-ion battery + 0.4 GW wind + 0.05 GW advanced energy efficiency + additional H2 generation**</p>

Scenario 2b: Deep Decarb. (Emerging Technologies)	+ 1.5 GW dual fuel NG/H2 CCGT + 0.7 GW nuclear SMR
Scenario 2c: Deep Decarb. (No New Combustion)	+ 10.6 GW wind + 1.4 GW solar

* 1 GW = 1,000 MW

** Replacing LSR dams GHG-free energy at least-cost leads RESOLVE model to generate an additional 1.2 TWh of hydrogen generation during low renewable conditions (or 0.14 average GW).

- In scenarios that assume new combustion generation may be permitted in the Northwest, firm capacity is mostly replaced with ~2 GW of dual fuel natural gas + hydrogen turbines. These turbines may initially burn natural gas when needed during reliability challenged periods, but would transition to green hydrogen by 2045 to reach zero-emissions.
- If advanced nuclear is available, it is selected in lieu of renewables and some of the gas plants.
- The “no new combustion” scenario with decarbonization of the broader economy (e.g. electric vehicles and electric heating) requires an impractically large (12 GW) buildout of renewable energy to replace the dams’ firm capacity contributions and GHG-free energy. This is required because the wind and solar power are not as reliable for serving load as would be firm combustion generation, and thus large quantities are needed to ensure that some generation may be available during the critical periods like winter cold spells.

Comment [KG(-P1): In their final PPT, they have this line with a footnote:
** Replacing LSR dams GHG-free energy at least-cost leads RESOLVE to generate an additional 1.2 TWh of hydrogen generation during low renewable conditions (or 0.14 average GW).

But in the final report, they write it out:
+ 1.2 TWh (i.e. fossil generation)

Given that they are switching units from GW (a capacity metric) to an hourly energy metric, I think it makes sense not to include thee TWh in the table, but let's add the footnotes.

5. What does each option cost?

	Total Costs (real 2022 \$)	Annual Cost Increase (real 2022 \$)			Incremental Public Power Costs [% increase vs. ~8.5 cents/kWh NW average retail rates]
	Net Present Value in year of breaching	2025	2035	2045	2045
Scenario 1: 100% Clean Retail Sales	\$9.7 billion		\$434 million	\$478 million	0.8 cents/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$11.7 billion	\$405 million	\$466 million	\$500 million	0.8 cents/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$15.1 billion		\$496 million	\$860 million	1.5 cents/kWh [+18%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$8.7 billion		\$415 million	\$428 million	0.7 cents/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$61 billion	n/a	\$1,953 million	\$3,199 million	5.5 cents/kWh [+65%]

	Total Costs (real 2022 \$)	Annual Cost Increase (real 2022 \$)			Incremental Public Power Costs [% increase vs. ~8.5 cents/kWh NW average retail rates]
	Net Present Value in year of breaching	2025	2035	2045	2045
Scenario 1: 100% Clean Retail Sales	\$11.8 billion	n/a	\$434 million	\$478 million	0.8 cents/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$12.8 billion	\$495 million	\$466 million	\$509 million	0.8 cents/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$19.0 billion	n/a	\$496 million	\$860 million	1.5 cents/kWh [+16%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$10.7 billion	n/a	\$415 million	\$428 million	0.7 cents/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$75.2 billion	n/a	\$1,953 million	\$3,199 million	5.5 cents/kWh [+65%]

•Cost increases account for replacement energy, capacity, and reserves as well as avoided LSR capital + expense, but do not include any costs for breaching the dams, which would be an additional cost.

•NPV and annual cost increase are shown for the Northwest Region as a whole, but the incremental costs are calculated relative to the BPA Tier I annual sales for public power customers.

•% increase versus average retail rates assumes ~8.5 cents/kWh retail rates (estimated from OR and WA average retail rates). This does not account for any other rate increases that will be driven by higher loads or clean energy needs that increase regional rates.

•Annual residential customer cost impact assumes 1,280 kWh/month for average residential customers in Oregon and Washington (current ~1,000 kWh/month average + 28% from electrification load growth).

•New federal tax credits for hydrogen plants/fuels or [Investor Tax Credit/Production Tax Credit](#) extension for renewables would provide a cost reduction to public power customers from taxpayers

Comment [LC(-L2): Suggest spelling out



E3 2022 study results: these are not the total costs to the Northwest of decarbonizing the electricity grid or its economy; these costs reflect the incremental costs of [removing breaching replacing the lost generation from](#) the four lower Snake River dams in each of those scenarios.

6. How do the replacement costs compare to the current costs of the [four](#) lower Snake River dams?

[The four lower Snake River dams average cost of generation \(which includes Lower Snake River Compensation Plan fish hatcheries and satellite facilities\) between FY18 and FY20 was \\$14.63/MWh to operate and maintain. The average Fully Loaded Cost, which includes allocations for system-wide costs BPA incurs such as the Fish and Wildlife Program and Residential Exchange, was \\$27.42/MWh. The 50-year forecasted values are expected to be in a similar range with a 50-year Cost of Generation of \\$12.50/MWh and a 50-year Fully Loaded Cost of \\$27.22/MWh. The lower Snake River dams average generation cost between \\$13 and or \\$17/MWh \(including the Lower Snake River Compensation Plan fish hatcheries and satellite facilities\) to operate and maintain.](#) Replacement resources, depending on those chosen, are projected to cost between \$77 and \$139/MWh. Replacement costs rise to more than \$500 MWh in the deep economy-wide decarbonization scenario that includes only existing technologies (wind, solar, etc.) and no emerging technology, such as hydrogen and small modular nuclear.

7. What is the projected rate impact to BPA customers?

In scenarios 1, 2a and 2b, the rate impact would be between 8% and 18% or ~\$100 to \$230 per year. In a deep economy-wide decarbonization scenario (2c) with no emerging technologies, the cost would be approximately a 65% increase or \$850 per year per household.

Note: Scenario 2c required increases in the supply of wind on new transmission (Northwest, Montana, Wyoming, and off-shore wind) to enable a feasible solution which drives the costs [impractically extremely](#) high.

- Comment [LC(-L3)]:** Removal is much more expensive.
- Comment [EAJ4]:** Does not include cost for breaching- this removal was meant to be indicative that it was removed from modeling. Revised language to reflect it is the lost generation cost (E3 did not include \$cost physical breaching would need)
- Comment [LC(-L5)]:** Reworked language with Gordon and Eve

8. What is the timeline necessary to add the resources that would be required?

E3 estimates that adding additional renewable energy and firm capacity additions would take approximately five to seven years after Congressional approval to breach the dams and possibly up to 10 to 20 years assuming additional new large-scale transmission was required ~~but there was not litigation or other major delay on~~ and successfully sited without litigation delaying.

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, July 12, 2022 3:06 PM
To: Zimmerman,Ryan J (BPA) - DKD-7; James,Eve A L (BPA) - PG-5
Cc: Habibi,Maryam A (BPA) - DKP-7; Scruggs,Joel L (BPA) - DK-7
Subject: RE: E3 report for posting, part 1 and Part 2

Thanks again Ryan for the very early morning duty! Word spread quickly once you had it out there.

From: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>
Sent: Tuesday, July 12, 2022 3:04 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Subject: RE: E3 report for posting, part 1 and Part 2

No problem. I'm going to log off for the day given the early start. If anything comes up, Maryam and Joel can get a hold of me.

Ryan

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, July 12, 2022 3:02 PM
To: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Subject: RE: E3 report for posting, part 1 and Part 2

Thanks for the quick turnaround Ryan!

From: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>
Sent: Tuesday, July 12, 2022 3:00 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Subject: RE: E3 report for posting, part 1 and Part 2

Both files have been updated.

Ryan

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, July 12, 2022 2:14 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>
Cc: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Subject: RE: E3 report for posting, part 1 and Part 2

This issue impacted the final report graphic as well so if you could replace both files with these ones as soon as possible.

Thanks!

Eve

From: James,Eve A L (BPA) - PG-5
Sent: Tuesday, July 12, 2022 2:02 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>
Cc: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Subject: RE: E3 report for posting, part 1 and Part 2

Hi Ryan- can you replace the slide deck on the website with this corrected version?

Thanks,
Eve James

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 12, 2022 6:26 AM
To: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>;
Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Subject: RE: E3 report for posting, part 1 and Part 2

Hi Ryan,
Thanks for getting up so early.

I've passed the link on to the Council as planned, using the page link, not the individual files. Your suggestion makes sense. And I let John Hairston and others know.

Birgit

From: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>
Sent: Tuesday, July 12, 2022 5:47 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>;
Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Subject: RE: E3 report for posting, part 1 and Part 2

Good morning, Birgit.

The E3 study and presentation are now live on www.bpa.gov. Below, are links to both the page and individual documents.

I generally recommend sharing the page link rather than the individual documents as a best practice, in case we need to rename or update the context around the documents. But I think the risk of changing file names is low, so if you would like to share any of the three links below, I think that would be fine.

Page

- <https://www.bpa.gov/energy-and-services/power/hydropower-impact>

Documents

- <https://www.bpa.gov/-/media/Aep/power/hydropower-data-studies/e3-bpa-lower-snake-river-dams-power-replacement-study.pdf>

- <https://www.bpa.gov/-/media/Aep/power/hydropower-data-studies/e3-bpa-lower-snake-river-dams-power-replacement-study-presentation.pdf>

Ryan Zimmerman (he / him)
Manager | Digital Media and Visual Design | Communications (DKD)
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-4327

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Monday, July 11, 2022 10:20 PM
To: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Subject: RE: E3 report for posting, part 1 and Part 2

I'm recalling my earlier message (which you can see below, but without the attachment since I don't want you to use that one). E3 sent an updated copy of the presentation with the final report, noting that the presentation had minor formatting improvements.

So, here are the two files to post.

And then Eve or I need to send the link to the Council (Chad and Jennifer). I imagine we should send the link that you sent me earlier, which will have both included. Alternatively, we could send them two links for the presentation and report. Thoughts?

[Hydropower Impact - Bonneville Power Administration \(bpa.gov\)](#)

Birgit

From: Koehler,Birgit G (BPA) - PG-5
Sent: Monday, July 11, 2022 9:42 PM
To: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Subject: E3 report for posting, part 1

Ryan,

I received the presentation from E3 at 5:15 pm with a note that they are still working on the report. I told them to not work all night, but take the time to QC. We need it by morning. Now it is 9:30 pm, and they are apparently still working on the report. I may go to bed soon and opt to get up early in time for you to have it by 5:30 am. If something comes up and we don't have the report in the morning, I suggest posting the presentation and writing a short note below it that the report will be posted shortly. However the going plan is still have both in your hands before 5:30 am.

For starters, here is the PDF of the presentation.

And then I am to send the link to the Council (Chad and Jennifer). I imagine I should send the link that you sent me earlier, which will have both included. We could send them two links for the presentation and report as an alternative. Thoughts?

[Hydropower Impact - Bonneville Power Administration \(bpa.gov\)](http://bpa.gov)

Birgit

From: Leary, Jill C (BPA) - LN-7
Sent: Tuesday, July 5, 2022 8:22 AM
To: Johnson, G Douglas (BPA) - DK-7; Goodwin, Summer G (BPA) - DKS-7; James, Eve A L (BPA) - PG-5
Cc: Koehler, Birgit G (BPA) - PG-5; Godwin, Mary E (BPA) - LN-7; Baskerville, Sonya L (BPA) - AIN-WASH
Subject: RE: E3 rollout

Thank you!

From: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Tuesday, July 5, 2022 8:03 AM
To: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: RE: E3 rollout

I am working with Birgit to get updated charts that reflect the change in the discount rate from 5% to 3%, which is more in line with what we use. Eve sent us the updated presentation late Friday, but I can't pull those charts from a PDF. We are working with Birgit to get those charts in a format we can use to drop them into the Talking Points. Once I have those files, I will send you an updated version of the talking points to share with DOE.

From: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Tuesday, July 5, 2022 8:01 AM
To: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: RE: E3 rollout

Hello,

When you have updated talking points later today, will you share with Sonya and me so one of us can send over to DOE?

I flagged this for Birgit, but CEQ/DOE noticed a "new" \$75 billion number in the E3 report, so I am hoping we can track down if that number changed from the \$45 billion number or is something different and add a talking point.

Birgit, can help draft this, and if not, would you reach out to E3 for assistance?

Thanks,

Jill

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Friday, July 1, 2022 11:42 AM
To: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Subject: RE: E3 rollout

Send me the charts. I'll get it done later today or over the weekend. Thanks! Enjoy the 4th.

On Jul 1, 2022 11:28 AM, "James,Eve A L (BPA) - PG-5" <eajames@bpa.gov> wrote:
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Subject: RE: E3 rollout

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From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
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Thanks for sharing! Yes. We can add a Q&A. I'll likely add that one and others we have discussed Tuesday and circulate. That work?

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Subject: E3 rollout

Confidential and privileged attorney client communication/FOIA-exempt

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- July 8 – afternoon – Congressional briefing with Northwestern congressional staff
- July 8 – afternoon – Congressional briefing with Senator Murray’s staff
- July 11 – morning – E3 Study presentation to Deputies
- July 15 – Post final Report on BPA’s website

From: James,Eve A L (BPA) - PG-5
Sent: Fri Jul 01 21:09:48 2022
To: Johnson,G Douglas (BPA) - DK-7; Goodwin,Summer G (BPA) - DKS-7
Cc: Koehler,Birgit G (BPA) - PG-5
Subject: RE: E3 rollout
Importance: Normal

Microsoft Exchange Server;converted from html;

Hi Doug-

Here is the updated NPV table for the talking points:

	Total Costs (real 2022 \$)	Annual Cost Increase (real 2022 \$)			Incremental Public Power Costs [% increase vs. ~8.5 cents/kWh NW average retail rates]
	Net Present Value in year of breaching	2025	2035	2045	2045
Scenario 1: 100% Clean Retail Sales	\$11.8 billion	n/a	\$434 million	\$478 million	0.8 cents/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$12.8 billion	\$495 million	\$466 million	\$509 million	0.8 cents/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$19.0 billion	n/a	\$496 million	\$860 million	1.5 cents/kWh [+18%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$10.7 billion	n/a	\$415 million	\$428 million	0.7 cents/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$75.2 billion	n/a	\$1,953 million	\$3,199 million	5.5 cents/kWh [+65%]

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From: Habibi, Maryam A (BPA) - DKP-7
Sent: Friday, July 22, 2022 11:35 AM
To: Johnson, G Douglas (BPA) - DK-7; Scruggs, Joel L (BPA) - DK-7; Baskerville, Sonya L (BPA) - AIN-WASH
Cc: Koehler, Birgit G (BPA) - PG-5
Subject: RE: E3 rollout plan and messages

I think so.

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C (b)(6)

From: Johnson, G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Sent: Friday, July 22, 2022 10:49 AM
To: Scruggs, Joel L (BPA) - DK-7 <jscruggs@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: E3 rollout plan and messages

This latest version has some input from Birgit. I think it is time to share it with Power Services senior leadership and the front office. Thoughts?

From: Johnson,G Douglas (BPA) - DK-7
Sent: Thursday, June 30, 2022 10:03 AM
To: Koehler,Birgit G (BPA) - PG-5; Leary,Jill C (BPA) - LN-7; James,Eve A L (BPA) - PG-5
Cc: Godwin,Mary E (BPA) - LN-7; Goodwin,Summer G (BPA) - DKS-7
Subject: RE: E3 study release plan

Which is why E3 used that number in the first place. Yes, we should definitely add that, which circles us back basically to where we started. Thanks.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 30, 2022 10:01 AM
To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: E3 study release plan

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The four lower Snake River dams average cost of generation (which includes Lower Snake River Compensation Plan fish hatcheries and satellite facilities) between FY18 and FY20 was \$14.63/MWh to operate and maintain. The average Fully Loaded Cost, which includes allocations for system-wide costs BPA incurs such as the Fish and Wildlife Program and Residential Exchange, was \$27.42/MWh. The 50-year forecasted values are expected to be in a similar range with a 50-year Cost of Generation of \$12.50/MWh and a 50-year Fully Loaded Cost of \$27.22/MWh. **The additional expenses in the fully loaded costs would be reallocated to the remaining resource and would not be eliminated if the four lower Snake River dams were breached. Thus it is the average cost of generation that should be used for comparison to potential replacement resources.** Replacement resources, depending on those chosen, are projected to cost between \$77 and \$139/MWh. Replacement costs rise to more than \$500 MWh in the deep economy-wide decarbonization scenario that includes only existing technologies (wind, solar, etc.) and no emerging technology, such as hydrogen and small modular nuclear.

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Updated draft saved. I will share a subsequent draft with Joel Cook, Ben Zelinsky (acting for Scott A), Sonya B, Suzanne Cooper and Marcus Chong Tim later this afternoon. Thanks for the quick work.

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Thanks Jill!

Doug I'm attaching a new version that has some added language to address Jill's comments. I like her edits so feel free to accept them and delete the comments if my changes look good.

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Subject: E3 study release plan

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Hi Jill-

Attached is a draft version of the E3 study release plan and talking points. I know there are still a few BPA staff that have comments to these drafts but haven't sent them to me so there might be some slight adjustments. The major tasks and framework won't change though so feel free to share with DOE.

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I like that a lot Birgit!

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Subject: RE: E3 study release plan

Looping in Gordon to review as well, thanks.

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 30, 2022 10:01 AM
To: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; James, Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Cc: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
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I like the clarify and transparency that Gordon's edits bring to question 6. But if we are bringing in the fully loaded costs, I would like to consider adding one piece. What do you think of this?

The four lower Snake River dams average cost of generation (which includes Lower Snake River Compensation Plan fish hatcheries and satellite facilities) between FY18 and FY20 was \$14.63/MWh to operate and maintain. The average Fully Loaded Cost, which includes allocations for system-wide costs BPA incurs such as the Fish and Wildlife Program and Residential Exchange, was \$27.42/MWh. The 50-year forecasted values are expected to be in a similar range with a 50-year Cost of Generation of \$12.50/MWh and a 50-year Fully Loaded Cost of \$27.22/MWh. **The additional expenses in the fully loaded costs would be reallocated to the remaining resource and would not be eliminated if the four lower Snake River dams were breached. Thus it is the average cost of generation that should be used for comparison to potential replacement resources.** Replacement resources, depending on those chosen, are projected to cost between \$77 and \$139/MWh. Replacement costs rise to more than \$500 MWh in the deep economy-wide decarbonization scenario that includes only existing technologies (wind, solar, etc.) and no emerging technology, such as hydrogen and small modular nuclear.

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Subject: RE: E3 study release plan

Updated draft saved. I will share a subsequent draft with Joel Cook, Ben Zelinsky (acting for Scott A), Sonya B, Suzanne Cooper and Marcus Chong Tim later this afternoon. Thanks for the quick work.

From: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Thursday, June 30, 2022 9:13 AM
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Thanks Jill!

Doug I'm attaching a new version that has some added language to address Jill's comments. I like her edits so feel free to accept them and delete the comments if my changes look good.

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Subject: RE: E3 study release plan
Attachments: E3 LSRD replacement cost analysis TPs v4 revised discount rate\LeajGA.docx

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Thanks. I used your version as the most recent.

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FOR INTERNAL USE ONLY

BPA talking points

E3 lower Snake River dam replacement costs analysis

June 2022

What this is

Earlier this year, BPA contracted with electric industry research firm Energy and Environmental Economics, also known as E3, to conduct an independent analysis of the electricity system value of the four lower Snake River (LSR) dams. This new analysis builds on the analysis performed in the Columbia River System Operations Environmental Impact Statement regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future. BPA anticipates E3's study to contribute to the regional dialogue about the future of these publicly-owned assets and help elevate regional understanding of the complexities and expenses involved in exploring replacement resources for the LSR dams.

Key messages and storyline

- As states move forward with clean energy policies, fossil-fuel generated power is being removed from the grid. Reducing hydropower would require the region to build new generation just to get the system back to its current state. Until all fossil-fuel power plants are retired, reducing hydropower means more CO2 emissions in the region, which is a step backward from the region's carbon reduction goals. Some of the lower-cost options for replacing lost hydropower rely on emerging technologies that are not yet developed or available at large-scale.
- Replacing the dams' hydropower energy and capacity services with existing renewable technology and no technological breakthroughs is projected to create 65% upward rate pressure. This is much higher than the other scenarios evaluated ~~prohibitively expensive~~.
- The E3 study evaluates what is required to maintain current reliability standards. Assuming different risk levels for reliability, as is done in other studies of LSRN dam power replacement, is a policy decision outside the scope of this analysis.
- New resources to replace the existing lower Snake River dams' energy and capacity would cost between \$8.7 to 15.1 billion with at least one emerging technology and up to \$61 billion absent breakthroughs in not-yet-commercialized emerging technologies. If these costs are not paid for by an outside source, it would result in higher electric bills for millions of Northwest residents.
- The replacement of the dams' hydropower could take up to approximately 20 years to complete after Congressional approval assuming Transmission builds were ~~needed but there was not litigation or other major delay on sitingsuccessfully sited without litigation delays~~.

Background

With multiple reviews of the future of the lower Snake River dams being conducted by the Council on Environmental Quality, the Columbia Basin Collaborative and Senator Patty Murray (D-WA) and Washington Governor Jay Inslee, BPA felt it necessary to update the potential costs of replacing the energy services from these facilities.

The CRSO EIS analysis examined a series of resource replacement portfolios using the Northwest Power and Conservation Council's latest forecasts and updated Energy Commodities resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. E3 used a resource portfolio optimizer model with their data sets and their criteria and objectives to create least-cost replacement portfolios.

E3's independent analysis includes several scenarios for replacement resources, including some with emerging technologies such as small modular nuclear reactors (SMRs) and gas plants with carbon capture or hydrogen burning capability that are not available yet. It also includes use of traditional renewable resources, such as wind, solar, storage and demand response. All of the scenarios present moderate to significant upward rate pressure for BPA's customers if not paid for by an outside source.

For more information, contact: Eve James, 503-230-5558 or Birgit Koehler, 503-230-4249

Questions and answers

1. What was the scope of the study and what questions did it address?

BPA contracted with E3 to answer what resources (one or more portfolios of resources) would be needed to maintain reliability, which is close to replacing the energy and other grid services provided by the [four](#) lower Snake River dams. This includes modeling regional grid scenarios with and without the dams. The model is designed to identify one or more replacement resource portfolio(s) and provide a comparison of the forecasted costs associated with each scenario. The analysis also discusses the timeline under which a build-out of replacement resources could occur.

E3's key study questions are:

- What additional resources would be needed to replace the power services provided by the LSR Dams through 2045?
- What is the net cost to BPA ratepayers?
- How do costs and resource needs change under different types of clean energy futures?
- How much does replacing the dams rely on emerging, not-yet commercialized technologies?

2. What power benefits do the four LSRDs currently provide?

These facilities first and foremost provide reliable electricity to help the western interconnection and the Pacific Northwest avoid blackouts. They also provide carbon-free energy. More specifically, they are capable of providing a short-term peaking capacity of more than 3,000 MWs. They can provide more than 2,000 MW of longer term peaking capacity during cold snaps when Pacific Northwest electricity use is at its highest as well as provide important reserves and essential grid reliability services, including voltage support, reactive power and black start ability.

3. What resources does the study recommend to replace the output of the lower Snake River dams?

The study recommends a combination of renewable generation (wind and solar) and “clean firm” resources (such as dual fuel natural gas + hydrogen plants, advanced small modular nuclear reactors (SMR), or gas with carbon capture and storage), and energy efficiency.

4. What are the replacement resource scenarios E3 evaluated?

Scenario	Replacement Resources Selected, Cumulative by 2045 (GW*)
<p>Scenario 1: 100% Clean Retail Sales</p>	<p>+ 2.1 GW dual fuel NG/H2 CCGT + 0.5 GW wind</p>
<p>Scenario 2a: Deep Decarb. (Baseline Technologies)</p>	<p>+ 2.0 GW dual fuel NG/H2 CCGT + 0.3 GW li-ion battery + 0.4 GW wind + 0.05 GW advanced energy efficiency + additional H2 generation**</p>
<p>Scenario 2b: Deep Decarb. (Emerging Technologies)</p>	<p>+ 1.5 GW dual fuel NG/H2 CCGT + 0.7 GW nuclear SMR</p>

Scenario 2c: Deep Decarb.
(No New Combustion)

+ 10.6 GW wind
+ 1.4 GW solar

- In scenarios that assume new combustion generation may be permitted in the Northwest, firm capacity is mostly replaced with ~2 GW of dual fuel natural gas + hydrogen turbines. These turbines may initially burn natural gas when needed during reliability challenged periods, but would transition to green hydrogen by 2045 to reach zero-emissions.
- If advanced nuclear is available, it is selected in lieu of renewables and some of the gas plants.
- The “no new combustion” scenario with decarbonization of the broader economy (e.g. electric vehicles and electric heating) requires an impractically large (12 GW) buildout of renewable energy to replace the dams’ firm capacity contributions and GHG-free energy. This is required because the wind and solar power are not as reliable for serving load as would be firm combustion generation, and thus large quantities are needed to ensure that some generation may be available during the critical periods like winter cold spells.

5. What does each option cost?

	Total Costs (real 2022 \$)	Annual Cost Increase (real 2022 \$)			Incremental Public Power Costs [% increase vs. -8.5 cents/kWh NW average retail rates]
	Net Present Value in year of breaching	2025	2035	2045	2045
Scenario 1: 100% Clean Retail Sales	\$9.7 billion		\$434 million	\$478 million	0.8 cents/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$11.7 billion	\$185 million	\$468 million	\$509 million	0.6 cents/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$15.1 billion		\$496 million	\$860 million	1.5 cents/kWh [+18%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$9.7 billion		\$415 million	\$426 million	0.7 cents/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$61 billion	n/a	\$1,953 million	\$3,190 million	5.5 cents/kWh [+65%]

•Cost increases account for replacement energy, capacity, and reserves as well as avoided LSR capital expense, but do not include any costs for breaching the dams, which would be an additional cost.

•NPV and annual cost increase are shown for the Northwest Region as a whole, but the incremental costs are calculated relative to the BPA Tier 1 annual sales for public power customers.

•% increase versus average retail rates assumes ~8.5 cents/kWh retail rates (estimated from OR and WA average retail rates). This does not account for any other rate increases that will be driven by higher loads or clean energy needs that increase regional rates.

•Annual residential customer cost impact assumes 1,280 kWh/month for average residential customers in Oregon and Washington (current ~1,000 kWh/month average + 28% from electrification load growth).

•New federal tax credits for hydrogen plants/fuels or [Investor Tax Credit](#)/[Production Tax Credit](#) extension for renewables would provide a cost reduction to public power customers from taxpayers.

Comment [LC-L1]: Suggest spelling out



E3 2022 study results: these are not the total costs to the Northwest of decarbonizing the electricity grid or its economy; these costs reflect the incremental costs of **removing breaching** replacing the lost generation from the four lower Snake River dams in each of those scenarios.

6. How do the replacement costs compare to the current costs of the four lower Snake River dams?

The four lower Snake River dams average cost of generation (which includes Lower Snake River Compensation Plan fish hatcheries and satellite facilities) between FY18 and FY20 was \$14.63/MWh to operate and maintain. The average Fully Loaded Cost, which includes allocations for system-wide costs BPA incurs such as the Fish and Wildlife Program and Residential Exchange, was \$27.42/MWh. The 50-year forecasted values are expected to be in a similar range with a 50-year Cost of Generation of \$12.50/MWh and a 50-year Fully Loaded Cost of \$27.22/MWh. The lower Snake River dams average generation cost between \$13 and or \$17/MWh (including the Lower Snake River Compensation Plan fish hatcheries and satellite facilities) to operate and maintain. Replacement resources, depending on those chosen, are projected to cost between \$77 and \$139/MWh. Replacement costs rise to more than \$500 MWh in the deep economy-wide decarbonization scenario that includes only existing technologies (wind, solar, etc.) and no emerging technology, such as hydrogen and small modular nuclear.

7. What is the projected rate impact to BPA customers?

In scenarios 1, 2a and 2b, the rate impact would be between 8% and 18% or ~\$100 to \$230 per year. In a deep economy-wide decarbonization scenario (2c) with no emerging technologies, the cost would be approximately a 65% increase or \$850 per year per household.

Note: Scenario 2c required increases in the supply of wind on new transmission (Northwest, Montana, Wyoming, and off-shore wind) to enable a feasible solution which drives the costs **impractically-extremely** high.

- Comment [LC(-L2)]:** Removal is much more expensive.
- Comment [EAJ3]:** Does not include cost for breaching- this removal was meant to be indicative that it was removed from modeling. Revised language to reflect it is the lost generation cost (E3 did not include \$cost physical breaching would need)
- Comment [LC(-L4)]:** Reworked language with Gordon and Eve

8. What is the timeline necessary to add the resources that would be required?

E3 estimates that adding additional renewable energy and firm capacity additions would take approximately five to seven years after Congressional approval to breach the dams and possibly up to 10 to 20 years assuming additional new large-scale transmission was required ~~but there was not litigation or other major delay or and successfully sited without litigation~~ delaying.

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Cc: Godwin,Mary E (BPA) - LN-7; Goodwin,Summer G (BPA) - DKS-7
Subject: RE: E3 study release plan

Thanks. We're good for now. Appreciate the help.

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Jill is right. The benefit of including Fully Loaded Cost is that we can say that even if we include allocations for all these other costs, it still isn't even close. Birgit's clarification is an important caveat.

From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
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OK. Confusing – but necessary to satisfy those folks. Not sure they are correct, but I'd rather placate them than incite them. Thanks for the explanation.

From: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
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Because O&M are not the only costs attributed to the LSRs, and we received numerous comments in the EIS and various IPR processes that we are hiding the accurate costs for the Snakes. So, the EIS public comments, IPR, the SAMP, etc. all include fully loaded costs so we are providing accurate cost information.

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I have to ask why we would add "fully loaded" costs to the scenario? If they are breached, there is no loaded. The facilities are gone. Why would you compare replacement resources to your costs of operation and maintenance. It seems confusing to me.

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Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: E3 study release plan

Updated draft saved. I will share a subsequent draft with Joel Cook, Ben Zelinsky (acting for Scott A), Sonya B, Suzanne Cooper and Marcus Chong Tim later this afternoon. Thanks for the quick work.

From: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Thursday, June 30, 2022 9:13 AM
To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: E3 study release plan

Confidential and privileged attorney client communication/FOIA-exempt

Let's use this version that incorporates edits from Gordon for Question 6, thanks.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Thursday, June 30, 2022 8:53 AM

To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>

Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>;

Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>

Subject: RE: E3 study release plan

Confidential and privileged attorney client communication/FOIA-exempt

Thanks Jill!

Doug I'm attaching a new version that has some added language to address Jill's comments. I like her edits so feel free to accept them and delete the comments if my changes look good.

From: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>

Sent: Thursday, June 30, 2022 8:40 AM

To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>;

Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>

Subject: RE: E3 study release plan

Confidential and privileged attorney client communication/FOIA-exempt

Hi Eve,

Marcus shared a new version of the talking points with me this morning, so I added my edits to that version and shared with DOE.

Cc-ing Summer and Doug so they can see my edits – Summer and Doug, please make sure I am on the internal emails reviewing documents related to E3, thanks!

Jill

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Wednesday, June 29, 2022 4:27 PM

To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>

Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Subject: E3 study release plan

Confidential and privileged attorney client communication/FOIA-exempt

Hi Jill-

Attached is a draft version of the E3 study release plan and talking points. I know there are still a few BPA staff that have comments to these drafts but haven't sent them to me so there might be some slight adjustments. The major tasks and framework won't change though so feel free to share with DOE.

Thanks,
Eve

From: Leary, Jill C (BPA) - LN-7
Sent: Tuesday, July 5, 2022 2:04 PM
To: Koehler, Birgit G (BPA) - PG-5; Johnson, G Douglas (BPA) - DK-7; Scruggs, Joel L (BPA) - DK-7; Baskerville, Sonya L (BPA) - AIN-WASH
Subject: RE: FINAL DRAFT: E3 LSRD analysis talking points
Attachments: E3 LSRD replacement cost analysis TPs v8.docx

Thanks, Birgit – I accepted the changes, deleted the comments and scrubbed the metadata. I will share this with Gabe now.

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Sent: Tuesday, July 5, 2022 1:46 PM
To: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Scruggs, Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: RE: FINAL DRAFT: E3 LSRD analysis talking points

If we want to add something for the TPs, here's an idea for this bullet, also included in attached

- New resources to replace the existing lower Snake River dams' energy and capacity would cost between \$10.7 to 19.0 billion with at least one emerging technology and up to \$75.2 billion absent breakthroughs in not-yet-commercialized emerging technologies. If these costs are not paid for by an outside source, it would result in higher electric bills for millions of Northwest residents. **(These net present value costs were calculated using a 3% discount rate, consistent with the discount rate used in the Inslee/Murray draft report which is a reasonable rate for public financing of large utility projects.)**

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Subject: RE: FINAL DRAFT: E3 LSRD analysis talking points

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I just got off the phone with Gabe asking for it ASAP, so since Kristel is not editing for substance, I would like to send this version now so we can get other next steps approved at the DC level.

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Subject: RE: FINAL DRAFT: E3 LSRD analysis talking points

One set of numbers need to be updated.

And I added a sentence that we had discussed in an email thread, but which didn't seem to have made it into the document.

From: Koehler,Birgit G (BPA) - PG-5

Sent: Tuesday, July 5, 2022 12:50 PM

To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>

Subject: RE: FINAL DRAFT: E3 LSRD analysis talking points

I'm working on checking this now. Annual numbers should not have changed, only NPV. But I'll take a look against the final report and PPT

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Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Subject: RE: FINAL DRAFT: E3 LSRD analysis talking points

I have not seen the report. Birgit will have to confirm these numbers.

From: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>

Sent: Tuesday, July 5, 2022 12:01 PM

To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>

Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Subject: RE: FINAL DRAFT: E3 LSRD analysis talking points

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Hi Doug,

I have a few edits and comments I am hoping you and Birgit can work through today.

I want to be absolutely certain all of numbers account for the new information in the report we received on Friday, so we are not sharing old numbers with DC.

Thanks,

Jill

From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>

Sent: Tuesday, July 5, 2022 10:20 AM

To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L

(BPA) - AIN-WASH <slbaskerville@bpa.gov>

Subject: FINAL DRAFT: E3 LSRD analysis talking points

This has the latest chart and the changes from Jill and Birgit. Please take one more look and I'll get to Kristel Turner for final review later today or early tomorrow.

DRAFT 6/30/22 v7 July 5 Birgit updating graphics from E3 from their July 1 final version. For question 5, I updated the table. NPV values changed. For question 4, I added the footnotes that go with the table

FOR INTERNAL USE ONLY

BPA talking points

E3 lower Snake River dam replacement costs analysis

June 2022

What this is

Earlier this year, BPA contracted with electric industry research firm Energy and Environmental Economics, also known as E3, to conduct an independent analysis of the electricity system value of the four lower Snake River (LSR) dams. This new analysis builds on the analysis performed in the Columbia River System Operations Environmental Impact Statement regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future. BPA anticipates E3's study to contribute to the regional dialogue about the future of these publicly-owned assets and help elevate regional understanding of the complexities and expenses involved in exploring replacement resources for the LSR dams.

Key messages and storyline

- As states move forward with clean energy policies, fossil-fuel generated power is being removed from the grid. Reducing hydropower would require the region to build new generation just to get the system back to its current state. Until all fossil-fuel power plants are retired, reducing hydropower means more CO₂ emissions in the region, which is a step backward from the region's carbon reduction goals. Some of the lower-cost options for replacing lost hydropower rely on emerging technologies that are not yet developed or available at large-scale.
- Replacing the dams' hydropower energy and capacity services with existing renewable technology and no technological breakthroughs is projected to create 65% upward rate pressure. This is much higher than the other scenarios evaluated.
- The E3 study evaluates what is required to maintain current reliability standards. Assuming different risk levels for reliability, as is done in other studies of LSR dam power replacement, is a policy decision outside the scope of this analysis.
- New resources to replace the existing lower Snake River dams' energy and capacity would cost between \$10.7 to 19.0 billion with at least one emerging technology and up to \$75.2 billion absent breakthroughs in not-yet-commercialized emerging technologies. If these costs are not paid for by an outside source, it would result in higher electric bills for millions of Northwest residents. (These net present value costs were calculated using a 3% discount rate, consistent with the discount rate used in the Inslee/Murray draft report which is a reasonable rate for public financing of large utility projects.)

- The replacement of the dams' hydropower could take up to approximately 20 years to complete after Congressional approval assuming Transmission builds were successfully sited without litigation delays.

Background

With multiple reviews of the future of the lower Snake River dams being conducted by the Council on Environmental Quality, the Columbia Basin Collaborative and Senator Patty Murray (D-WA) and Washington Governor Jay Inslee, BPA felt it necessary to review the potential costs of replacing the energy services from these facilities.

The CRSO EIS analysis examined a series of resource replacement portfolios using the Northwest Power and Conservation Council's latest forecasts and updated Energy Commodities resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. E3 used a resource portfolio optimizer model with their data sets and their criteria and objectives to create least-cost replacement portfolios.

E3's independent analysis includes several scenarios for replacement resources, including some with emerging technologies such as small modular nuclear reactors (SMRs) and gas plants with carbon capture or hydrogen burning capability that are not available yet. It also includes use of traditional renewable resources, such as wind, solar, storage and demand response. All of the scenarios present moderate to significant upward rate pressure for BPA's customers if not paid for by an outside source.

For more information, contact: Eve James, 503-230-5558 or Birgit Koehler, 503-230-4249

Questions and answers

1. What was the scope of the study and what questions did it address?

BPA contracted with E3 to answer what resources (one or more portfolios of resources) would be needed to maintain reliability, which is close to replacing the energy and other grid services provided by the four lower Snake River dams. This includes modeling regional grid scenarios with and without the dams. The model is designed to identify one or more replacement resource portfolio(s) and provide a comparison of the forecasted costs associated with each scenario. The analysis also discusses the timeline under which a build-out of replacement resources could occur.

E3's key study questions are:

- What additional resources would be needed to replace the power services provided by the LSR Dams through 2045?
- What is the net cost to BPA ratepayers?
- How do costs and resource needs change under different types of clean energy futures?

- How much does replacing the dams rely on emerging, not-yet commercialized technologies?

2. What power benefits do the four LSRDs currently provide?

These facilities provide reliable, carbon-free electricity to help the western interconnection and the Pacific Northwest avoid blackouts. More specifically, they are capable of providing a short-term peaking capacity of more than 3,000 MWs. They can provide more than 2,000 MW of longer term peaking capacity during cold snaps when Pacific Northwest electricity use is at its highest as well as provide important reserves and essential grid reliability services, including voltage support, reactive power and black start ability.

3. What resources does the study recommend to replace the output of the lower Snake River dams?

The study recommends a combination of renewable generation (wind and solar) and “clean firm” resources (such as dual fuel natural gas + hydrogen plants, advanced small modular nuclear reactors (SMR), or gas with carbon capture and storage), and energy efficiency.

4. What are the replacement resource scenarios E3 evaluated?

Scenario	Replacement Resources Selected, Cumulative by 2045 (GW*)
Scenario 1: 100% Clean Retail Sales	+ 2.1 GW dual fuel NG/H2 CCGT + 0.5 GW wind
Scenario 2a: Deep Decarb. (Baseline Technologies)	+ 2.0 GW dual fuel NG/H2 CCGT + 0.3 GW li-ion battery + 0.4 GW wind + 0.05 GW advanced energy efficiency + additional H2 generation**

Scenario 2b: Deep Decarb. (Emerging Technologies)	+ 1.5 GW dual fuel NG/H2 CCGT + 0.7 GW nuclear SMR
Scenario 2c: Deep Decarb. (No New Combustion)	+ 10.6 GW wind + 1.4 GW solar

* 1 GW = 1,000 MW

** Replacing LSR dams GHG-free energy at least-cost leads RESOLVE model to generate an additional 1.2 TWh of hydrogen generation during low renewable conditions (or 0.14 average GW).

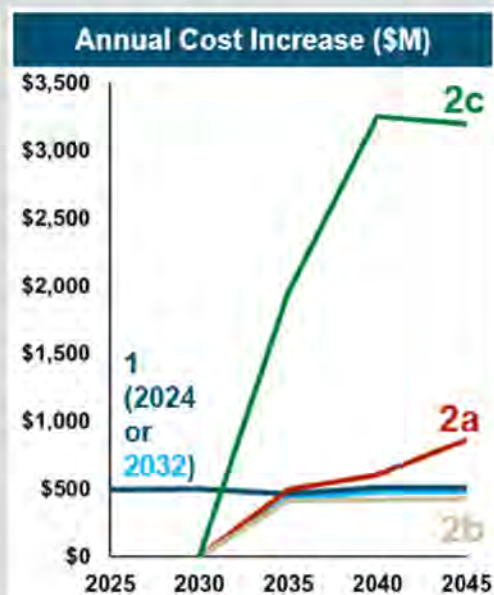
- In scenarios that assume new combustion generation may be permitted in the Northwest, firm capacity is mostly replaced with ~2 GW of dual fuel natural gas + hydrogen turbines. These turbines may initially burn natural gas when needed during reliability challenged periods, but would transition to green hydrogen by 2045 to reach zero-emissions.
- If advanced nuclear is available, it is selected in lieu of renewables and some of the gas plants.
- The “no new combustion” scenario with decarbonization of the broader economy (e.g. electric vehicles and electric heating) requires an unprecedented large (12 GW) buildout of renewable energy to replace the dams’ firm capacity contributions and GHG-free energy. This is required because the wind and solar power are not as reliable for serving load as would be firm combustion generation, and thus large quantities are needed to ensure that some generation may be available during the critical periods like winter cold spells.

5. What does each option cost?

	Total Costs (real 2022 \$)	Annual Cost Increase (real 2022 \$)			Incremental Public Power Costs [% Increase vs. ~8.5 cents/kWh NW average retail rates]
	Net Present Value in year of breaching	2025	2035	2045	2045
Scenario 1: 100% Clean Retail Sales	\$11.8 billion	n/a	\$434 million	\$478 million	0.8 cents/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$12.8 billion	\$495 million	\$466 million	\$509 million	0.8 cents/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$19.0 billion	n/a	\$496 million	\$860 million	1.5 cents/kWh [+18%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$10.7 billion	n/a	\$415 million	\$428 million	0.7 cents/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$75.2 billion	n/a	\$1,953 million	\$3,199 million	5.5 cents/kWh [+65%]

•Cost increases account for replacement energy, capacity, and reserves as well as avoided LSR capital + expense, but do not include any costs for breaching the dams, which would be an additional cost.

- NPV and annual cost increase are shown for the Northwest Region as a whole, but the incremental costs are calculated relative to the BPA Tier 1 annual sales for public power customers.
- % increase versus average retail rates assumes ~8.5 cents/kWh retail rates (estimated from OR and WA average retail rates). This does not account for any other rate increases that will be driven by higher loads or clean energy needs that increase regional rates.
- Annual residential customer cost impact assumes 1,280 kWh/month for average residential customers in Oregon and Washington (current ~1,000 kWh/month average + 28% from electrification load growth).
- New federal tax credits for hydrogen plants/fuels or Investor Tax Credit/Production Tax Credit extension for renewables would provide a cost reduction to public power customers from taxpayers



E3 2022 study results: these are not the total costs to the Northwest of decarbonizing the electricity grid or its economy; these costs reflect the incremental costs of replacing the lost generation from the four lower Snake River dams in each of those scenarios.

6. How do the replacement costs compare to the current costs of the four lower Snake River dams?

The four lower Snake River dams average cost of generation (which includes Lower Snake River Compensation Plan fish hatcheries and satellite facilities) between FY18 and FY20 was \$14.63/MWh to operate and maintain. The average Fully Loaded Cost, which includes allocations for system-wide costs BPA incurs such as the Fish and Wildlife Program and Residential Exchange, was \$27.42/MWh. The additional expenses in the fully loaded costs would be reallocated to the remaining resource and would not be eliminated if the four lower Snake River dams were breached. Thus it is the average cost of generation that should be used for comparison to potential replacement resources. The 50-year forecasted values are expected to be in a similar range with a 50-year Cost of Generation of \$12.50/MWh and a 50-year Fully Loaded Cost of \$27.22/MWh. Replacement resources, depending on those chosen, are projected to cost between \$77 and \$139/MWh. Replacement costs rise to more than \$500 MWh in the deep economy-wide decarbonization scenario that includes only existing technologies (wind, solar, etc.) and no emerging technology, such as hydrogen and small modular nuclear.

7. What is the projected rate impact to BPA customers?

In scenarios 1, 2a and 2b, the rate impact would be between 8% and 18% or ~\$100 to \$230 per year. In a deep economy-wide decarbonization scenario (2c) with no emerging technologies, the cost would be approximately a 65% increase or \$850 per year per household.

Note: Scenario 2c required increases in the supply of wind on new transmission (Northwest, Montana, Wyoming, and off-shore wind) to enable a feasible solution which drives the costs extremely high.

8. What is the timeline necessary to add the resources that would be required?

E3 estimates that adding additional renewable energy and firm capacity additions would take approximately five to seven years after Congressional approval to breach the dams and possibly up to 10 to 20 years assuming additional new large-scale transmission was required and successfully sited without litigation delays.

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Subject: RE: FINAL DRAFT: E3 LSRD analysis talking points

I'll share this version with Kristel Turner for her final review. Thanks for the help and patience.

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From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>

Sent: Tuesday, July 5, 2022 10:20 AM

To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <sibaskerville@bpa.gov>

Subject: FINAL DRAFT: E3 LSRD analysis talking points

This has the latest chart and the changes from Jill and Birgit. Please take one more look and I'll get to Kristel Turner for final review later today or early tomorrow.

From: Leary, Jill C (BPA) - LN-7
Sent: Tuesday, July 5, 2022 11:07 AM
To: Johnson, G Douglas (BPA) - DK-7; Goodwin, Summer G (BPA) - DKS-7
Cc: Koehler, Birgit G (BPA) - PG-5
Subject: RE: HOLD TENTATIVE MEDIA AVAILABILITY

Thanks for the updates.

From: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Tuesday, July 5, 2022 10:45 AM
To: Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: HOLD TENTATIVE MEDIA AVAILABILITY

We are discussing keeping BPA completely out and having a telephone moderator (like the CRSO virtual meetings) queue up reporter questions for E3.

From: Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Sent: Tuesday, July 5, 2022 10:34 AM
To: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: HOLD TENTATIVE MEDIA AVAILABILITY

It's an opportunity for media to call in and ask their questions. Doug as spokesperson will be there to help answer and SMEs like Birgit, Eve and Arne would also be answering questions. I assume you should also be there or another attorney.

We could have a behind the scenes skype sessions going in case you want to take a question or correct something.

Doug, should chime in here. He's lead and he may be thinking of doing it differently, but that's typically what I have seen done in the past.

Best

Summer

From: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Tuesday, July 5, 2022 9:39 AM
To: Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: HOLD TENTATIVE MEDIA AVAILABILITY

Hi Summer,
Can you remind me what this meeting is? I am blanking, thanks.

Jill

-----Original Appointment-----

From: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>

Sent: Thursday, June 30, 2022 11:18 AM

To: Goodwin,Summer G (BPA) - DKS-7; Goodwin,Summer G (BPA) - DKS-7; Johnson,G Douglas (BPA) - DK-7; James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5; Leary,Jill C (BPA) - LN-7; arne@ethree.com

Subject: HOLD TENTATIVE MEDIA AVAILABILITY

When: Thursday, July 7, 2022 1:00 PM-2:00 PM (UTC-08:00) Pacific Time (US & Canada).

Where: telephone

This is just to get it on your calendar and stave off late lunch plans in case we have the media availability. May not need everyone there. Doug will lead us.

From: Johnson,G Douglas (BPA) - DK-7
Sent: Tuesday, July 5, 2022 11:29 AM
To: Koehler,Birgit G (BPA) - PG-5
Cc: Scruggs,Joel L (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7
Subject: RE: HOLD TENTATIVE MEDIA AVAILABILITY

Could you help us set up a meeting for tomorrow morning with E3 to discuss logistics for the media availability. We are working with the phone office to secure a line – but have some stuff to talk through.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 5, 2022 10:47 AM
To: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Cc: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Subject: RE: HOLD TENTATIVE MEDIA AVAILABILITY

One additional note is that we, BPA, will try to stay largely in the background so that this looks as independent from us as possible. Eve already coordinated with E3 that they will be available.

From: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Sent: Tuesday, July 5, 2022 10:34 AM
To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Subject: RE: HOLD TENTATIVE MEDIA AVAILABILITY

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Sent: Thursday, June 30, 2022 11:18 AM

To: Goodwin, Summer G (BPA) - DKS-7; Goodwin, Summer G (BPA) - DKS-7; Johnson, G Douglas (BPA) - DK-7; James, Eve A L (BPA) - PG-5; Koehler, Birgit G (BPA) - PG-5; Leary, Jill C (BPA) - LN-7; arne@ethree.com

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Where: telephone

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From: Koehler,Birgit G (BPA) - PG-5
Sent: Monday, July 11, 2022 3:12 PM
To: Habibi,Maryam A (BPA) - DKP-7
Subject: RE: Huddle on report release plan

When do you need it, and remind me of Ryan's last name

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Monday, July 11, 2022 2:08 PM
To: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: Huddle on report release plan

Scheduled short check-in to confirm progress on the release plan we just set. Here are my notes:

- Next huddle at 3 p.m. today – 7/11
- Birgit obtaining final report (two PDF copies, one with Embargo watermark and one without for posting tomorrow) and sending to Sonya
- Sonya will notify DOE and determine who will send to congressional staff prior to briefings this evening
- Once embargoed copy is sent to staff, John will call Bill Edmunds/Guy Norman for heads up and to prepare for Council posting tomorrow a.m.
- Maryam will coordinate BPA posting by 6 a.m. 7/12
- Maryam will notify interested media of availability once posted

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C (b)(6)

-----Original Appointment-----

From: Habibi,Maryam A (BPA) - DKP-7
Sent: Monday, July 11, 2022 2:01 PM
To: Habibi,Maryam A (BPA) - DKP-7; Hairston,John L (BPA) - A-7; Baskerville,Sonya L (BPA) - AIN-WASH; Zelinsky,Benjamin D (BPA) - E-4; Godwin,Mary E (BPA) - LN-7; Armentrout,Scott G (BPA) - E-4; Scruggs,Joel L (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7; Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5
Subject: Huddle on report release plan
When: Monday, July 11, 2022 3:00 PM-3:30 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Bridge info: 503-230-4000,,837855086#

866-340-4886,(b)(6)
503-230-4000,(b)(6)

From: Rhoads,Abigail M (BPA) - DKD-7
Sent: Wednesday, June 29, 2022 12:16 PM
To: James,Eve A L (BPA) - PG-5; Johnson,G Douglas (BPA) - DK-7; Zimmerman,Ryan J (BPA) - DKD-7
Cc: Koehler,Birgit G (BPA) - PG-5
Subject: RE: Power Services web post

Categories: Other critical

Noted! We can still prep things ahead of time, but it's good to know we have more time. You can send the materials and information to both me and Ryan.

From: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Sent: Wednesday, June 29, 2022 12:14 PM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Rhoads,Abigail M (BPA) - DKD-7 <amhoward@bpa.gov>; Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Power Services web post

That is correct Doug- I was going to send them if available on Friday since I will be out of the office that week but they shouldn't show up on the website until July 7.

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
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To: Rhoads,Abigail M (BPA) - DKD-7 <amhoward@bpa.gov>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Power Services web post

I don't think we will post this until the day of (after) we brief the Power Council (AM - Thursday, July 7). We won't publicly share anything until then.

From: Rhoads,Abigail M (BPA) - DKD-7 <amhoward@bpa.gov>
Sent: Wednesday, June 29, 2022 12:11 PM
To: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Power Services web post

So, it sounds like you anticipate the materials being ready for publication on Friday. I am available in the morning until 12:30 (or possibly earlier if we get early release), but I am OOO the next week, through July 6. Ryan or his backup should be able to help you during that period.

Do you picture the materials going here (see screen snip)?

Energy and Environmental Economics lower Snake River Dam analysis

Earlier this year, BPA engaged electric industry research firm Energy and Environmental Economics (E3) to build on the analysis performed in the Columbia River System Operations (CRSO) Environmental Impact Statement (EIS) regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future.

The CRSO EIS analysis examined a series of resource replacement portfolios using the Northwest Power and Conservation Council's latest resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. E3 will include a resource portfolio optimizer model using their data sets and their criteria and objectives to create least cost replacement portfolios.

The objective of the current analysis is to provide BPA with an independent study of lower Snake River dam breaching and potential replacement resources from a realistic analytic, operational, and resource characteristic perspective, so that BPA can enhance its understanding of the complexity and expense involved in replacing those assets.

Earthjustice, an organization representing several entities in the American Rivers v. BPA and NWF v. NMFS litigation, recently submitted a list of questions regarding the E3 analysis. Those questions and BPA's responses are posted below:

- [Energy and Environmental Economics lower Snake River Dam analysis Q&A](#)

BPA also provided answers to additional questions from interested entities regarding its ongoing analysis of potential replacement resources for the services provided by the four lower Snake River dams.

- [Additional Q&A - Resource Replacement Analysis](#)



And do you know what the accompanying text for the materials will be? We can get things prepped now. It sounds like there are two documents – (1) a presentation and (2) a final report – is that right?

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, June 29, 2022 11:44 AM
To: Johnson,G Douglas (BPA) - DK-7 <gjdjohnson@bpa.gov>; Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>; Rhoads,Abigail M (BPA) - DKD-7 <amhoward@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Power Services web post

Hello-

I wanted to give you a heads up that E3 will be presenting the final results of their analysis at the next Power Council meeting July 7 from 8:30 – 10 AM. We wanted to post the presentation materials and the final report after the presentation where the Q&A was posted on the BPA website: [Hydropower Impact - Bonneville Power Administration \(bpa.gov\)](#)

I know it is a holiday week and I will be out of the office so just wondering who I should send the materials to on Friday July 1st? If the materials have an unexpected delay I will coordinate with Birgit Koehler to send them prior to the July 7th Council meeting since she is covering for me that week.

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Sent: Thursday, May 5, 2022 10:06 AM
To: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: Power Services web post

How about: Energy and Environmental Economics lower Snake River Dam analysis Q&A

From: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>
Sent: Thursday, May 5, 2022 9:48 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: Power Services web post

That's probably fine. I think we'll still need a sub-head before the text that Doug created.

Ryan

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Thursday, May 5, 2022 9:43 AM
To: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: Power Services web post

I was thinking it could go here:

Hydropower Data & Studies

Hydropower Impact

Climate Change and FCRPS

Hydro

Hydropower de
Northwest. It ac
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Doug do you think it should just go on the bottom of that page as a link to additional studies? I think once we have final results we'll want a distinct link with a longer article similar to the Hydropower Impact but since this is just an input QA could we put it on here for now? I know folks were trying to get it online ASAP.

From: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>

Sent: Thursday, May 5, 2022 9:36 AM

To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gjohnson@bpa.gov>

Subject: RE: Power Services web post

Reaching back in mind to last week.

This information would go under Power Services > Hydropower Data & Studies ?

What can we title this new page?

Ryan

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Thursday, May 5, 2022 9:31 AM

To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>

Subject: RE: Power Services web post

Good morning-

Just checking on the status of getting this up on the website. Please let me know when it's posted so we can send the link out to interested parties.

Thanks,

Eve

From: James,Eve A L (BPA) - PG-5

Sent: Tuesday, May 3, 2022 3:23 PM

To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>

Subject: RE: Power Services web post

Thanks for helping Ryan. Attached is the Q&A that needs to get posted.

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>

Sent: Tuesday, May 3, 2022 3:20 PM

To: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>

Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Subject: Power Services web post

Ryan,

Eve has a Q&A about some analysis E3 is doing on replacement costs related to the lower Snake River Dams in a breaching scenario. I worked with Eve and other in Power Services and OGC to draft the attached intro. Eve can get you the Q&A. Can someone on your team help with posting? Thanks.

From: Zimmerman,Ryan J (BPA) - DKD-7
Sent: Wednesday, July 6, 2022 4:27 PM
To: Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5; Rhoads,Abigail M (BPA) - DKD-7; Johnson,G Douglas (BPA) - DK-7
Cc: Habibi,Maryam A (BPA) - DKP-7
Subject: RE: Power Services web post

Yep, of course. I'll wait for your update and Doug's green light.

Ryan

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, July 6, 2022 4:22 PM
To: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Rhoads,Abigail M (BPA) - DKD-7 <amhoward@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Cc: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Subject: RE: Power Services web post

Ryan and Abigail, please hold off. This is still sensitive and timing uncertain.

I am glad that you reminded us all. I also have a revised version with 2 additional slides that I'll send if we get the go-ahead.

From: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>
Sent: Wednesday, July 6, 2022 4:18 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Rhoads,Abigail M (BPA) - DKD-7 <amhoward@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
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Subject: RE: Power Services web post

I'm popping this to the top of everyone's inbox for tomorrow.

Given the sensitivity of the timing, I'll wait for Doug to give the word to publish this tomorrow.

Ryan Zimmerman (he / him)
Manager | Digital Media and Visual Design | Communications (DKD)
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-4327

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, July 1, 2022 9:15 PM
To: Rhoads,Abigail M (BPA) - DKD-7 <amhoward@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Power Services web post

Attached is the public presentation that E3 will be giving to the Council on July 7. I will be out of the office next week but the screen snip looks like the correct location to me- you can contact Doug or Birgit if you have any questions. Please don't post this until July 7th.

Thanks,
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From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Thursday, May 5, 2022 9:31 AM

To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>

Subject: RE: Power Services web post

Good morning-

Just checking on the status of getting this up on the website. Please let me know when it's posted so we can send the link out to interested parties.

Thanks,

Eve

From: James,Eve A L (BPA) - PG-5

Sent: Tuesday, May 3, 2022 3:23 PM

To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>

Subject: RE: Power Services web post

Thanks for helping Ryan. Attached is the Q&A that needs to get posted.

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>

Sent: Tuesday, May 3, 2022 3:20 PM

To: Zimmerman,Ryan J (BPA) - DKD-7 <rjzimmerman@bpa.gov>

Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Subject: Power Services web post

Ryan,

Eve has a Q&A about some analysis E3 is doing on replacement costs related to the lower Snake River Dams in a breaching scenario. I worked with Eve and other in Power Services and OGC to draft the attached intro. Eve can get you the Q&A. Can someone on your team help with posting? Thanks.

From: Godwin,Mary E (BPA) - LN-7
Sent: Tuesday, May 3, 2022 12:48 PM
To: Leary,Jill C (BPA) - LN-7; Johnson,G Douglas (BPA) - DK-7; Diffely,Robert J (BPA) - PGPL-5
Cc: Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5
Subject: RE: REVIEW REQUESTED: Intro Paragraph for E3 study questions from EarthJustice
Attachments: EarthJustice QA intro v3 FINAL DRAFTJL_meg.docx

A few suggestions from me. I think this looks pretty good.

Thanks,
Mary

From: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Tuesday, May 3, 2022 12:10 PM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdifely@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Subject: RE: REVIEW REQUESTED: Intro Paragraph for E3 study questions from EarthJustice

One minor nit from me, but agree we are almost there, thanks.

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Tuesday, May 3, 2022 8:34 AM
To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdifely@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Subject: REVIEW REQUESTED: Intro Paragraph for E3 study questions from EarthJustice

I worked with Rob to answer the "because" part. Please take one last look. I think we're almost there.

From: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Monday, May 2, 2022 11:25 AM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdifely@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: REVIEW REQUESTED: Intro Paragraph for E3 study questions from EarthJustice

Thanks, Rob, Mary and I had a few edits for clean-up/litigation sensitivity purposes. It would be great to add a "because" at the end of the last sentence to capture why we want this done.

From: Diffely,Robert J (BPA) - PGPL-5 <rjdifely@bpa.gov>
Sent: Monday, May 2, 2022 11:12 AM
To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: REVIEW REQUESTED: Intro Paragraph for E3 study questions from EarthJustice

Suggested replacement language:

Current paragraph:

The CRSO EIS analysis did not include use of “resource portfolio optimizers.” The analysis being performed by E3 will include a resource portfolio optimizer model, which could influence the estimated cost of replacement resources. BPA will also make this information available to other processes considering the future of those facilities.

New:

The CRSO EIS analysis **examined** a series of resource replacement portfolios using the **Northwest Power and Conservation Council’s (Council)** latest resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. **The analysis was limited to the year of 2022 because it was the latest year that the Council had a data set to run the models.** E3 will include a resource portfolio optimizer model using their data sets and their criteria and objectives to create least cost replacement portfolios **{can we add what the benefit of having them do this is}**.

From: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>

Sent: Monday, May 2, 2022 10:21 AM

To: Diffely, Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson, G Douglas (BPA) - DK-7 <gjohnson@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>

Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Subject: RE: REVIEW REQUESTED: Intro Paragraph for E3 study questions from EarthJustice

Combined edits from OGC, thanks.

From: Diffely, Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>

Sent: Friday, April 29, 2022 2:15 PM

To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson, G Douglas (BPA) - DK-7 <gjohnson@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>

Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Subject: RE: REVIEW REQUESTED: Intro Paragraph for E3 study questions from EarthJustice

Hmm,

The optimizer is not the only difference. Incorporating new clean energy laws in Oregon and Washington – mostly focusing in 2032 so most if not all coal is out of the modeling.

Not going to be just a strait comparison to the EIS . . . Should we state that it won’t be apples to apples with the EIS?

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Sent: Friday, April 29, 2022 12:43 PM

To: Johnson, G Douglas (BPA) - DK-7 <gjohnson@bpa.gov>; Diffely, Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>

Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Subject: RE: REVIEW REQUESTED: Intro Paragraph for E3 study questions from EarthJustice

Only one small edit from me in the attached.

Adding two words “...replacement **resources and** costs..”

From: Johnson, G Douglas (BPA) - DK-7 <gjohnson@bpa.gov>

Sent: Friday, April 29, 2022 12:35 PM

To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: REVIEW REQUESTED: Intro Paragraph for E3 study questions from EarthJustice

Hey there,

I worked with Eve James, who is copied, to draft the attached intro to answers to questions from EarthJustice that we intend to post on the Power Services section of BPA.gov. I have also attached the original email from Heidi Helwig that started this process that includes the Q&A document we intend to post.

Please review the Intro (not the PDF in the other attachment) and provide edits/comments by COB, Monday, May 2. That way we can get the intro and the link to the Q&A posted next week. Thanks. Let Eve and me know if you have questions.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, April 29, 2022 12:09 PM
To: Johnson,G Douglas (BPA) - DK-7 <gjohnson@bpa.gov>
Subject: RE: Intro Paragraph for E3 study questions from EarthJustice

Thanks Doug- attached are just a few small edits. If you could include Birgit Koehler, Rob Diffely, Jill Leary, and Mary Godwin in the review for the next draft I think you'll capture the brilliant minds working on this topic.

Thanks,
Eve

From: Johnson,G Douglas (BPA) - DK-7 <gjohnson@bpa.gov>
Sent: Friday, April 29, 2022 11:48 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: Intro Paragraph for E3 study questions from EarthJustice

Eve,

Please take a look at the attached. Once you have reviewed and commented, please let me know who else needs to review. Once that review is complete, we'll get this intro posted to BPA.gov with a link to the Q&A you sent us. Thanks.

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, July 5, 2022 12:41 PM
To: Goodwin,Summer G (BPA) - DKS-7; Johnson,G Douglas (BPA) - DK-7
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

I switched calendaring to a different thread with an easy-to-find-again subject line. 1 pm PDT works.

From: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Sent: Tuesday, July 5, 2022 12:26 PM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

There is nothing in writing that I have about the availability of E3. We had a convo about it with Eve. She said he was available at 1 our time. I sent Arne the meeting invite and he accepted. Is 1PM PT still an ok time for the media call?

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Tuesday, July 5, 2022 12:15 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

We were under the impression that E3 was talking 10 a.m to 1 p.m. ET because Arne is on the east coast. BTW, why are we still briefing the Council? Didn't we set this up when we were expecting the final report in Mid-June?

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 5, 2022 12:13 PM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

Doug,

I found the emails between Eve and E3 on availability. E3 is not available 10 am to 1 pm one the days, I think it is the 7th. I have on my calendar a tentative media briefing at 1 pm from Summer. I did send a message to E3 checking for their availability again on the 7th and the 8th.

I'm adding Summer to the thread, because she's always well organized and may have the info if Eve sent it to her.

Birgit

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, July 5, 2022 11:38 AM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

If you are asking if E3 is available to do the Council briefing at 8:30, that's all set.

Ah, but I see you are asking about 10 PT for a media briefing. My memory is that they had a conflict, but I have too many emails to try to find it and will have to ask

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>

Sent: Tuesday, July 5, 2022 10:16 AM

To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>

Cc: Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>

Subject: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

Please take a look. Birgit, can you confirm with E3 that this time works?

Earlier this year, BPA engaged electric industry research firm Energy and Environmental Economics (E3) to build on the analysis performed in the Columbia River System Operations (CRSO) Environmental Impact Statement (EIS) regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future.

The CRSO EIS analysis examined a series of resource replacement portfolios using the Northwest Power and Conservation Council's latest resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. E3 will include a resource portfolio optimizer model using their data sets and their criteria and objectives to create least cost replacement portfolios.

The objective of the [current](#) analysis is to provide BPA with an independent study of lower Snake [River](#) dam breaching and potential replacement resources from a realistic analytic, operational, and resource characteristic perspective, so that BPA can enhance its understanding of the complexity and expense [involved](#) in replacing those assets.

Earthjustice, an organization representing several entities in the *American Rivers v. BPA* and *NWF v. NMFS* litigation, recently submitted a list of questions regarding the E3 analysis. Those questions and BPA's responses are posted below:

(ADD LINK ONCE POSTED)

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, July 5, 2022 12:40 PM
To: Johnson,G Douglas (BPA) - DK-7
Cc: Goodwin,Summer G (BPA) - DKS-7
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

We would like the E3 information to be included in the final Inslee/Murray report, hence trying to get it out in public quickly. Also want it out sooner than later for informing discussions in the region about dam breaching.

From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Sent: Tuesday, July 5, 2022 12:36 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

So, the two are related in some way?

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 5, 2022 12:17 PM
To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

We are briefing the Council as a way to make this public, without it being a big BPA release. This makes it in time for the deadline for input to the Inslee Murray report, where comments are due July 11.

From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Sent: Tuesday, July 5, 2022 12:15 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

We were under the impression that E3 was talking 10 a.m to 1 p.m. ET because Arne is on the east coast. BTW, why are we still briefing the Council? Didn't we set this up when we were expecting the final report in Mid-June?

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
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To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
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Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

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I'm adding Summer to the thread, because she's always well organized and may have the info if Eve sent it to her.

Birgit

From: Koehler,Birgit G (BPA) - PG-5

Sent: Tuesday, July 5, 2022 11:38 AM

To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>

Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

If you are asking if E3 is available to do the Council briefing at 8:30, that's all set.

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Cc: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>

Subject: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

Please take a look. Birgit, can you confirm with E3 that this time works?

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Cc: Goodwin,Summer G (BPA) - DKS-7
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Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

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I'm adding Summer to the thread, because she's always well organized and may have the info if Eve sent it to her.
Birgit

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To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

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Ah, but I see you are asking about 10 PT for a media briefing. My memory is that they had a conflict, but I have too many emails to try to find it and will have to ask

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Sent: Tuesday, July 5, 2022 10:16 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary

E (BPA) - LN-7 <megodwin@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Cc: Scruggs, Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

Please take a look. Birgit, can you confirm with E3 that this time works?

From: Johnson,G Douglas (BPA) - DK-7
Sent: Tuesday, July 5, 2022 10:46 AM
To: Baskerville,Sonya L (BPA) - AIN-WASH; Koehler,Birgit G (BPA) - PG-5; Zelinsky,Benjamin D (BPA) - E-4; James,Eve A L (BPA) - PG-5; Godwin,Mary E (BPA) - LN-7; Leary,Jill C (BPA) - LN-7
Cc: Goodwin,Summer G (BPA) - DKS-7; Scruggs,Joel L (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

Yep. Looks like we are going to try to have an independent moderator queue up questions for E3 and not even be on the phone other than to listen.

From: Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Sent: Tuesday, July 5, 2022 10:36 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Subject: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

Just discussing this at the enterprise board. In the last sentence, we should say we would be facilitating E3's availability to answer questions about their report. Joel may have more commentary. Thanks.

Sonya Baskerville
BPA National Relations

(b)(6) m

On Jul 5, 2022 12:16 PM, "Johnson,G Douglas (BPA) - DK-7" <gdjohnson@bpa.gov> wrote:
Please take a look. Birgit, can you confirm with E3 that this time works?

From: Johnson,G Douglas (BPA) - DK-7
Sent: Tuesday, July 5, 2022 10:44 AM
To: Scruggs,Joel L (BPA) - DK-7; Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5; Godwin,Mary E (BPA) - LN-7; Leary,Jill C (BPA) - LN-7; Zelinsky,Benjamin D (BPA) - E-4; Baskerville,Sonya L (BPA) - AIN-WASH
Cc: Habibi,Maryam A (BPA) - DKP-7; Goodwin,Summer G (BPA) - DKS-7
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

It is awkward – but not unrelated. The only reason to breach is for fish, so

From: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>
Sent: Tuesday, July 5, 2022 10:26 AM
To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Cc: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

Is that somewhat awkward? It seems like a better fit for the Power committee. But I guess that's not possible this month.

Joel Scruggs (He/Him)
Director of Communications | Communications (DK)
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-5511 | C (b)(6)



From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Sent: Tuesday, July 5, 2022 10:20 AM
To: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Cc: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

Says Fish and Wildlife on the Council site. It says there is no Power session this month. [F&W Committee Meeting and Council Meeting | Northwest Power and Conservation Council \(nwcouncil.org\)](#)

From: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>
Sent: Tuesday, July 5, 2022 10:19 AM
To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>

Cc: Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

Good morning. There was a question during this morning's Enterprise Board meeting about which Council committee is being briefed. Can we confirm if it's the Fish or Power Committee?

Joel Scruggs (He/Him)

Director of Communications | Communications (DK)

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-5511 | C (b)(6)



From: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>

Sent: Tuesday, July 5, 2022 10:16 AM

To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>

Cc: Scruggs, Joel L (BPA) - DK-7 <jscruggs@bpa.gov>; Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>

Subject: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

Please take a look. Birgit, can you confirm with E3 that this time works?

From: Johnson,G Douglas (BPA) - DK-7
Sent: Tuesday, July 5, 2022 1:30 PM
To: Baskerville,Sonya L (BPA) - AIN-WASH; Koehler,Birgit G (BPA) - PG-5; Zelinsky,Benjamin D (BPA) - E-4; James,Eve A L (BPA) - PG-5; Godwin,Mary E (BPA) - LN-7; Leary,Jill C (BPA) - LN-7
Cc: Goodwin,Summer G (BPA) - DKS-7; Scruggs,Joel L (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7
Subject: RE: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

Got it. E3 will be available via phone in conference to answer questions about its report.

From: Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Sent: Tuesday, July 5, 2022 10:36 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Cc: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Subject: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability

Just discussing this at the enterprise board. In the last sentence, we should say we would be facilitating E3's availability to answer questions about their report. Joel may have more commentary. Thanks.

Sonya Baskerville
BPA National Relations
(b)(6) m

On Jul 5, 2022 12:16 PM, "Johnson,G Douglas (BPA) - DK-7" <gdjohnson@bpa.gov> wrote:
Please take a look. Birgit, can you confirm with E3 that this time works?

From: Leary, Jill C (BPA) - LN-7
Sent: Thursday, July 7, 2022 3:32 PM
To: Johnson, G Douglas (BPA) - DK-7; Koehler, Birgit G (BPA) - PG-5; Scruggs, Joel L (BPA) - DK-7; Habibi, Maryam A (BPA) - DKP-7; Baskerville, Sonya L (BPA) - AIN-WASH
Subject: RE: Thanks, can you give us a copy now.

Hi Doug,
Would you send this to Charisma at DOE? I shared her email earlier.

The White House would now like to run Communications on this delay and Charisma is leading that coordination.

Thanks,
Jill

From: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Thursday, July 7, 2022 3:11 PM
To: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs, Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: RE: Thanks, can you give us a copy now.

Dan Catchpole with Clearing Up just called me and asked if this line he intends to use in his story tomorrow is correct:

E3's presentation to the Council on analysis of potential replacement resources and costs for the lower Snake River dams is being rescheduled. We continue to coordinate with other federal agencies and officials on the broader release plan for the presentation and final study. The briefing has been rescheduled for Tuesday. **DOE and CEQ are involved in the discussions.**

From: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Thursday, July 7, 2022 1:10 PM
To: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs, Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: RE: Thanks, can you give us a copy now.

Correct

From: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Thursday, July 7, 2022 1:06 PM
To: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs, Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: FW: Thanks, can you give us a copy now.

The report will not be released before the presentation is delivered on Tuesday. I am assuming E3 is putting the final touches on the presentation and we are not prepared to release either at this time. Correct?

From: Hal Bernton <hbernton@seattletimes.com>
Sent: Thursday, July 7, 2022 1:03 PM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: [EXTERNAL] Thanks, can you give us a copy now.

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Thursday, July 7, 2022 12:06 PM
To: Hal Bernton <hbernton@seattletimes.com>
Subject: RE: Note from Hal

See the link. [COO 2022-07 Updated Council Meeting Spokane WA \(1\).pdf | Powered by Box](#)

From: Hal Bernton <hbernton@seattletimes.com>
Sent: Thursday, July 7, 2022 12:02 PM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Cc: Nick Turner <nturner@seattletimes.com>
Subject: [EXTERNAL] Note from Hal

What is up with the Snake River E3 report? Why is it taking so long to release. Are revisions being made, as I was under the impression it was complete?

I will be out of town for the next two weeks on assignment but would like you to send to my colleague Nick Turner if it is released.

Thanks for your help with this.

Hal

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

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From: Habibi, Maryam A (BPA) - DKP-7
Sent: Monday, July 11, 2022 12:46 PM
To: Baskerville, Sonya L (BPA) - AIN-WASH; Koehler, Birgit G (BPA) - PG-5; Johnson, G Douglas (BPA) - DK-7
Cc: Zelinsky, Benjamin D (BPA) - E-4; James, Eve A L (BPA) - PG-5; Godwin, Mary E (BPA) - LN-7; Scruggs, Joel L (BPA) - DK-7
Subject: RE: this week's E3 rollout. Media meeting? Congressional briefing?

I am. I'll call now.

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C (b)(6)

From: Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Sent: Monday, July 11, 2022 12:45 PM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson, G Douglas (BPA) - DK-7 <gjohnson@bpa.gov>; Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Cc: Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Scruggs, Joel L (BPA) - DK-7 <jscruggs@bpa.gov>
Subject: RE: this week's E3 rollout. Media meeting? Congressional briefing?

I think Doug may be out today? Who from comms is running point? I have some update intel for you. Call me on my cell. Thanks!

Sonya Baskerville
BPA National Relations
(b)(6) m

On Jul 11, 2022 3:41 PM, "Koehler, Birgit G (BPA) - PG-5" <bgkoehler@bpa.gov> wrote:
Joel Scruggs,
E3 is also asking what they should do about media inquiries. Can they talk on the record? Off the record to correct facts?

From: Koehler, Birgit G (BPA) - PG-5
Sent: Monday, July 11, 2022 12:12 PM
To: Johnson, G Douglas (BPA) - DK-7 <gjohnson@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Scruggs, Joel L (BPA) - DK-7 <jscruggs@bpa.gov>
Subject: this week's E3 rollout. Media meeting? Congressional briefing?

Doug/Maryam and Sonya,

Here are the meetings that I am tracking for this week. Are we rescheduling the media and congressional briefings from last week?

Tuesday, July 12, 3:30-5 Council presentation

Thurs, July 14 "Department and Agency E3 Meeting" (request via Jill, but I have zero info besides the title)

E3 is aware of both of these meetings. And I'm meeting with them in 20 minutes to confirm and answer any of their questions.

As of last Wednesday, this is Arne's availability, PDT. His lead on this project, Aaron, is just coming back from leave and could cover if we need something when Arne isn't available. Don't know his schedule though.

Tuesday, 7/12

8-11 AM

1-5 PM

Wednesday, 7/13

Anytime

Thursday, 7/14

After 10 AM

Friday, 7/15

8-10 AM

From: Scruggs,Joel L (BPA) - DK-7
Sent: Monday, July 11, 2022 12:48 PM
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Subject: RE: this week's E3 rollout. Media meeting? Congressional briefing?

As far as I know, we haven't received any additional guidance from back east. To ensure greater accuracy of initial reporting, E3 should make themselves available to for any news media inquiries or follow-up questions. Ultimately, E3 is an independent industry research firm. They should be able to explain and defend their analysis. Their findings are essentially made public when Arne briefs the Council tomorrow.

Joel Scruggs (He/Him)
Director of Communications | Communications (DK)
BONNEVILLE POWER ADMINISTRATION
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Cc: Scruggs,Joel L (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7; Goodwin,Summer G (BPA) - DKS-7
Subject: REVIEW REQUESTED: Media Advisory E3 Council briefing/media availability
Attachments: MEDIA ADVISORY - E3 Council presentation and media availability v2 Comms.docx

Please take a look. Birgit, can you confirm with E3 that this time works?

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Sent: Tuesday, July 5, 2022 10:36 AM
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Cc: Goodwin,Summer G (BPA) - DKS-7; Scruggs,Joel L (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7
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Sonya Baskerville
BPA National Relations
(b)(6) m

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BPA NEWS

PR XX -22

BONNEVILLE POWER ADMINISTRATION
FOR IMMEDIATE RELEASE: Wednesday, July 6, 2022
CONTACT: Doug Johnson, 503-713-7658
or 503-230-5131

E3 briefing: lower Snake River dams power replacement study

Portland, Oregon – On **Thursday, July 7 at 8:30 a.m. PT**, representatives from electric industry research firm Energy and Environmental Economics will brief the Northwest Power and Conservation Council’s Fish and Wildlife Committee on their new independent analysis of replacement resources and costs associated with the lower Snake River dams. . Details are available at this [link](#).

Earlier this year, BPA engaged E3 to revisit the analysis performed in the [Columbia River System Operations Environmental Impact Statement](#), issued by BPA, the U.S. Army Corps of Engineers and Bureau of Reclamation in 2020 after nearly four years of intense research and collaboration. The CRSO EIS addressed several scenarios, including specific analysis regarding resource alternatives and costs associated with breaching four lower Snake River dams may be breached in the future.

The CRSO EIS analysis examined a series of resource replacement portfolios using the Council’s latest resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. E3 will include a resource portfolio optimizer model using their data sets and their criteria and objectives to create least cost replacement portfolios.

The analysis provides BPA with an independent study of lower Snake River dam breaching and potential replacement resources from a realistic analytic, operational, and resource characteristic perspective, so that BPA can enhance its understanding of the complexity and expense involved in replacing those assets.

Shortly after the briefing, BPA will hold a call-in media availability allowing reporters to ask questions about the analysis.

Call-in details:

Time: 10 a.m., PT

Phone: XXX-XXX-XXXX, Passcode: XXX-XXX-XXXX



About BPA

The Bonneville Power Administration, headquartered in Portland, Oregon, is a nonprofit federal power marketer that sells wholesale, carbon-free hydropower from 31 federal dams in the Columbia River Basin. It also markets the output of the region's only nuclear plant. BPA delivers this power to more than 140 Northwest electric utilities, serving millions of consumers and businesses in Washington, Oregon, Idaho, western Montana and parts of California, Nevada, Utah and Wyoming. BPA also owns and operates more than 15,000 circuit miles of high-voltage power lines and 261 substations, and provides transmission service to more than 300 customers. In all, BPA provides nearly a third of the power generated in the Northwest. To mitigate the impacts of the federal dams, BPA implements a fish and wildlife program that includes working with its partners to make the federal dams safer for fish passage. It also pursues cost-effective energy savings and operational solutions that help maintain safe, affordable, reliable electric power for the Northwest. www.bpa.gov

###

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Monday, August 1, 2022 2:31 PM
To: James,Eve A L (BPA) - PG-5
Cc: Egerdahl,Ryan J (BPA) - PGPR-5; Koehler,Birgit G (BPA) - PG-5
Subject: [EXTERNAL] FW: Follow-Up Questions on LSRD Power Replacement Study
Attachments: Questions about LSRD removal study Assumptions.docx

Hi Eve,

I should have cc-ed your team on this. I wanted to let you know that we finally pulled together our questions for E3. Thank you again for letting us reach out. You can see the questions attached. Pretty weedy. Let me know if you have any questions too, and I am happy to loop you in on any follow-up as you prefer.

Thanks,
Jennifer

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Monday, August 1, 2022 2:28 PM
To: Arne Olsen (arne@ethree.com) <arne@ethree.com>; aaron.burdick@ethree.com
Cc: John Ollis <JOllis@NWCouncil.org>
Subject: Follow-Up Questions on LSRD Power Replacement Study

Hello Arne and Aaron,

Thank you for presenting your study at the July Council meeting. I think it was a great discussion. The fact that the Council members were able to ask so many good questions is a testament to the good presentation.

I am reaching out with a few follow up questions (see attached). My team had some questions about the analysis and assumptions that we were not able to fully answer through reading the report or listening to the presentation. As you can see, these get more into the weeds, as you might expect from the staff/analytical level. Our goal is to just make sure we understand the analysis, as we have been getting some questions from our members. I reached out to Bonneville to confirm that they were okay with us following up, and they asked that we just contact you directly. Hopefully you can take some time to respond.

Thank you in advance for your time, and please let me know if a call might be easier to talk through any of these.

Jennifer Light (she/her)
Interim Director of Power Planning
Office: 503-222-5161 | Direct: (b)(6)
www.nwcouncil.org | [LinkedIn](#)



From: Chad Madron <CMadron@NWCouncil.org>
Sent: Wednesday, July 6, 2022 2:32 PM
To: Koehler,Birgit G (BPA) - PG-5
Subject: [EXTERNAL] FW: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Birgit,

I haven't heard at all from Arne. Are you all still in edit mode on slides and such?

From: Chad Madron
Sent: Wednesday, July 6, 2022 10:10 AM
To: Ryan J (BPA) - PGPR-5 Egerdahl - BPA (rjegerdahl@bpa.gov) <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; bgkoehler@bpa.gov
Cc: Jennifer Light - Northwest Power and Conservation Council (JLight@NWCouncil.org) <JLight@NWCouncil.org>; Kendra Coles (kcoles@nwcouncil.org) <kcoles@nwcouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Good morning Arne and BPA folks,

Just a reminder that it is our preference for you to send slides shown tomorrow morning to me ahead of time - then I use our computer to present them, but give you "keyboard and mouse control" so you can advance them using your equipment. This makes it so you don't have to worry about presenting from your machine. If you are very comfortable presenting from your computer directly we can accommodate that, we just find we have more consistent results if we do it the other way as different folks have differing levels of comfort with different webinar technologies.

Thanks!

Chad

(b)(6)

From: Chad Madron
Sent: Monday, June 27, 2022 10:48 AM
To: Ryan J (BPA) - PGPR-5 Egerdahl - BPA (rjegerdahl@bpa.gov) <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Jennifer Light - Northwest Power and Conservation Council (JLight@NWCouncil.org) <JLight@NWCouncil.org>; Kendra Coles (kcoles@nwcouncil.org) <kcoles@nwcouncil.org>
Subject: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Ryan, Eve, and Arne,

I am working with Jenn on pulling together a memo and any other background material we can for Members ahead of the July 7 presentation on BPA's Snake River Dams study that is at 8:30am Pacific.

Can you confirm who from BPA and E3 will officially be presenting/speaking? Arne, I know you are giving the main presentation. Is there a report exec summary or any slides we could include with the memo to help them prepare? We will be sending them the prep memo THIS Wed by the middle of the day. Any info you can help us provide to help them be prepared is appreciated.

For July 7 – I will make sure you three all have calendar invites and panelist email/invites for the webinar.

Arne – speakers generally appear on camera, but it is not required. Our preference is for you to send me your slides and then I use our computer to present them, but give you “keyboard and mouse control” so you can advance them using your equipment. This makes it so you don’t have to worry about presenting from your machine. If you are very comfortable presenting from your screen directly we can accommodate that, we just find we have more consistent results if we do it the other way as different folks have differing levels of comfort with different webinar technologies.

You should all get the GoToWebinar emails today! Those will have your UNIQUE entry links for the webinar. You will get the emails again 1 day and 1 hour before the meeting as reminders.

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Wednesday, July 13, 2022 9:36 AM
To: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5
Cc: Egerdahl,Ryan J (BPA) - PGPR-5
Subject: [EXTERNAL] RE: [EXTERNAL] Opportunity to Follow Up with E3

Thanks Eve,

I can reach out directly by email. Just wanted to run it past you first. Thank you!

Jennifer

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, July 13, 2022 9:24 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Jennifer Light <JLight@NWCouncil.org>
Cc: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: [EXTERNAL] Opportunity to Follow Up with E3

Hi Jennifer--

Their contact info is on the last slide prior to the Appendix if you want to reach out. I can also set up a meeting time if you think a discussion would be better.

Thanks,
Eve

On Jul 13, 2022 7:29 AM, Jennifer Light <JLight@NWCouncil.org> wrote:
Good Morning Birgit,

I thought yesterday's presentation went well. The Council members asked a lot of fantastic questions, and there was really good discussion considering the prep time. Credit to E3 for providing enough information in the presentation to help spur discussion.

I am starting with you, but please point me elsewhere if needed. After digging into the report, we have a few more questions. Some of which were asked, but we didn't fully understand the answers yesterday. Is it possible for me to reach out to E3 to get a bit more information to help understand the study?

Thanks!

Jennifer Light (she/her)
Interim Director of Power Planning
Office: 503-222-5161 | Direct: (b)(6)
www.nwcouncil.org | [LinkedIn](#)



1. Can you please provide more clarity on how you treated energy efficiency in this study? Our understanding is that you removed the expected energy efficiency from the load forecast. For the energy efficiency you subtracted from loads, did you only look at the energy efficiency that was cost-effective in the 2021 Plan? (pg 45). Or did you remove all of the energy efficiency in the Council (or other) supply curve? If the former, did you allow the model to consider energy efficiency that was not cost-effective under the 2021 Plan but was otherwise available in your supply curve?
2. Similar question for demand response. It appears from pg 45 that you looked at the demand response that was considered cost-effective in the plan, which I am assuming is the ~720 MW we identified in the resource program. What additional DR did you consider in the study?
3. Are the hourly load shapes used for the High Electrification case the same as in the baseline? Or do they change due to different sectoral usage patterns? (p. 17)
4. Is three years of sampling historical data enough to extrapolate hydro ramps? How is the 5% day to day shift of non-LSRD hydro energy shifting calculated? Does the PNUCC estimate of hydro capacity being 65% of nameplate apply to every dam individually or the NW system as a whole? Is there any assumed change in peaking capability of the non-LSRD hydropower after removal? From what years is the historical hydro dispatch data for the rest of the northwest fleet based? In general, do these shaping numbers change as the system and portfolio changes? (page 22-26)
5. When considering the ELCC of each resource type, the previous 2019 RA study seemed to use a larger NW footprint and portfolio when calculating ELCC. Since ELCC is generally sensitive to the portfolio makeup in which it is tested and unless we are mistaken this study seems to leverage the results from the previous study, how much do you suspect the different ELCC of new resources might be with the revised footprint for the NW used in this study? Did the removal of the LSR dams capability influence the ELCC calculations? Are there any intra-regional transmission limitations in the ELCC analysis? Is the ELCC analysis using historical hydro conditions from 1929 to 2008? Or a more limited set of hydro conditions? If reliability challenges shift to the summer ELCC of other resources might change other than storage, were any of these potential changes considered? (p. 24)
6. What is the data source or methodology to extract the deemed market emissions rate of 0.43 tons/MWh? (pg 30)
7. Can you provide some information as to why you used 2001 sustained peaking as a sample year (pg 33)? We understand that 2001 is a low hydro year, especially in the summer, but are wondering how this connects with the 15% planning reserve margin?
8. Can you provide more information why the model picked more wind in the no combustion case? We were seeing a different picture in our modeling of the amount of solar vs wind to replace peak needs, and are trying to understand your model better from that perspective.
9. Our understanding is that for outside the region you used policy targets and a planning reserve margin to develop the build trajectory. In this analysis, what kind of out of region natural gas additions do you assume (where? How much?).
10. In your high electrification scenario, did the potential of EE and DR increase from the baseline potential?
11. What is the underlying source or thought behind the Load following up and down assumptions of 3% of hourly load? Does that change with renewable buildout size? (P.55)

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Saturday, August 13, 2022 2:16 PM
To: Aaron Burdick
Cc: John Ollis; Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5; Arne Olson
Subject: [EXTERNAL] RE: Follow-Up Questions on LSRD Power Replacement Study

Hi Aaron,

Thank you for these detailed responses. We appreciate it. Definitely clarified some places for us. I will connect with John Ollis to see if anything else comes up, but these are very helpful.

Thanks again.
Jennifer

From: Aaron Burdick <aaron.burdick@ethree.com>
Sent: Friday, August 12, 2022 5:35 PM
To: Jennifer Light <JLight@NWCouncil.org>
Cc: John Ollis <JOllis@NWCouncil.org>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Arne Olson <arne@ethree.com>
Subject: RE: Follow-Up Questions on LSRD Power Replacement Study

Hi Jennifer,

Sharing written responses to your questions. Let me know if you have any further questions.

Enjoy the weekend!

Aaron

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Thursday, August 4, 2022 5:30 PM
To: Aaron Burdick <aaron.burdick@ethree.com>
Cc: John Ollis <JOllis@NWCouncil.org>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Arne Olson <arne@ethree.com>
Subject: RE: Follow-Up Questions on LSRD Power Replacement Study

Thank you Aaron! I appreciate your willingness to help us better understand your work.

Please reach out if talking is easier or anything else we can help with.

Thanks,
Jennifer

From: Aaron Burdick <aaron.burdick@ethree.com>
Sent: Thursday, August 4, 2022 2:05 PM
To: Jennifer Light <JLight@NWCouncil.org>
Cc: John Ollis <JOllis@NWCouncil.org>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5

<eajames@bpa.gov>; Arne Olson <arne@ethree.com>

Subject: RE: Follow-Up Questions on LSRD Power Replacement Study

Hi Jennifer,

Wanted to confirm we received your questions and will work to provide a response to them by next week.

All the best,

Aaron

From: Jennifer Light <JLight@NWCouncil.org>

Sent: Monday, August 1, 2022 2:28 PM

To: Arne Olson <arne@ethree.com>; Aaron Burdick <aaron.burdick@ethree.com>

Cc: John Ollis <JOllis@NWCouncil.org>

Subject: Follow-Up Questions on LSRD Power Replacement Study

Hello Arne and Aaron,

Thank you for presenting your study at the July Council meeting. I think it was a great discussion. The fact that the Council members were able to ask so many good questions is a testament to the good presentation.

I am reaching out with a few follow up questions (see attached). My team had some questions about the analysis and assumptions that we were not able to fully answer through reading the report or listening to the presentation. As you can see, these get more into the weeds, as you might expect from the staff/analytical level. Our goal is to just make sure we understand the analysis, as we have been getting some questions from our members. I reached out to Bonneville to confirm that they were okay with us following up, and they asked that we just contact you directly. Hopefully you can take some time to respond.

Thank you in advance for your time, and please let me know if a call might be easier to talk through any of these.

Jennifer Light (she/her)

Interim Director of Power Planning

Office: 503-222-5161 | Direct: (b)(6)

www.nwcouncil.org | [LinkedIn](#)



From: Chad Madron <CMadron@NWCouncil.org>
Sent: Wednesday, July 6, 2022 6:41 PM
To: Koehler,Birgit G (BPA) - PG-5; Jennifer Light; Kendra Coles
Cc: James,Eve A L (BPA) - PG-5; John Shurts
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Would E3 be available Tue afternoon in particular? If we adjust agenda that is likely where they will land.

We are working on notice and such now. If we can confirm their availability for next week tonight or early tomorrow that'd be especially helpful!

Sent via the Samsung Galaxy S21 Ultra 5G, an AT&T 5G smartphone

----- Original message -----

From: "Koehler,Birgit G (BPA) - PG-5" <bgkoehler@bpa.gov>
Date: 7/6/22 6:27 PM (GMT-08:00)
To: Jennifer Light <JLight@NWCouncil.org>, Chad Madron <CMadron@NWCouncil.org>
Cc: "James,Eve A L (BPA) - PG-5" <ejames@bpa.gov>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hello again,

I'm afraid I just received confirmation that the presentation is indeed being delayed a week. Guy Normal has been informed, and I think Mike Edmonds too, or at least he knows that this was likely.

I'm checking with E3 on their availability for next week in hopes that we have the go-ahead to proceed—and that it works from your end too.

Again, sorry for the last minute change in plans.

Birgit

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Wednesday, July 6, 2022 5:11 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Chad Madron <CMadron@NWCouncil.org>
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.
Thanks for the note Birgit. We will stay tuned. We are discussing options for next week to try to make it work if needed.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, July 6, 2022 4:46 PM
To: Jennifer Light <JLight@NWCouncil.org>; Chad Madron <CMadron@NWCouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Jennifer and Chad,

I have some news for you, not the presentation you have been waiting for.

The E3 presentation to the Council tomorrow will **likely** be canceled. The current plan is to delay one week, potentially to the full Council meeting, but this still needs to be confirmed and coordinated. The Council Chair has already been contacted and is aware.

Should it turn out that we are delaying the presentation, is there availability on the agenda for July 12 or 13th? I'll also need to check with Arne Olson at E3 if he is available. For now, I've just given him the same alert that we are likely but not yet confirmed about delaying.

Sorry about all the swirl,

Birgit

From: Jennifer Light <JLight@NWCouncil.org>

Sent: Wednesday, July 6, 2022 3:27 PM

To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Chad Madron <CMadron@NWCouncil.org>

Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed. Fantastic. Thanks for confirming.

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Sent: Wednesday, July 6, 2022 3:27 PM

To: Jennifer Light <JLight@NWCouncil.org>; Chad Madron <CMadron@NWCouncil.org>

Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hello Jennifer,

Yes, that's the current plan. There is still some coordination on our side, but unless you hear from me, please introduce Arne and pass it off to him. We engaged them to do an independent study, and so are happy to let them present independently.

Cheers,

Birgit

From: Jennifer Light <JLight@NWCouncil.org>

Sent: Wednesday, July 6, 2022 3:24 PM

To: Chad Madron <CMadron@NWCouncil.org>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Birgit,

One more quick question. I just want to confirm the plan for the morning. My understanding is that it is Bonneville's preference that I just introduce Arne for the topic and him just diving right in, rather than first handing it off to someone at Bonneville to introduce him. I just want to make sure that I pass it to the right person.

Thanks!

Jennifer

From: Chad Madron <CMadron@NWCouncil.org>

Sent: Wednesday, July 6, 2022 2:39 PM

To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Cc: Jennifer Light <JLight@NWCouncil.org>

Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Cool, no worries! I just hadn't heard from him at all so I was worried he was perhaps not seeing my traffic. I appreciate you confirming. Even slides by 8am is ok if that is what needs to happen!

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Sent: Wednesday, July 6, 2022 2:34 PM

To: Chad Madron <CMadron@NWCouncil.org>

Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Chad,

Sorry for the delay. Yes, the slides are still being reviewed. I will do my utmost to make sure you get them in plenty of time for the meeting.

Birgit

From: Chad Madron <CMadron@NWCouncil.org>

Sent: Wednesday, July 6, 2022 2:32 PM

To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Subject: [EXTERNAL] FW: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Birgit,

I haven't heard at all from Arne. Are you all still in edit mode on slides and such?

From: Chad Madron

Sent: Wednesday, July 6, 2022 10:10 AM

To: Ryan J (BPA) - PGPR-5 Egerdahl - BPA (rjegerdahl@bpa.gov) <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; bgkoehler@bpa.gov

Cc: Jennifer Light - Northwest Power and Conservation Council (JLight@NWCouncil.org) <JLight@NWCouncil.org>; Kendra Coles (kcoles@nwcouncil.org) <kcoles@nwcouncil.org>

Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Good morning Arne and BPA folks,

Just a reminder that it is our preference for you to send slides shown tomorrow morning to me ahead of time - then I use our computer to present them, but give you "keyboard and mouse control" so you can advance them using your equipment. This makes it so you don't have to worry about presenting from your machine. If you are very comfortable presenting from your computer directly we can accommodate that, we just find we have more consistent results if we do it the other way as different folks have differing levels of comfort with different webinar technologies.

Thanks!

Chad

(b)(6)

From: Chad Madron

Sent: Monday, June 27, 2022 10:48 AM

To: Ryan J (BPA) - PGPR-5 Egerdahl - BPA (rjegerdahl@bpa.gov) <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

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Subject: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Ryan, Eve, and Arne,

I am working with Jenn on pulling together a memo and any other background material we can for Members ahead of the July 7 presentation on BPA's Snake River Dams study that is at 8:30am Pacific.

Can you confirm who from BPA and E3 will officially be presenting/speaking? Arne, I know you are giving the main presentation. Is there a report exec summary or any slides we could include with the memo to help them prepare? We will be sending them the prep memo THIS Wed by the middle of the day. Any info you can help us provide to help them be prepared is appreciated.

For July 7 – I will make sure you three all have calendar invites and panelist email/invites for the webinar.

Arne – speakers generally appear on camera, but it is not required. Our preference is for you to send me your slides and then I use our computer to present them, but give you "keyboard and mouse control" so you can advance them using your equipment. This makes it so you don't have to worry about presenting from your machine. If you are very comfortable presenting from your screen directly we can accommodate that, we just find we have more consistent results if we do it the other way as different folks have differing levels of comfort with different webinar technologies.

You should all get the GoToWebinar emails today! Those will have your UNIQUE entry links for the webinar. You will get the emails again 1 day and 1 hour before the meeting as reminders.

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Wednesday, July 6, 2022 4:55 PM
To: Koehler,Birgit G (BPA) - PG-5; Jennifer Light
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Ok! Standing by. We will discuss what could be possible next week

----- Original message -----

From: "Koehler,Birgit G (BPA) - PG-5" <bgkoehler@bpa.gov>
Date: 7/6/22 4:46 PM (GMT-08:00)
To: Jennifer Light <JLight@NWCouncil.org>, Chad Madron <CMadron@NWCouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Jennifer and Chad,

I have some news for you, not the presentation you have been waiting for.

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Should it turn out that we are delaying the presentation, is there availability on the agenda for July 12 or 13th? I'll also need to check with Arne Olson at E3 if he is available. For now, I've just given him the same alert that we are likely but not yet confirmed about delaying.

Sorry about all the swirl,

Birgit

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Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.
Fantastic. Thanks for confirming.

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Cc: Jennifer Light - Northwest Power and Conservation Council (JLight@NWCouncil.org) <JLight@NWCouncil.org>;

Kendra Coles (kcoles@nwcouncil.org) <kcoles@nwcouncil.org>

Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Good morning Arne and BPA folks,

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(b)(6)

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Cc: Jennifer Light - Northwest Power and Conservation Council (JLight@NWCouncil.org) <JLight@NWCouncil.org>;

Kendra Coles (kcoles@nwcouncil.org) <kcoles@nwcouncil.org>

Subject: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Ryan, Eve, and Arne,

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From: Chad Madron <CMadron@NWCouncil.org>
Sent: Tuesday, July 12, 2022 11:14 AM
To: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5; Kendra Coles; Jennifer Light; Arne Olsen (arne@ethree.com); aaron.burdick@ethree.com
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Correct, all times are Pacific since we are in Spokane.

From: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Sent: Tuesday, July 12, 2022 11:11 AM
To: Chad Madron <CMadron@NWCouncil.org>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Kendra Coles <kcoles@nwcouncil.org>; Jennifer Light <JLight@NWCouncil.org>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; aaron.burdick@ethree.com
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Thanks Chad- just to confirm that is 3:15 PDT and not Mountain time?

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Tuesday, July 12, 2022 10:50 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Kendra Coles <kcoles@nwcouncil.org>; Jennifer Light <JLight@NWCouncil.org>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; aaron.burdick@ethree.com
Cc: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

For this afternoon:

I will have the ppt loaded on a computer I have with me – then I will give one of you “keyboard and mouse control” to advance the slides. We can practice this at 3:15 at the break if you like. We find this works well rather than having to make you be the presenter or having to do the dreaded “next slide” thing... Please let me know who should have control (it can be shared as well).

More tips for webinar presenters are here:

<https://www.nwcouncil.org/presentation-guidelines>

Agenda: <https://www.nwcouncil.org/meeting/council-meeting-july-12-2022>

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 12, 2022 9:57 AM
To: Kendra Coles <kcoles@nwcouncil.org>; Chad Madron <CMadron@NWCouncil.org>; Jennifer Light <JLight@NWCouncil.org>
Cc: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; John Shurts <jshurts@nwcouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Thank you Kendra and team!

From: Kendra Coles <kcoles@nwcouncil.org>
Sent: Tuesday, July 12, 2022 9:56 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Chad Madron <CMadron@NWCouncil.org>; Jennifer Light <JLight@NWCouncil.org>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; John Shurts <jshurts@nwcouncil.org>
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Birgit,

The following are panelists: Arne, Aaron, Eve and yourself. You will be receiving an email from Meeting Organizer with your **unique login**. Please let us know if you do not receive this email.

Thanks,
Kendra

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 12, 2022 6:18 AM
To: Chad Madron <CMadron@NWCouncil.org>; Jennifer Light <JLight@NWCouncil.org>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Kendra Coles <kcoles@nwcouncil.org>; John Shurts <jshurts@nwcouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Good morning Chad and Jennifer,

Here at last is the long-awaited link to the page with the E3 study

- <https://www.bpa.gov/energy-and-services/power/hydropower-impact>

Would you make all of us panelists for the presentation today please?

Arne Olson arne@ethree.com

Aaron Burdick aaron.burdick@ethree.com

James,Eve A L (BPA) - PG-5 eajames@bpa.gov

Koehler,Birgit G (BPA) - PG-5 bgkoehler@bpa.gov

We expect Arne and Aaron to do 99% of the talking, but Eve and I would answer a question if it were directed at BPA.

Thanks for coordinating all of this 😊

Birgit

From: Chad Madron
Sent: Monday, June 27, 2022 10:48 AM
To: Ryan J (BPA) - PGPR-5 Egerdahl - BPA (rjegerdahl@bpa.gov) <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Jennifer Light - Northwest Power and Conservation Council (JLight@NWCouncil.org) <JLight@NWCouncil.org>;

Kendra Coles (kcoles@nwcouncil.org) <kcoles@nwcouncil.org>

Subject: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Ryan, Eve, and Arne,

I am working with Jenn on pulling together a memo and any other background material we can for Members ahead of the July 7 presentation on BPA's Snake River Dams study that is at 8:30am Pacific.

Can you confirm who from BPA and E3 will officially be presenting/speaking? Arne, I know you are giving the main presentation. Is there a report exec summary or any slides we could include with the memo to help them prepare? We will be sending them the prep memo THIS Wed by the middle of the day. Any info you can help us provide to help them be prepared is appreciated.

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From: Jennifer Light <JLight@NWCouncil.org>
Sent: Tuesday, July 12, 2022 11:13 AM
To: James,Eve A L (BPA) - PG-5; Chad Madron; Koehler,Birgit G (BPA) - PG-5; Kendra Coles; Arne Olsen (arne@ethree.com); aaron.burdick@ethree.com
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

3:15 Pacific Time

From: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Sent: Tuesday, July 12, 2022 11:11 AM
To: Chad Madron <CMadron@NWCouncil.org>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Kendra Coles <kcoles@nwcouncil.org>; Jennifer Light <JLight@NWCouncil.org>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; aaron.burdick@ethree.com
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Thanks Chad- just to confirm that is 3:15 PDT and not Mountain time?

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Tuesday, July 12, 2022 10:50 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Kendra Coles <kcoles@nwcouncil.org>; Jennifer Light <JLight@NWCouncil.org>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; aaron.burdick@ethree.com
Cc: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

For this afternoon:

I will have the ppt loaded on a computer I have with me – then I will give one of you “keyboard and mouse control” to advance the slides. We can practice this at 3:15 at the break if you like. We find this works well rather than having to make you be the presenter or having to do the dreaded “next slide” thing... Please let me know who should have control (it can be shared as well).

More tips for webinar presenters are here:

<https://www.nwcouncil.org/presentation-guidelines>

Agenda: <https://www.nwcouncil.org/meeting/council-meeting-july-12-2022>

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 12, 2022 9:57 AM
To: Kendra Coles <kcoles@nwcouncil.org>; Chad Madron <CMadron@NWCouncil.org>; Jennifer Light <JLight@NWCouncil.org>
Cc: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; John Shurts <jshurts@nwcouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Thank you Kendra and team!

From: Kendra Coles <kcoles@nwcouncil.org>
Sent: Tuesday, July 12, 2022 9:56 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Chad Madron <CMadron@NWCouncil.org>; Jennifer Light <JLight@NWCouncil.org>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; John Shurts <jshurts@nwcouncil.org>
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Birgit,

The following are panelists: Arne, Aaron, Eve and yourself. You will be receiving an email from Meeting Organizer with your **unique login**. Please let us know if you do not receive this email.

Thanks,
Kendra

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- <https://www.bpa.gov/energy-and-services/power/hydropower-impact>

Would you make all of us panelists for the presentation today please?

Arne Olson arne@ethree.com

Aaron Burdick aaron.burdick@ethree.com

James,Eve A L (BPA) - PG-5 eajames@bpa.gov

Koehler,Birgit G (BPA) - PG-5 bgkoehler@bpa.gov

We expect Arne and Aaron to do 99% of the talking, but Eve and I would answer a question if it were directed at BPA.

Thanks for coordinating all of this 😊

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Sent: Monday, June 27, 2022 10:48 AM
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Hi Ryan, Eve, and Arne,

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From: Chad Madron <CMadron@NWCouncil.org>
Sent: Tuesday, July 12, 2022 2:01 PM
To: Aaron Burdick; James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5; Kendra Coles; Jennifer Light; Arne Olson
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

OK Aaron, we are on it!

From: Aaron Burdick <aaron.burdick@ethree.com>
Sent: Tuesday, July 12, 2022 1:54 PM
To: Chad Madron <CMadron@NWCouncil.org>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Kendra Coles <kcoles@nwcouncil.org>; Jennifer Light <JLight@NWCouncil.org>; Arne Olson <arne@ethree.com>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.
Importance: High

Apologies, we found a graph error in slide 14 and am therefore sending an updated version of E3's slides.

Aaron

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Tuesday, July 12, 2022 11:14 AM
To: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Kendra Coles <kcoles@nwcouncil.org>; Jennifer Light <JLight@NWCouncil.org>; Arne Olson <arne@ethree.com>; Aaron Burdick <aaron.burdick@ethree.com>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Correct, all times are Pacific since we are in Spokane.

From: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Sent: Tuesday, July 12, 2022 11:11 AM
To: Chad Madron <CMadron@NWCouncil.org>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Kendra Coles <kcoles@nwcouncil.org>; Jennifer Light <JLight@NWCouncil.org>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; aaron.burdick@ethree.com
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Aaron Burdick aaron.burdick@ethree.com

James,Eve A L (BPA) - PG-5 eajames@bpa.gov

Koehler,Birgit G (BPA) - PG-5 bgkoehler@bpa.gov

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Thanks for coordinating all of this 😊

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Sent: Monday, June 27, 2022 10:48 AM

To: Ryan J (BPA) - PGPR-5 Egerdahl - BPA (rjegerdahl@bpa.gov) <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Cc: Jennifer Light - Northwest Power and Conservation Council (JLight@NWCouncil.org) <JLight@NWCouncil.org>; Kendra Coles (kcoles@nwcouncil.org) <kcoles@nwcouncil.org>

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From: Jennifer Light <JLight@NWCouncil.org>
Sent: Monday, July 11, 2022 3:26 PM
To: Koehler,Birgit G (BPA) - PG-5
Cc: Chad Madron; James,Eve A L (BPA) - PG-5; Kendra Coles; John Shurts
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Thank you Birgit. We appreciate the confirmation and look forward to it.

Jennifer

On Jul 11, 2022 3:22 PM, "Koehler,Birgit G (BPA) - PG-5" <bgkoehler@bpa.gov> wrote:
Hello Chad and Jennifer,

We are ready to post the E3 analysis tomorrow morning at 6 am. I will send you a link to the E3 analysis as soon as we have it ready.

Our administrator, John Hairston, will call Council leadership to inform them that we are releasing it.
Birgit

From: Koehler,Birgit G (BPA) - PG-5
Sent: Thursday, July 7, 2022 9:41 AM
To: Chad Madron <CMadron@NWCouncil.org>; Jennifer Light <JLight@NWCouncil.org>; Kendra Coles <kcoles@nwcouncil.org>
Cc: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; John Shurts <jshurts@nwcouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.
Great. Thanks.

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Thursday, July 7, 2022 9:39 AM
To: Jennifer Light <JLight@NWCouncil.org>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Kendra Coles <kcoles@nwcouncil.org>
Cc: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; John Shurts <jshurts@nwcouncil.org>
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.
This has been updated online
<https://www.nwcouncil.org/meeting/council-meeting-july-12-2022/>
Arne will receive a new panelist email soon – as I'm assuming he is presenting via webinar.

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Thursday, July 7, 2022 9:33 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Chad Madron <CMadron@NWCouncil.org>; Kendra Coles <kcoles@nwcouncil.org>
Cc: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; John Shurts <jshurts@nwcouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.
Thanks for confirming.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, July 7, 2022 9:11 AM
To: Jennifer Light <JLight@NWCouncil.org>; Chad Madron <CMadron@NWCouncil.org>; Kendra Coles <kcoles@nwcouncil.org>
Cc: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; John Shurts <jshurts@nwcouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Good morning Jennifer,

Arne told me that he is available from 1-5 that day (and 8-11 am). If 3:30-5 is the only good time that works from your end, then that's what we should do.

Thanks again and thanks again and again for the scramble.

Cheers,

Birgit

From: Jennifer Light <JLight@NWCouncil.org>

Sent: Thursday, July 7, 2022 8:44 AM

To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Chad Madron <CMadron@NWCouncil.org>; Kendra Coles <kcoles@nwcouncil.org>

Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; John Shurts <jshurts@nwcouncil.org>

Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Birgit,

It looks like we can move a couple things around to accommodate the E3 presentation at 3:30-5:00. I realize that is late in the day, but that is the only time we could work. Does this work for Arne? We want to confirm before updating our online agenda.

Thanks

Jennifer

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Sent: Wednesday, July 6, 2022 7:25 PM

To: Chad Madron <CMadron@NWCouncil.org>; Jennifer Light <JLight@NWCouncil.org>; Kendra Coles <kcoles@nwcouncil.org>

Cc: Division Directors <DivisionDirectors@NWCouncil.org>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; John Shurts <jshurts@nwcouncil.org>

Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Thanks Chad. Speedy work.

I'm calling it a day. (It's been a long one!)

We can connect again tomorrow.

Have a good evening.

Cheers,

Birgit

From: Chad Madron <CMadron@NWCouncil.org>

Sent: Wednesday, July 6, 2022 7:04 PM

To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Jennifer Light <JLight@NWCouncil.org>; Kendra Coles <kcoles@nwcouncil.org>

Cc: Division Directors <DivisionDirectors@NWCouncil.org>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; John Shurts <jshurts@nwcouncil.org>

Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Birgit, we have updated our website.

<https://www.nwcouncil.org/meeting/fw-and-council-meeting-july-6-2022/>

For now it says this item is tentatively scheduled for July 12 – however John Hairston had indicated to Guy in conversation that he expected that date to be acceptable. Please let us know as soon as you can that we can remove the word tentative!

We will work to adjust the schedule that is posted there now tomorrow morning to work Arne in sometime after 1:30pm. My assumption is he would present via webinar, but if he is available to come to Spokane that would be great!

Chad

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Sent: Wednesday, July 6, 2022 6:50 PM

To: Chad Madron <CMadron@NWCouncil.org>; Jennifer Light <JLight@NWCouncil.org>; Kendra Coles <kcoles@nwcouncil.org>

Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; John Shurts <jshurts@nwcouncil.org>

Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hello Chad,

As luck would have it, I already received a reply from E3. Arne is available Tuesday afternoon.

For your awareness, we cannot fully guarantee on our end that we will have the go-ahead for next week, but I sure do hope so!

Birgit

From: Chad Madron <CMadron@NWCouncil.org>

Sent: Wednesday, July 6, 2022 6:41 PM

To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Jennifer Light <JLight@NWCouncil.org>; Kendra Coles <kcoles@nwcouncil.org>

Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; John Shurts <jshurts@nwcouncil.org>

Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Would E3 be available Tue afternoon in particular? If we adjust agenda that is likely where they will land.

We are working on notice and such now. If we can confirm their availability for next week tonight or early tomorrow that'd be especially helpful!

Sent via the Samsung Galaxy S21 Ultra 5G, an AT&T 5G smartphone

----- Original message -----

From: "Koehler,Birgit G (BPA) - PG-5" <bgkoehler@bpa.gov>

Date: 7/6/22 6:27 PM (GMT-08:00)

To: Jennifer Light <JLight@NWCouncil.org>, Chad Madron <CMadron@NWCouncil.org>

Cc: "James,Eve A L (BPA) - PG-5" <eajames@bpa.gov>

Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hello again,

I'm afraid I just received confirmation that the presentation is indeed being delayed a week. Guy Normal has been informed, and I think Mike Edmonds too, or at least he knows that this was likely.

I'm checking with E3 on their availability for next week in hopes that we have the go-ahead to proceed—and that it works from your end too.

Again, sorry for the last minute change in plans.

Birgit

From: Jennifer Light <JLight@NWCouncil.org>

Sent: Wednesday, July 6, 2022 5:11 PM

To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Chad Madron <CMadron@NWCouncil.org>

Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Thanks for the note Birgit. We will stay tuned. We are discussing options for next week to try to make it work if needed.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Sent: Wednesday, July 6, 2022 4:46 PM

To: Jennifer Light <JLight@NWCouncil.org>; Chad Madron <CMadron@NWCouncil.org>

Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Jennifer and Chad,

I have some news for you, not the presentation you have been waiting for.

The E3 presentation to the Council tomorrow will **likely** be canceled. The current plan is to delay one week, potentially to the full Council meeting, but this still needs to be confirmed and coordinated. The Council Chair has already been contacted and is aware.

Should it turn out that we are delaying the presentation, is there availability on the agenda for July 12 or 13th?

I'll also need to check with Arne Olson at E3 if he is available. For now, I've just given him the same alert that we are likely but not yet confirmed about delaying.

Sorry about all the swirl,

Birgit

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Wednesday, July 6, 2022 3:27 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Chad Madron <CMadron@NWCouncil.org>
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.
Fantastic. Thanks for confirming.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, July 6, 2022 3:27 PM
To: Jennifer Light <JLight@NWCouncil.org>; Chad Madron <CMadron@NWCouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hello Jennifer,

Yes, that's the current plan. There is still some coordination on our side, but unless you hear from me, please introduce Arne and pass it off to him. We engaged them to do an independent study, and so are happy to let them present independently.

Cheers,

Birgit

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Wednesday, July 6, 2022 3:24 PM
To: Chad Madron <CMadron@NWCouncil.org>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Birgit,

One more quick question. I just want to confirm the plan for the morning. My understanding is that it is Bonneville's preference that I just introduce Arne for the topic and him just diving right in, rather than first handing it off to someone at Bonneville to introduce him. I just want to make sure that I pass it to the right person.

Thanks!

Jennifer

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Wednesday, July 6, 2022 2:39 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Jennifer Light <JLight@NWCouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Cool, no worries! I just hadn't heard from him at all so I was worried he was perhaps not seeing my traffic. I appreciate you confirming. Even slides by 8am is ok if that is what needs to happen!

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, July 6, 2022 2:34 PM
To: Chad Madron <CMadron@NWCouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Chad,

Sorry for the delay. Yes, the slides are still being reviewed. I will do my utmost to make sure you get them in plenty of time for the meeting.

Birgit

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Wednesday, July 6, 2022 2:32 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: [EXTERNAL] FW: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Birgit,

I haven't heard at all from Arne. Are you all still in edit mode on slides and such?

From: Chad Madron
Sent: Wednesday, July 6, 2022 10:10 AM
To: Ryan J (BPA) - PGPR-5 Egerdahl - BPA (riegerdahl@bpa.gov) <riegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com)

<arne@ethree.com>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; bgkoehler@bpa.gov

Cc: Jennifer Light - Northwest Power and Conservation Council (JLight@NWCouncil.org) <JLight@NWCouncil.org>;

Kendra Coles (kcoles@nwcouncil.org) <kcoles@nwcouncil.org>

Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Good morning Arne and BPA folks,

Just a reminder that it is our preference for you to send slides shown tomorrow morning to me ahead of time - then I use our computer to present them, but give you "keyboard and mouse control" so you can advance them using your equipment. This makes it so you don't have to worry about presenting from your machine. If you are very comfortable presenting from your computer directly we can accommodate that, we just find we have more consistent results if we do it the other way as different folks have differing levels of comfort with different webinar technologies.

Thanks!

Chad

503-705-9323

From: Chad Madron

Sent: Monday, June 27, 2022 10:48 AM

To: Ryan J (BPA) - PGPR-5 Egerdahl - BPA (rjegerdahl@bpa.gov) <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Cc: Jennifer Light - Northwest Power and Conservation Council (JLight@NWCouncil.org) <JLight@NWCouncil.org>;

Kendra Coles (kcoles@nwcouncil.org) <kcoles@nwcouncil.org>

Subject: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Ryan, Eve, and Arne,

I am working with Jenn on pulling together a memo and any other background material we can for Members ahead of the July 7 presentation on BPA's Snake River Dams study that is at 8:30am Pacific.

Can you confirm who from BPA and E3 will officially be presenting/speaking? Arne, I know you are giving the main presentation. Is there a report exec summary or any slides we could include with the memo to help them prepare? We will be sending them the prep memo THIS Wed by the middle of the day. Any info you can help us provide to help them be prepared is appreciated.

For July 7 – I will make sure you three all have calendar invites and panelist email/invites for the webinar.

Arne – speakers generally appear on camera, but it is not required. Our preference is for you to send me your slides and then I use our computer to present them, but give you "keyboard and mouse control" so you can advance them using your equipment. This makes it so you don't have to worry about presenting from your machine. If you are very comfortable presenting from your screen directly we can accommodate that, we just find we have more consistent results if we do it the other way as different folks have differing levels of comfort with different webinar technologies.

You should all get the GoToWebinar emails today! Those will have your UNIQUE entry links for the webinar. You will get the emails again 1 day and 1 hour before the meeting as reminders.

From: James,Eve A L (BPA) - PG-5
Sent: Thursday, May 26, 2022 1:49 PM
To: Koehler,Birgit G (BPA) - PG-5
Subject: 2022-05-LSR-Dam-Replacement-Study-Full-Deck-Final-to-Client-220518.pdf
Attachments: 2022-05-LSR-Dam-Replacement-Study-Full-Deck-Final-to-Client-220518.pdf



Lower Snake River Dam Replacement Study

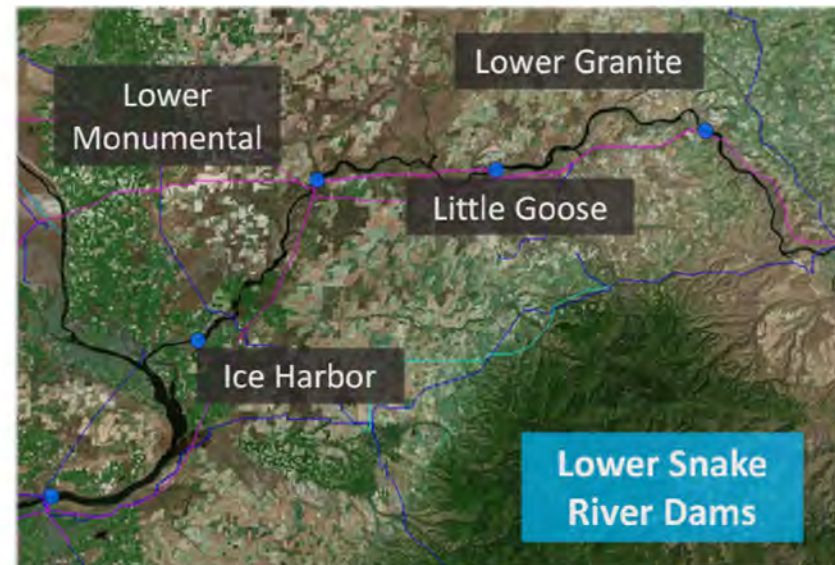
*A study investigating the cost and feasibility of optimized
clean-energy replacement portfolios*

May 18th, 2022

Study Motivation

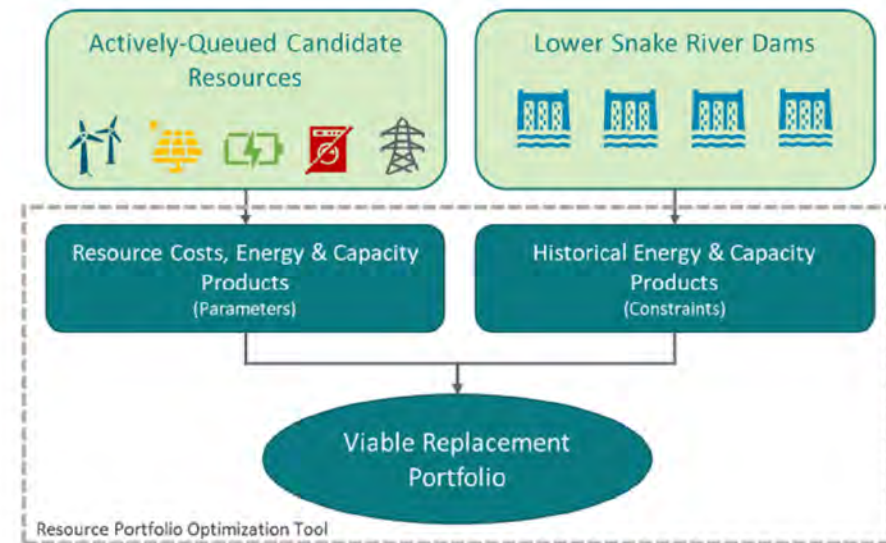
- **The potential removal of the Lower Snake River (LSR) Dams is a central topic of debate in the Pacific Northwest**
 - ❖ As it relates to the LSR dams' energy value, proponents for retaining the dams argue that they provide a carbon-free, flexible, and reliable source of power that supports the stable operation of the regional transmission grid
 - ❖ Advocates for dam removal cite high O&M costs, relatively low energy value of LSR dam output, and the prevalence of low-cost carbon-free replacement resources
- **In 2018, Energy Strategies published the Lower Snake River Dams Power Replacement Study commissioned by the NW Energy Coalition**
 - ❖ The study evaluated the cost, feasibility, & regional reliability implications of replacing the LSR Dams with a variety of clean energy portfolios and demonstrated that:
 - The LSR dams could be replaced with a portfolio of market-ready resources
 - Replacement would require minimal high-voltage transmission upgrades as transmission reliability was not compromised based on powerflow reliability analysis
- **This new study complements this prior work by identifying an optimal set of *specific* investments required to replace the LSR dams in the late-2020 timeframe, subject to market supply constraints**
 - ❖ The objective of this study is to identify least-cost clean energy replacement energy portfolios that meet or exceed energy attributes historically provided by the dams
 - ❖ Study focuses on a "one-to-one" replacement strategy, as well as alternative replacement objectives where monthly energy "needs" of the region are prioritized over what the dams have provided the region historically, allowing for a consideration of tradeoffs

LSR Dam	Year in Service	Nameplate Capacity (MW)
Ice Harbor	1961	603
Lower Monumental	1969	810
Little Goose	1970	810
Lower Granite	1975	810



Study Overview

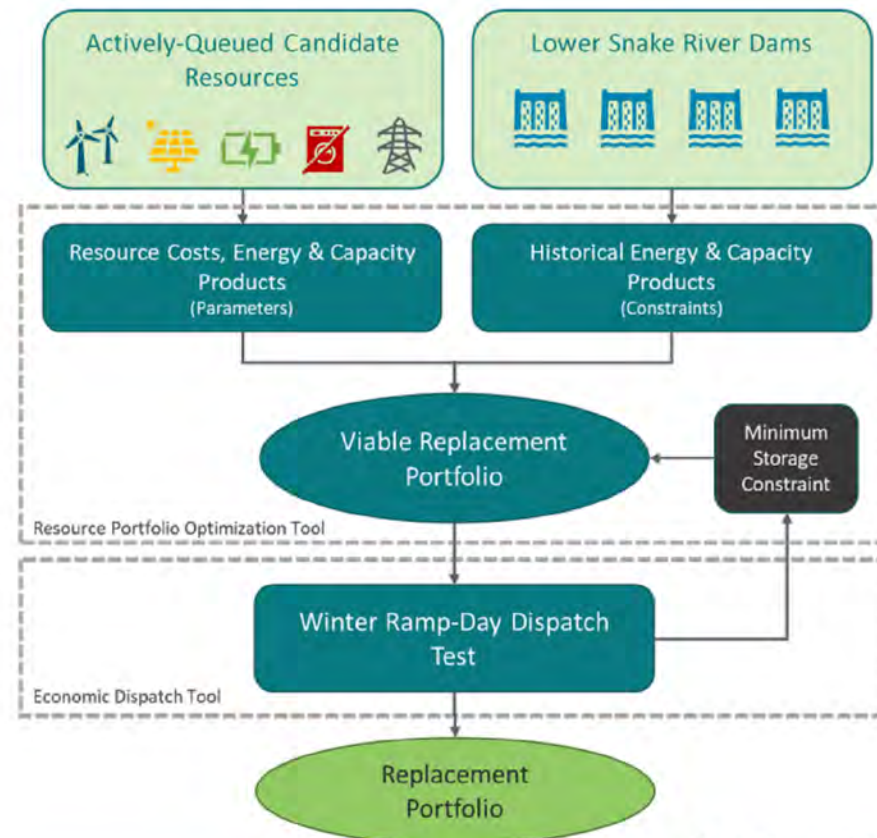
- **Study methodology uses an in-house resource planning optimization tool to identify least-cost replacement portfolios that meet or exceed the following grid products provided by the LSR dams:**
 - ❖ Monthly Energy (MWh/month)
 - ❖ Energy Value (\$M/year)
 - ❖ Capacity Value (MW)
- **Study compiled these parameters for the LSR dams and actively-queued, market-ready resources**
 - ❖ Study based on data from 2006 to 2020
 - ❖ This timeframe aligns with current spill and fish management protocols



All results presented in 2020\$

Study Overview

- Study methodology uses an in-house resource planning optimization tool to identify least-cost replacement portfolios that meet or exceed the following grid products provided by the LSR dams:
 - ❖ Monthly Energy (MWh/month)
 - ❖ Energy Value (\$M/year)
 - ❖ Capacity Value (MW)
- Study compiled these parameters for the LSR dams and actively-queued, market-ready resources
 - ❖ Study based on data from 2006 to 2020
 - ❖ This timeframe aligns with current spill and fish management protocols
- **After a viable portfolio is selected based on above criteria, the portfolio was dispatched against historical LSR dam production “high-ramp-days”**
 - ❖ Attempted to match historical dam production for top 10% of days in which the LSR dams provided morning or evening ramping (mainly occurring in winter months)
 - ❖ If portfolio was deficient, additional battery storage introduced into portfolio optimization tool to ensure the ramping objective was met



All results presented in 2020\$

Study Purpose: Summary

What the study IS:

- An effort to **characterize select energy attributes** of the dams based on 15+ years of historical operations.
- An exploration into the selection of **optimal blends of specific resources & investments** to create a portfolio that provides similar or greater energy attributes.
- An attempt to emulate aspects of utility **RFP evaluations** in which specific projects are selected into a portfolio, subject to market supply limitations.
- An effort to move beyond conceptual or generic replacement portfolios to the identification of a specific set of real-world projects in development.
- An independent assessment using a new **analytical framework** designed to address targeted energy issues surrounding dam replacement.

What the study is NOT:

- A **regionally-focused planning study** considering dispatch, resource adequacy, and flexibility modeling in the context of the Pacific Northwest system (*see Energy Strategies' 2018 study for detailed analysis of such issues*).
- A consideration of **all replacement options**, alternatives, and their impacts. For example, energy efficiency was not considered as a replacement option, nor was any transmission reliability analysis performed as a part of this assessment, although both issues have been explored previously.
- Designed to capture the **full range of costs** and benefits associated with dam removal related to fisheries, transportation, irrigation, and recreation.
- A **policy position** on whether the dams should or should not be removed – the study is technically focused and does not seek to replicate prior work, instead it adopts a new approach to help better inform the region on the subject matter.

Sensitivities Consider Impact of Different Planning “Objectives”

- **Energy Strategies performed two sensitivity studies to investigate the ability of replacement portfolios to meet BPA system needs, as opposed to LSR historical output targets, alone**

- ❖ Sensitivities assess a monthly energy constraint profile that highlights different planning objectives for the BPA system, but results in portfolios built to **obtain the same amount of total annual energy as the dams generated historically**

- **Base (LSR Dam Shape)**

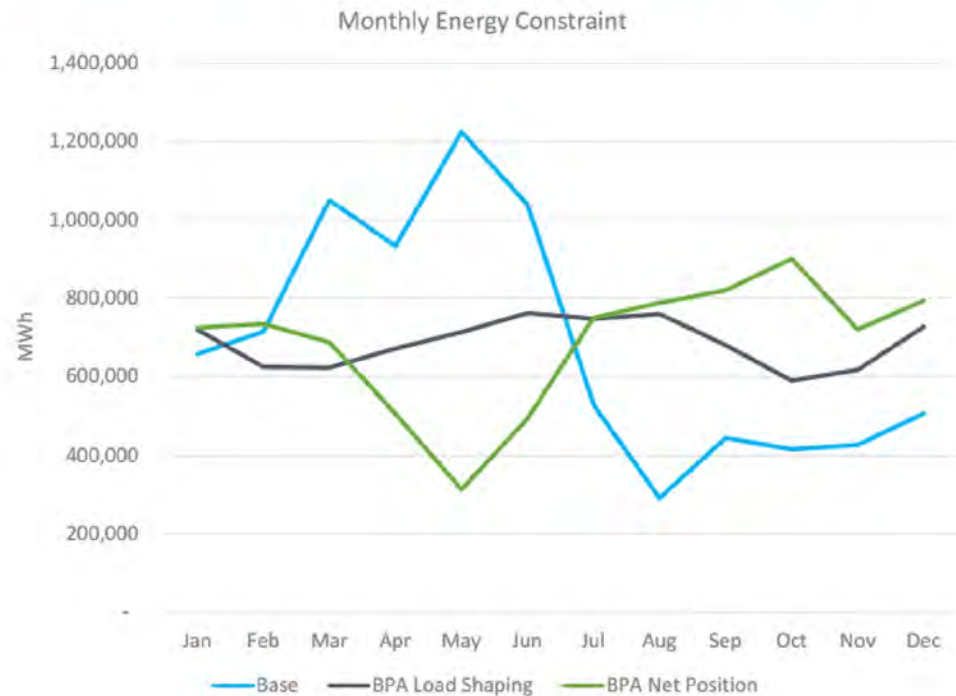
- ❖ Monthly energy profile is represented by the average monthly energy output of the dams, based on 2006 – 2021 production data
 - High energy output in late spring and early summer

- **BPA Load Shape Sensitivity**

- ❖ Monthly energy profile developed based on BPA Gross Load per NWPCC’s CanESM2 Medium 2030 climate scenario
 - Summer & Winter-peaking shape with smaller month-to-month variation

- **BPA Net Position Shape Sensitivity**

- ❖ Monthly Energy profile developed based on BPA Net Position (Gross load – Hydro generation) in 2019
 - Late-summer peaking shape as this represents time when electrical load is high while hydro output is low

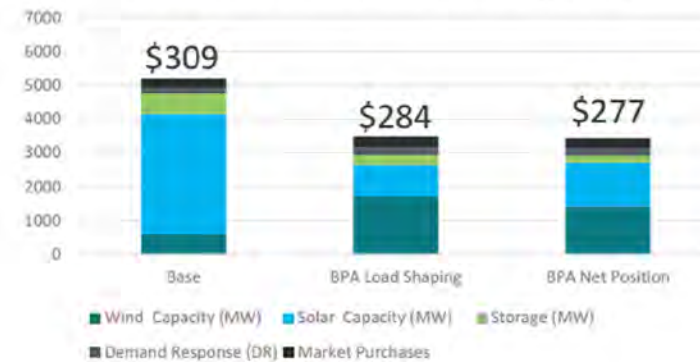


Sensitivities

Key Takeaways from Study

- A diverse resource portfolio made up of wind, solar, DR, storage, and market purchases, at a net annual cost of \$277M, was able to sufficiently replace the energy, capacity value, and ramping provided historically by the LSR dams
 - ❖ Replacement costs estimated in this study range from \$309M - 277M/year
 - ❖ Study did not consider energy efficiency but doing so would likely help reduce replacement costs
 - ❖ “Base” study sought to replace monthly energy output from dams, while “BPA Load Shaping” and “BPA Net Position” sensitivities sought to replace annual energy provided by dams but in months in which the region was likely in need (versus when power was generated, historically)
- Replacing the dams on a one-for-one basis could cause an increase in annual replacement costs of \$32M/year compared to scenarios that assume a planning objective based on what the region needs going forward
 - ❖ Analysis suggests that cost-efficient replacement of the LSR dams requires a diverse set of replacement resources and a *regional planning objective* that does not simply replace energy services historically provided by the dams
 - ❖ When the planning objective is centered around replacing historical dam output, replacement portfolios are skewed towards solar resources, which drives up the cost of the portfolio as solar has limited to no ramping capability in the early morning winter hours

Replacement Capacity and Net Cost (\$M/yr)



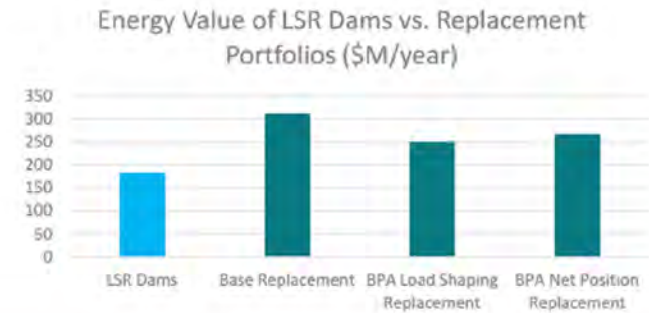
Planning Objective Comparison:
LSR Generation vs. BPA Net Position



Key Takeaways from Study (continued)

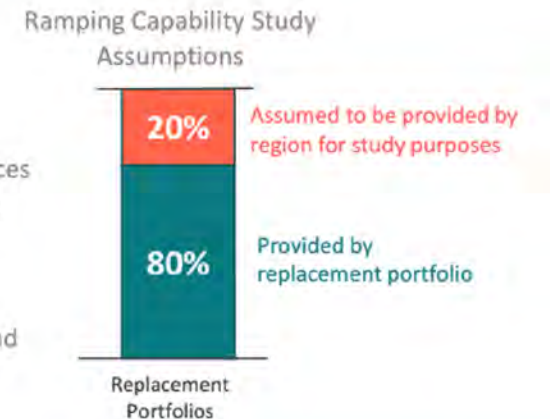
- **The study indicates that replacement portfolios will generate power at times when the region needs it the most, resulting in \$69M - \$143M million per year of energy value above what the LSR dams provide for the same time period**

- ❖ This result is heavily driven by the LSR dams generating most of their annual energy output during the spring runoff season when power prices are low and the region exports its excess energy



- **Study supports prior conclusions regarding the technical feasibility of replacing the energy, capacity, and ramping value provided by the LSR dams**

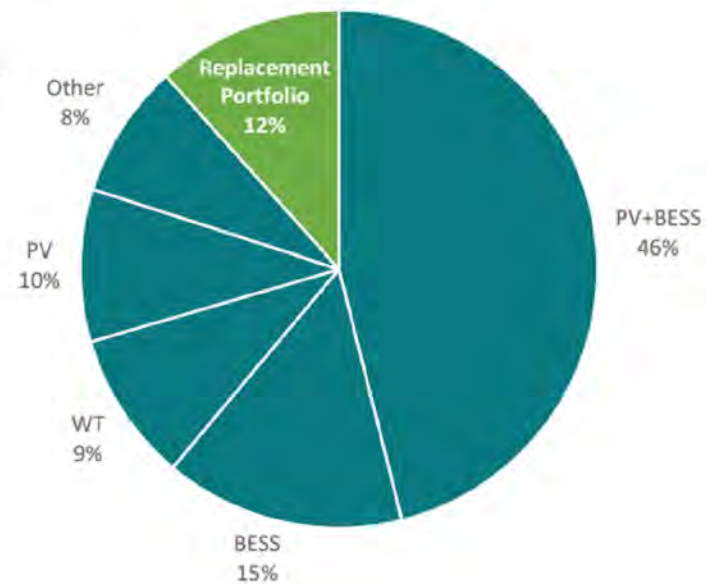
- ❖ Ramping was the most difficult replacement criteria to evaluate in this study since the modeling framework did not account for the broader region's ability to provide some portion of ramping services
- ❖ It was clear that a diverse mix, inclusive of storage, is the best route to providing maximum ramping capability within the replacement portfolio
- ❖ Given potential for flexibility being supplied from elsewhere in the region, providing 100% of the historical ramping of the dams may not be necessary or cost effective, so the study sought to have replacement portfolios meet 80% of historical ramping service provided by LSR dams. We recommend regionally-focused analysis to confirm the reasonableness of this approach and provide more detail about regional ability to contribute to ramping capacity as a part of a replacement portfolio.



Key Takeaways from Study (continued)

- **Approximately 12% of the total candidate supply, including wind, solar, storage, DR, and market purchases, were selected into the portfolios in this study, indicating the region's status quo level of resource development is more than sufficient to replace the LSR dams in the late-2020/2030 timeframe**
 - ❖ It is well understood that development interest in the Northwest region is still growing, so even after this study's conservative assumption regarding the likely contracting of many resources in BPA's queue, the aggregate demand for LSR dam replacement is much less than the regional supply (which is likely to grow)

Relative Size of Replacement Portfolio vs. Candidate Resource Pool

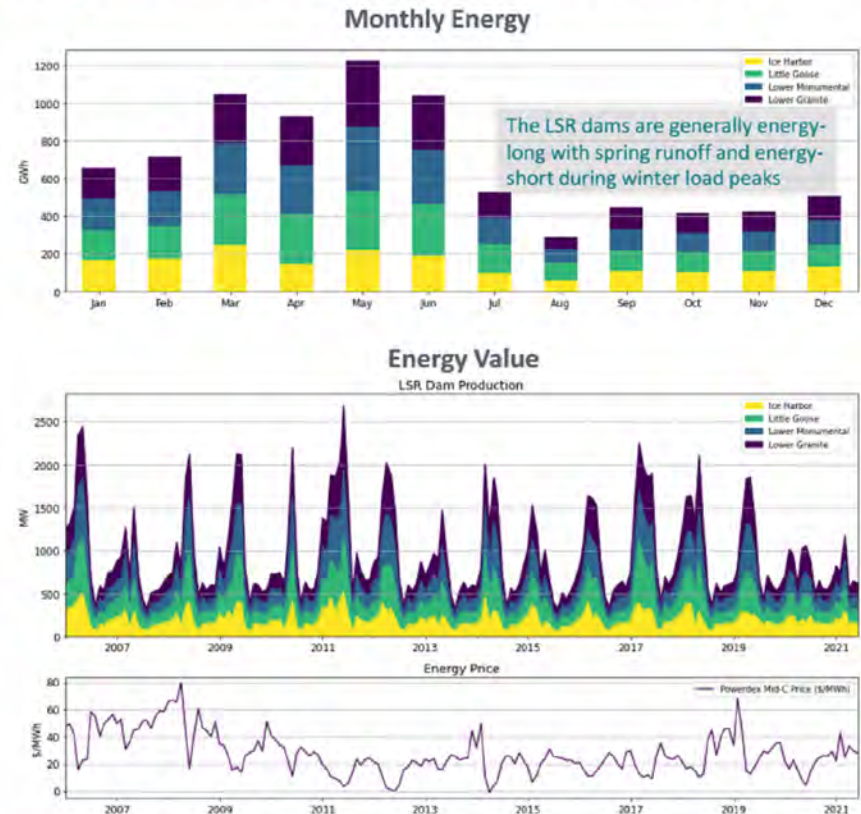




Overview of Study Assumptions and Methods

Historical Dam Data Used to Define Replacement Requirements

- **Analysis of historical operational data, energy prices, and prior study work was used to define constraints, or “requirements”, of the replacement portfolio**
- **A monthly energy constraint was calculated based on 15 years of dam production**
 - ❖ Hourly production data of Lower Snake River Dams sourced from US Army Corps of Engineers Northwestern Division Website (aggregated to calculate total hourly production)
 - ❖ Constraint ensures replacement portfolios generate monthly power greater than or equal to what the dams have generated historically
- **An annual energy value constraint was calculated based on hourly production and coincident hourly historical prices at Mid-C**
 - ❖ The median-year energy value of \$182M was selected as the requirement for candidate resources
 - ❖ Constraint ensures energy produced by replacement portfolios has system value that is greater than or equal to what dams have provided historically
- **A capacity value constraint was introduced to ensure that the replacement portfolio provides the region with equal or greater levels of resource adequacy**
 - ❖ LSR Dams assumed to convey 1,000 MW of capacity value, based on prior study work performed by Energy Strategies in 2018



Candidate Resources Represent Actual Projects and Market Supply of Replacement Assets

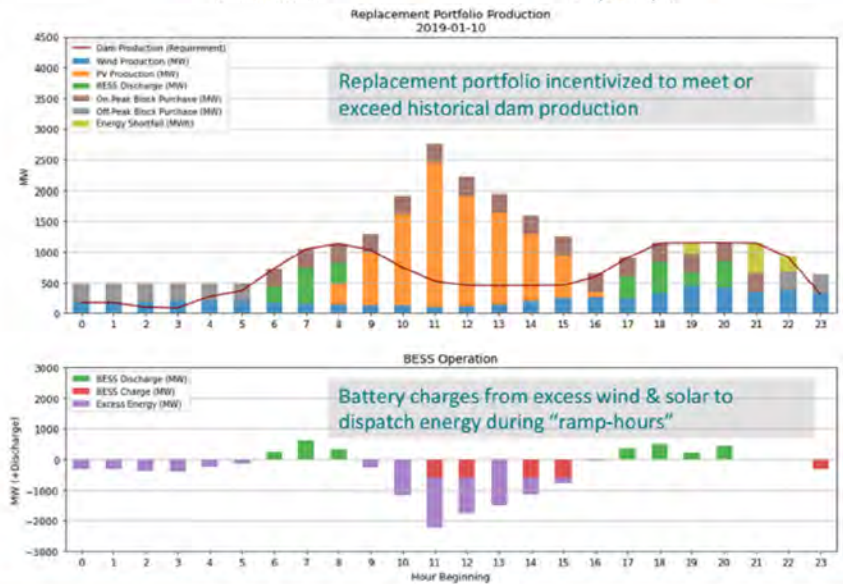
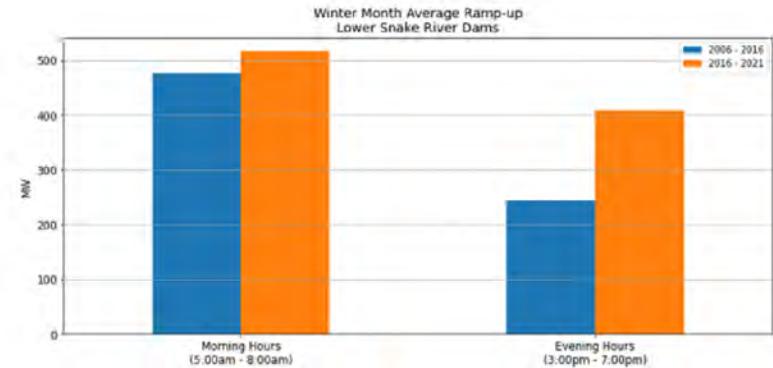
- **Set of candidate generation/storage resources total nearly 30 GWs of capacity split among eight technology types and three regions**
 - ❖ **25 GW of supply:** BPA interconnection queue was screened for candidate resources, capturing those project undergoing system impact study with in-service dates between 2024-2028, and a max capacity >20 MWs
 - ❖ **1.5 GW of supply:** Assumed to be available from Montana in the form of wind generation
 - ❖ **2.8 GW of supply:** Assumed to be available from California in the form of solar generation
- **300 MWs of Mid-C on/off-peak market purchase options were also assumed as a candidate resource**
- **559 MWs of regional demand response, sourced from the NWPCC Power Plan, assumes that 25% of unused regional supply in 2028 could be used for LSR dam replacement**
- **Each candidate was assigned an annualized cost based on technology, cost forecasts, and resource quality**
- **Wind & solar production profiles generated for each project using NREL WIND and SIND datasets**
 - ❖ Mid-C prices used to derive energy value from each resource
- **To assign each resource a capacity value regional effective load carrying capability (ELCC) assumptions sourced from regional IRPs and assigned**

Candidate Resource Pool & Modeled Capacity Factor

Resource Type	Number of Candidates	State	Interconnection Capacity (MW)	Avg. Capacity Factor (%)	Assumed ELCC (%)
BESS	1	MT	120	-	100%
	5	OR	2,600	-	
	3	WA	1,775	-	
PV	1	CA	100	25%	7%
	13	OR	3,609	25%	
	6	WA	640	23%	
PV+BESS	7	CA	2,700	31%	30%
	18	OR	8,300	29%	
	7	WA	2,225	23%	
WT	4	MT	1,456	36%	17%
	3	OR	1,077	33%	
	5	WA	1,483	33%	
WT+BESS	1	OR	500	29%	35%
	1	WA	200	30%	
WT+PV+BESS	2	WA	1,500	35%	40%
Pumped Storage	1	WA	500	-	100%
DR	23	-	559	-	100%
On-Peak Block	3	-	100	-	100%
Off-Peak Block	3	-	100	-	0%

Ramping Assessment

- **The objective of this study is to identify the lowest-cost portfolio of resources that can replace grid services provided by the LSR Dams**
 - ❖ Methodology up to this point identifies portfolios that meet energy and capacity requirements, but has not assessed their ability to provide ramping value during critical morning & evening hours during winter months
 - ❖ A review of historical dam production suggests that the LSR dams have provided a significant, and increasing, amount of morning & evening ramp capacity in the last 5 years
 - ❖ Using statistical analysis, we selected the top 10% of “high-ramp-days” in last 15 years during which the dams provided significant morning/evening ramp within winter months (occurred between Dec – Mar)
- **Replacement portfolios were dispatched against dam production on these high-ramp days to test the ability of the portfolios to provide “like” ramping capability**
 - ❖ Percent Energy Served (%) measured during morning ramp hours (5:00am – 8:00am), and evening-ramp hours (3:00pm – 7:00pm), respectively
 - ❖ A portfolio that met an average ramp-hour energy served of 80% was considered a sufficient replacement portfolio
 - ❖ 80% threshold is a planning estimate, recognizing that within the region there may be “latent” or unused flexibility that can be sourced to assist with dam replacement – regional analysis investigating this issue is recommended
- **Based on these results, a “minimum battery storage constraint” was re-introduced into the portfolio optimization tool, and replacement portfolio re-optimized and dispatched until this criteria was met**



Dam Ramping Analysis

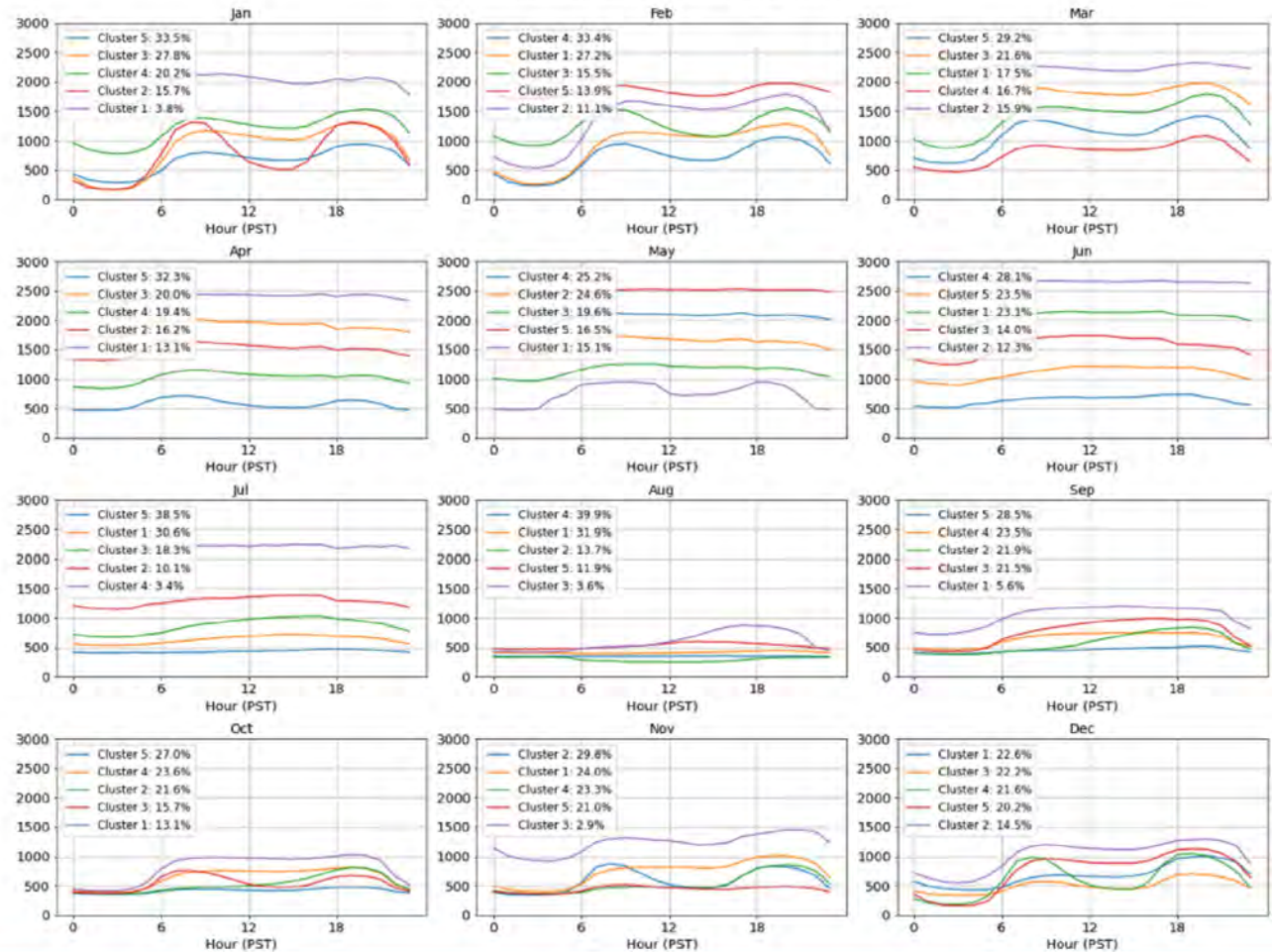
- K-means clustering algorithm used to classify daily dam profiles into 5 clusters for each month

- ❖ Based on 15 years of historical dam production data

- Clustering results suggest prevalence of morning & evening ramp-up service generally in winter months

- ❖ These shapes were used to inform ramping analysis

LSR Dam Clustered Production Profiles (2006 - 2021)



Dam Ramping Analysis

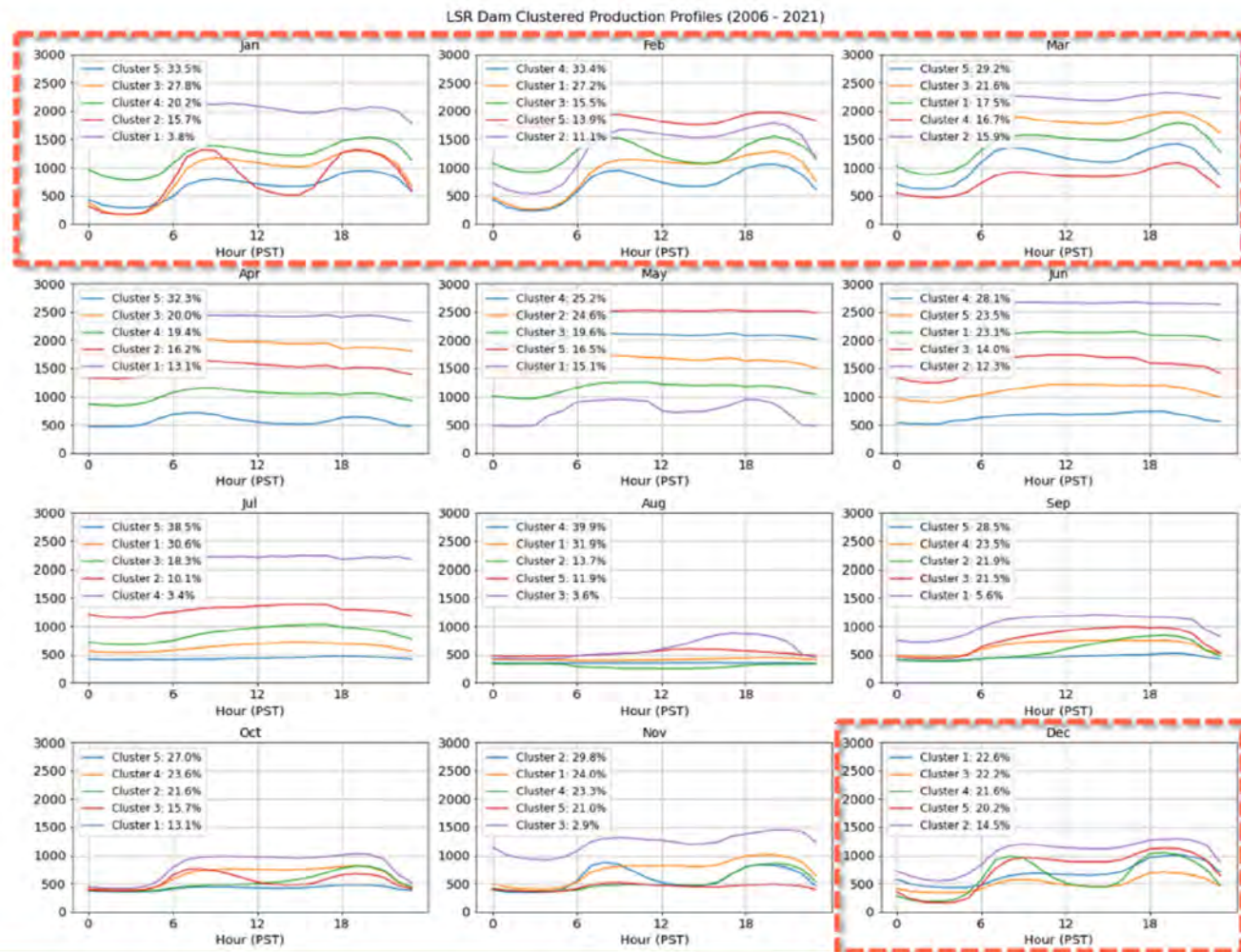
- K-means clustering algorithm used to classify daily dam profiles into 5 clusters for each month

- ❖ Based on 15 years of historical dam production data

- Clustering results suggest prevalence of morning & evening ramp-up service generally in winter months

- ❖ These shapes were used to inform ramping analysis

- Results demonstrate material ramping service provided in winter months only

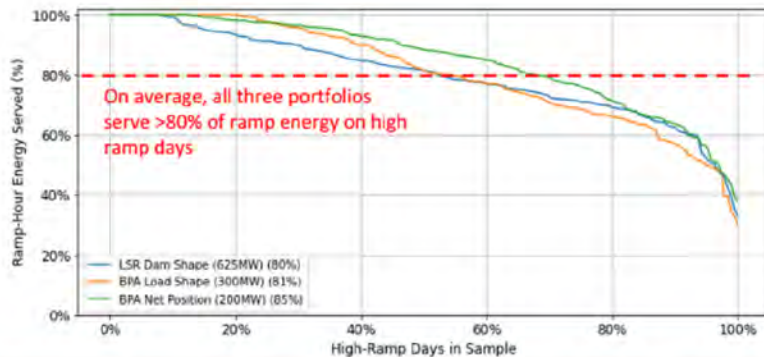




Sensitivities & Summary of Results

Summary of Study Results

- **The optimization model was able to select least-cost portfolios of resources that met the planning constraints established for the study**
 - ❖ Portfolios featured between 200-625 MW of battery storage resources to meet the 80% ramp-hour energy served requirement
- **Resource selection outcomes based on trade-offs:**
 - ❖ PV tends to be the cheapest replacement resource per MWh
 - ❖ Wind provides generation around-the-clock & has a higher ELCC than PV
 - ❖ Demand response and market purchases necessary for replacement portfolio to meet capacity value
 - ❖ Portfolio selection sensitive to ELCC assumption
 - ❖ Market purchases selected



Result Metric	Base	BPA Load Shape	BPA Net Position
Number of Replacement Units (Not including DR)	19	16	22
Replacement Capacity (MW)	4,884	3,484	3,532
Wind Nameplate Capacity (MW)	600	1,709	1,415
Solar Nameplate Capacity (MW)	3,548	930	1,296
Battery Capacity (MW) – 4hr	625	300	200
Demand Response (MW)	136	245	221
Off-Peak Market Purchases (MW)	300	300	300
On-Peak Market Purchases (MW)	300	300	300
Annualized Cost (\$M)	\$452	\$353	\$362
Annual Value of Energy (\$M)	\$325	\$251	\$267
LSR Dam Annual Value of Energy (\$M)	\$182	\$182	\$182
Incremental Energy Value (\$M) (Portfolio Energy Value – Dam Energy Value)	\$143	\$69	\$85
Incremental Energy Value (%)	79%	38%	47%
Net Replacement Cost (\$M) (Annualized Cost – Incremental Energy Value)	\$309	\$284	\$277
Capacity Value	1,204	1,002	1,002
Net Capacity Cost (\$/MW-year) <u>Annualized Cost – Annual Value of Energy</u> Capacity Value	\$105,481	\$101,621	\$94,976
Binding Energy Month	March	June	December
Largest Excess Energy Month	August	October	May
Ramp-Hour Energy Served	80%	81%	85%

Areas of Additional Study and Caveats

- **Identifying the most cost effective, environmentally efficient, and robust/adequate replacement portfolio will require scenario-based optimization studies that include modeling of the entire Northwest regional footprint. This approach differs from the approach taken in this analysis, which explored a one-for-one replacement analysis and focused on selecting specific resources to assess feasibility.**
 - ❖ A regional approach will allow for a more comprehensive assessment of resource adequacy and flexibility issues, which were addressed in this study through assumptions
 - ❖ Methods similar to Energy Strategies 2018 study are appropriate for evaluating system-wide issues
- **Given the weather-dependent nature of the replacement portfolios, any final or “binding” assessment of the optimal mix of replacement resources should take a multi-year stochastic approach to weather modeling, versus the more deterministic analysis featured in this study**
 - ❖ However, given the intent and purpose of this study, the scope of weather-years and data used were reasonable an inline with industry standards
- **Unlike the 2018 study of LSR dam replacement, this analysis did not consider the potential for energy efficiency to play a role in the replacement portfolio. Assuming EE could be acquired at a low cost, that suggests the cost results in this study could be conservative.**
- **Much of the pricing and dam output data used in this analyses were historical. It will be important for future analyses to incorporate changes in power prices in the future, along with drought or climate-driven impacts to LSR and Northwest hydro output. Such effects add uncertainty regarding the value of future dam production.**
- **Unlike prior efforts exploring replacement feasibility, this study did not evaluate the degree that that dam removal and replacement will impact regional generation dispatch.**
- **This study required several important assumptions that impacted the findings, including:**
 - ❖ Estimated capacity value of the dams at 1000 MW of capacity, based on Energy Strategies’ 2018 study which used GENESYS to estimate dam capacity value.
 - ❖ Capacity contribution, or ELCC, of most replacement resources were sourced from regional or IRP planning assumptions. No such assumptions were available for hybrid resources, so Energy Strategies made rule-of-thumb adjustments to the ELCC values of non-hybrid resources based on planning assumptions from other regions, such as California
- **Market purchases in this study were assumed to be bilateral market purchases at Mid-C, which typically do not include environmental attributes (e.g., RECs). However, should 100% clean replacement be sought, associated purchases could be paid with unbundled RECs to achieve this environmental outcome.**
 - ❖ The incremental cost of these RECs was not considered in this study. However, relative to the cost of the replacement portfolio it is anticipated this cost may be small.



THANK YOU

Contact

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📞 (801) 355-4365

🌐 energystrat.com

Presenters

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Daniel Ramirez, Consultant

John Muhs, Consultant

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✉ dramirez@energystrat.com

✉ jmuhs@energystrat.com



Technical Appendices

- Replacement Candidates and Assumptions
- Replacement Portfolio Details
- Ramping Analysis Methodology and Results



Technical Appendices

- **Replacement Candidates and Assumptions**
- Replacement Portfolio Details
- Ramping Analysis Methodology and Results

Summary of Options for Replacement Resources

Type	Technologies Considered	Locations	Key Assumptions / Sources
Clean Energy Generation and Storage	Wind, Solar, Storage, Hybrid	Individual proposed projects sourced primarily from BPA interconnection queue, with additional projects in California and Montana were made available for selection	<u>Details:</u> Interconnection queues screened to identify viable projects <u>Costs:</u> Technology-specific <u>Production:</u> Location-specific, hourly output based on NREL integration study datasets <u>Capacity value:</u> Sourced from IRPs
Other Resources	<i>Not considered – no thermal or carbon emitting resources were included as options</i>	N/A	N/A
Market Purchases	On/Off-peak block purchases at Mid-C, up to 300 MW of each in 100 MW increments	Mid-C, which is the primary bilateral trading hub in the PNW (very liquid supply)	<u>Details:</u> N/A <u>Costs:</u> Based on historical ICE Mid-C prices <u>Production:</u> Assume power physically delivered <u>Capacity value:</u> 100% capacity value
Demand Response	Irrigation DLC, commercial, space cooling DLC, residential water heaters, heat pumps, etc.	Specific location of DR not considered but supply was limited to what was available in PNW region, per Northwest Power and Conservation Council (NWPCC)	<u>Details:</u> NWPCC 2021 Plan primary source <u>Costs:</u> Based on NWPCC 2021 Plan <u>Production:</u> N/A, not included in dispatch <u>Capacity value:</u> Based on NWPCC forecast @ 100%
Energy Efficiency	<i>Not considered – did not have method to select “tranches” or specific programs of EE</i>	N/A	N/A

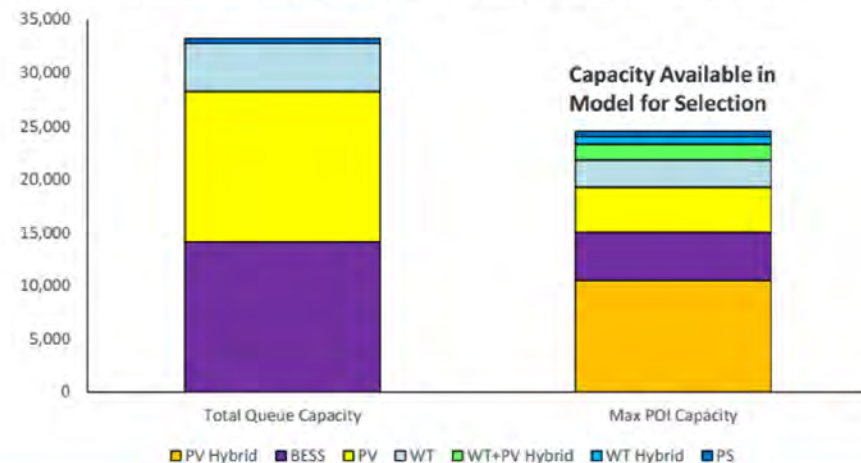
BPA Queue Analysis to Identify Candidates

- The BPA generator interconnection queue was used to identify candidate renewable energy projects which could, hypothetically, be contracted to replace LSR dam services
- The following criteria was applied to the screen down the queue to a set of candidate resources:
 - ❖ Consider queue projects which are currently undergoing studies or that have a status of "Received"
 - Projects which have completed their studies or have executed interconnection agreements are likely to have contracts already and were therefore screened out of analysis
 - ❖ Fuel types included were solar, wind, battery, pumped storage
 - ❖ Projected In-Service Dates ranged from 2024-2028
 - ❖ Max capacity ≥ 20 MW
- Screening led to nearly 25 GWs of candidate resource capacity (at point-of-interconnection)
- Several wind projects in Montana connecting to the Colstrip transmission system were added, along with a few solar projects in California
 - ❖ Supply in both of these areas is sufficient that detailed analysis was not required

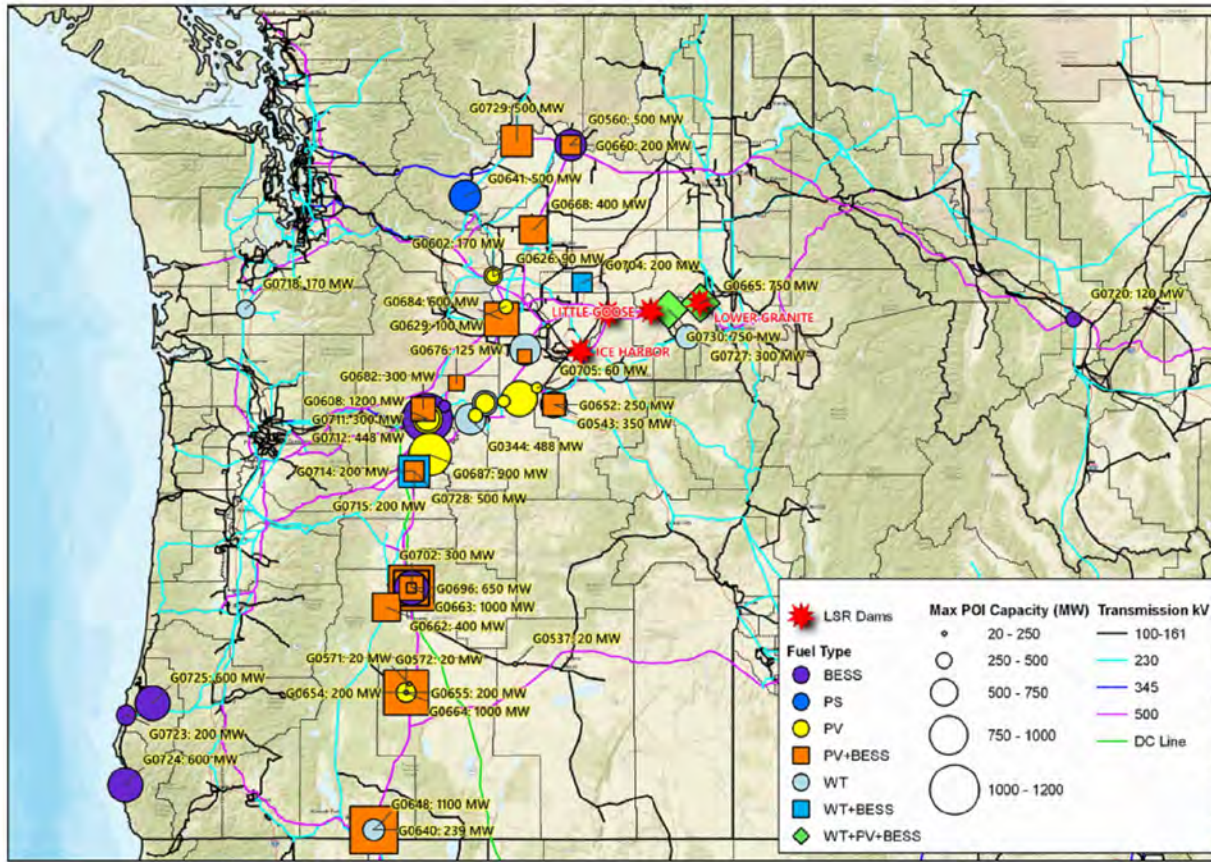
BPA Queue Capacity as of 2/16/2022

Status	Max Capacity (MW)
Received	4,483
Study	31,426
Study Completed	2,826
IA Executed	500
Energized	5,528
Withdrawn	54,287

Potential BPA Queue Capacity (MW) to Replace LSR Dams



Screening of BPA Queue Identified 25 GW of Viable Capacity



Candidate Resource Cost Assignment

- Energy Strategies utilized cost information from a variety of sources with the intention of creating annualized costs for each project to allow for the optimization tool to make cost-minimizing decisions
- Energy Strategies used NREL 2021 Annual Technology Baseline (ATB) database to assign a levelized cost of energy to solar and wind resources, including hybrid configurations.
 - ❖ The Pacific Northwest National Laboratory data repository was used to feed cost information into the WECC Capital Cost Model to determine annualized costs for storage resources on a \$/kW-Yr basis.
- The Northwest Power and Conservation Council 2021 Power Plan was used to determine demand response product options and their associated potential capacities and costs

Annualized Cost of Standalone Renewable = Standalone LCOE x Annual Energy

Annualized Cost of Standalone Storage = Annualized Capital Cost x Storage Capacity

Annualized Cost of Hybrid Resource = (Hybrid LCOE x Annual Energy) + Annualized Cost of Standalone Storage

Annualized Cost of Demand Response = Levelized Cost x (Max Potential x 25%)



Candidate Resource Cost Assignment – Renewables

- Wind speed and irradiance quality have a significant impact on the levelized costs of their respective projects
- Energy Strategies inherently accounts for resource quality when applying the productions profiles leveraged from the NREL WIND and SIND datasets.
 - ❖ In order to not bias the annualized cost development, Energy Strategies applied a single LCOE for each resource type, which is based on an average in-service date year and the most typical resource class, allowing for production to be the main driver of annualized costs across resources classes
- Since hybrid renewable pairings are more cost-effective than building separate resources of the equivalent capacities, NREL ATB represents these cost savings as a lower levelized cost for the renewable resource (WT or PV) compared to their standalone counterparts. Storage costs remain the same

LCOE Assumptions for Select Resources

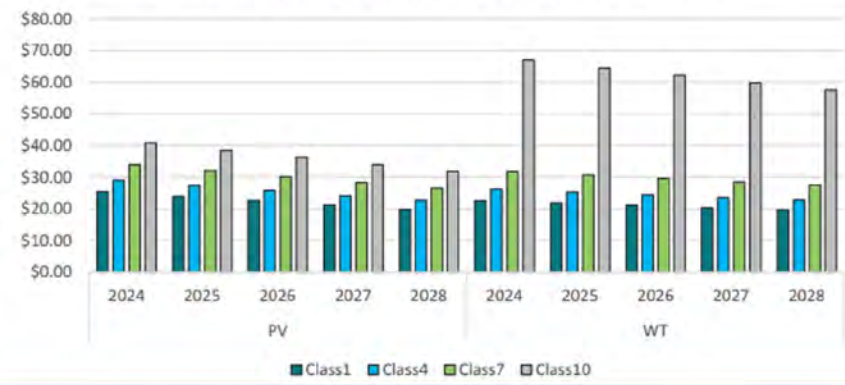
Resource Type	Avg ISD Year	Resource Class	LCOE (2020 \$/MWh)
PV	2025	5	\$29.39
PV (Hybrid)*	2025	5	\$26.47
WT	2025	8	\$34.66
WT (Hybrid)*	2025	8	\$31.81

Resource Type	Annualized Capital Costs (2020 \$/kW-Yr)
BESS (4hr)	\$154.00
PS Hydro	\$256.00

*Values marked as "Hybrid" only account for the energy-producing resource (WT or PV) in a hybrid unit. Supplemental storage costs are then applied separately

Annualized Cost of Hybrid Resource =
 Resource Annual Energy (MWh) * Resource LCOE (\$/MWh)
 + Battery Capacity (kW) * Annualized Capital Cost of BESS (4hr) (\$/kW-Yr)

NREL ATB LCOE by Resource Type (2020 \$/MWh)



Candidate Resource Cost Assignment – Demand Response

- Demand response (DR) products and levelized costs were derived from the Northwest Power and Conservation Council’s 2021 Power Plan
- Max potential is defined as a cumulative capacity value, with summer and winter providing different ratings for each product
- Energy Strategies only allowed for 25% of the 2028 max potential to be a resource option, given the infeasibility of integrating DR products across the entire BPA footprint

❖ Winter DR products assessed in this analysis

Annualized Cost of Demand Response = Levelized Cost x (Max Potential x 25%)

Product	Product Name	25% of 2028 Max Potential (MW)
NRCurtailCom	Demand Curtailment - Commercial	7.25
NRCurtailInd	Demand Curtailment - Industrial	37
NRIrrLg	Irrigation DLC - Large Farm	0
NRIrrSmMed	Irrigation DLC - Small/Medium Farm	0
ComCPP	Commercial Critical Peak Pricing	12.25
IndCPP	Industrial Critical Peak Pricing	12
DVR	Demand Voltage Response	124
IndRTP	Industrial Real Time Pricing	2.75
ResCPP	Residential Critical Peak Pricing	29.75
ResTOU	Residential Time of Use	21.25
NRCoolSwchMed	Space Cooling DLC - Commercial Medium	0
NRHeatSwchMed	Space Heating DLC - Commercial Medium	3.25
NRCoolSwchSm	Space Cooling DLC - Commercial Small	0
NRHeatSwchSm	Space Heating DLC - Commercial Small	3.75
NRTstatSm	Space Heating/Cooling DLC Thermostat - Commercial Small	3
ResACSwch	Residential Space Cooling DLC Switch	0
ResHeatSwitch	Residential Space Heating DLC Switch	122.75
ResBYOT	Residential Bring Your Own Thermometer	10
ResERWHDLCswch	Residential Electric Resistance Water Heater DLC Switch	99.5
ResERWHDLCGrd	Residential Electric Resistance Water Heater DLC Grid-Ready	64.5
ResEVSEDLCSwch	Residential Electric Vehicle Supply Equipment DLC Switch	3.75
ResHPWHDLCswch	Residential Heat Pump Water Heater DLC Switch	1
ResHPWHDLCGrd	Residential Heat Pump Water Heater DLC Grid-Ready	1



Technical Appendices

- Replacement Candidates and Assumptions
- **Replacement Portfolio Details**
- Ramping Analysis Methodology and Results

Base Replacement Portfolio

All results in 2020\$

Resource Type	POI Capacity (MW)	Annualized Cost (\$M)	Annual Value of Energy (\$M)	March Energy (MWh)	May Energy (MWh)	August Energy (MWh)	December Energy (MWh)	Capacity Value (MW)	Number of Units Selected
DR	136	\$0	\$0	-	-	-	-	136	2
Mkt - On Peak	300	\$57	\$52	148,800	148,800	148,800	148,800	300	3
Mkt - Off Peak	300	\$22	\$20	74,400	74,400	74,400	74,400	-	3
PV	2,398	\$144	\$133	397,071	532,170	569,212	201,597	168	10
PV+BESS	1,000	\$103	\$67	179,629	261,402	285,192	108,947	300	2
WT+PV+BESS	750	\$127	\$54	250,732	220,714	217,742	105,319	300	1
Candidate Resource Portfolio	4,884	\$452	\$325	1,050,630	1,228,490	1,295,350	639,045	1,204	19 (+ 2 DR)
LSR Dams			\$182	1,050,622	1,223,523	290,678	507,193	1,000	
Constraint Ratio			1.783	1.000	1.005	4.456	1.259	1.204	

- The optimal replacement portfolio determined by our in-house tool is comprised of **19 replacement resources totaling a 4,884 MW nameplate capacity**
 - ❖ Winter & spring monthly energy constraints represent the binding factors in portfolio selection
 - ❖ Portfolio is PV-heavy, which would result in excess energy without sufficient storage resources
- The **LSR Dam Shape (Base) portfolio is energy-long in summer & fall, since the portfolio procured energy to meet high spring production**
- Replacement portfolio provides an energy value increase of **79%**, resulting in a net portfolio cost of **\$309M/year**

BPA Load Shaping Replacement Portfolio

All results in 2020\$

Resource Type	POI Capacity (MW)	Annualized Cost (\$M)	Annual Value of Energy (\$M)	March Energy (MWh)	May Energy (MWh)	August Energy (MWh)	December Energy (MWh)	Capacity Value (MW)	Number of Units Selected
DR	245	\$1	\$0	-	-	-	-	245	11
Mkt - Off Peak	300	\$22	\$20	74,400	74,400	74,400	74,400	-	3
Mkt - On Peak	300	\$57	\$52	148,800	148,800	148,800	148,800	300	3
PV	880	\$65	\$61	158,326	229,895	256,343	111,380	62	4
PV+BESS	50	\$11	\$4	9,547	14,162	15,861	6,886	15	1
WT	1,209	\$118	\$83	395,329	296,730	200,077	275,533	206	4
WT+BESS	500	\$79	\$31	154,136	104,609	64,549	110,161	175	1
Candidate Resource Portfolio	3,484	\$353	\$251	940,538	868,597	760,029	727,158	1,002	16 (+11 DR)
LSR Dams			\$182	622,636	712,982	759,315	726,755	1,000	
Constraint Ratio			1.375	1.511	1.218	1.001	1.001	1.002	

- **The optimal replacement portfolio determined by our in-house tool is comprised of 16 replacement resources totaling a 3,484 MW nameplate capacity**
 - ❖ Winter & summer monthly energy constraints and capacity constraints represent the binding factors in portfolio selection
 - ❖ Portfolio represents a balanced selection between solar and wind energy resources, supplemented by DR and block market purchases
- **The BPA Load Shape sensitivity shows the lowest level of excess energy**
- **Replacement portfolio provides an energy value increase of 38%, resulting in a net portfolio cost of \$284M/year**

BPA Net Position Replacement Portfolio

All results in 2020\$

Resource Type	POI Capacity (MW)	Annualized Cost (\$M)	Annual Value of Energy (\$M)	March Energy (MWh)	May Energy (MWh)	August Energy (MWh)	December Energy (MWh)	Capacity Value (MW)	Number of Units Selected
DR	221	\$0	\$0	-	-	-	-	221	7
Mkt - Off Peak	300	\$22	\$20	74,400	74,400	74,400	74,400	-	3
Mkt - On Peak	300	\$57	\$52	148,800	148,800	148,800	148,800	300	3
PV	646	\$40	\$37	100,636	137,475	151,837	68,675	45	8
PV+BESS	650	\$77	\$49	124,105	184,111	206,192	89,512	195	2
WT	1,415	\$165	\$109	430,492	360,530	256,449	412,535	241	6
Candidate Resource Portfolio	3,532	\$362	\$267	878,434	905,316	837,678	793,922	1,002	22 (+ 7 DR)
LSR Dams			\$182	687,516	313,134	788,033	793,739	1,000	
Constraint Ratio			1.463	1.278	2.891	1.063	1.000	1.002	

- **The optimal replacement portfolio determined by our in-house tool is comprised of 22 replacement resources totaling a 3,532 MW nameplate capacity**
 - ❖ Late-Summer & Winter monthly energy constraints and capacity constraints represent the binding factors in portfolio selection
 - ❖ Portfolio represents a balanced selection between solar and wind energy resources, supplemented by DR and block market purchases
- **The BPA Net Position portfolio is energy-long in spring months when hydro runoff is at its peak**
- **Replacement portfolio provides an energy value increase of 47%, resulting in a net portfolio cost of \$277M/year**



Technical Appendices

- Replacement Candidates and Assumptions
- Replacement Portfolio Details
- **Ramping Analysis Methodology and Results**

Ramping Analysis: Base Replacement Portfolio

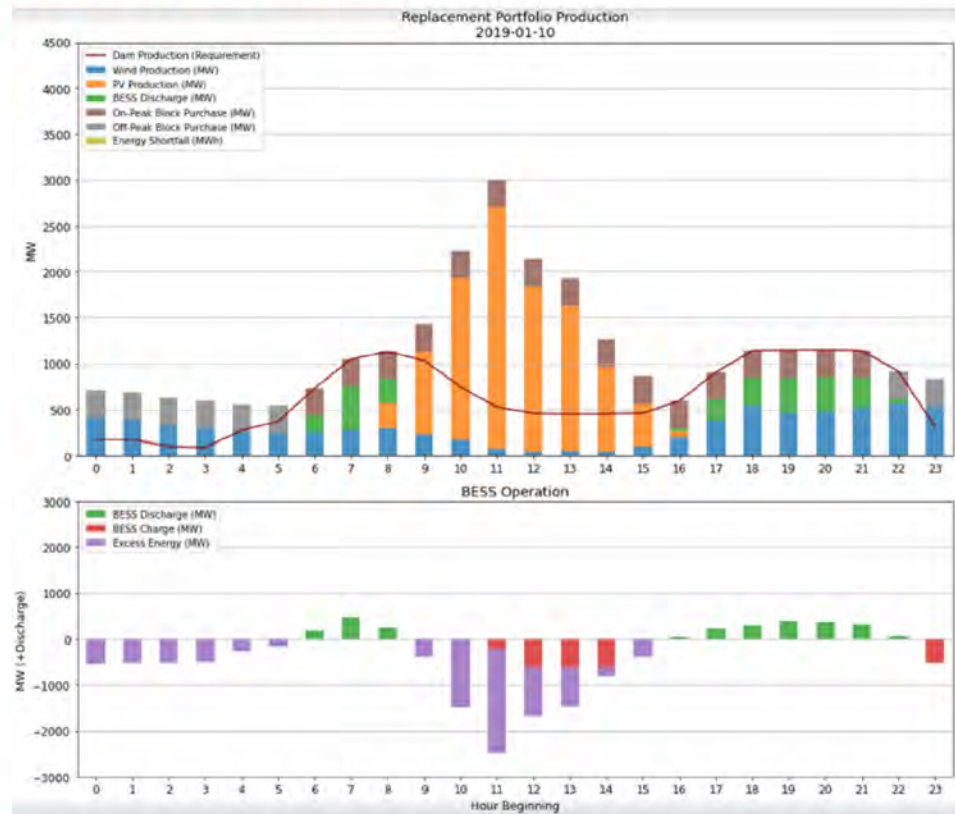
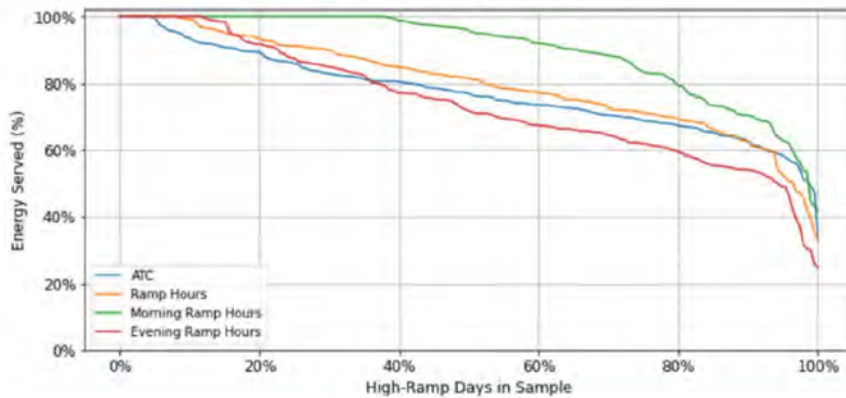
(600 MW BESS)

• **Observations:**

- ❖ For this sample day, addition of 625 MW to BESS allows replacement portfolio to match dam production
- ❖ BESS discharge critical to morning/evening ramp

• **Average RH Energy Served: 80% (Viable)**

Energy Served in "High Ramp Days"



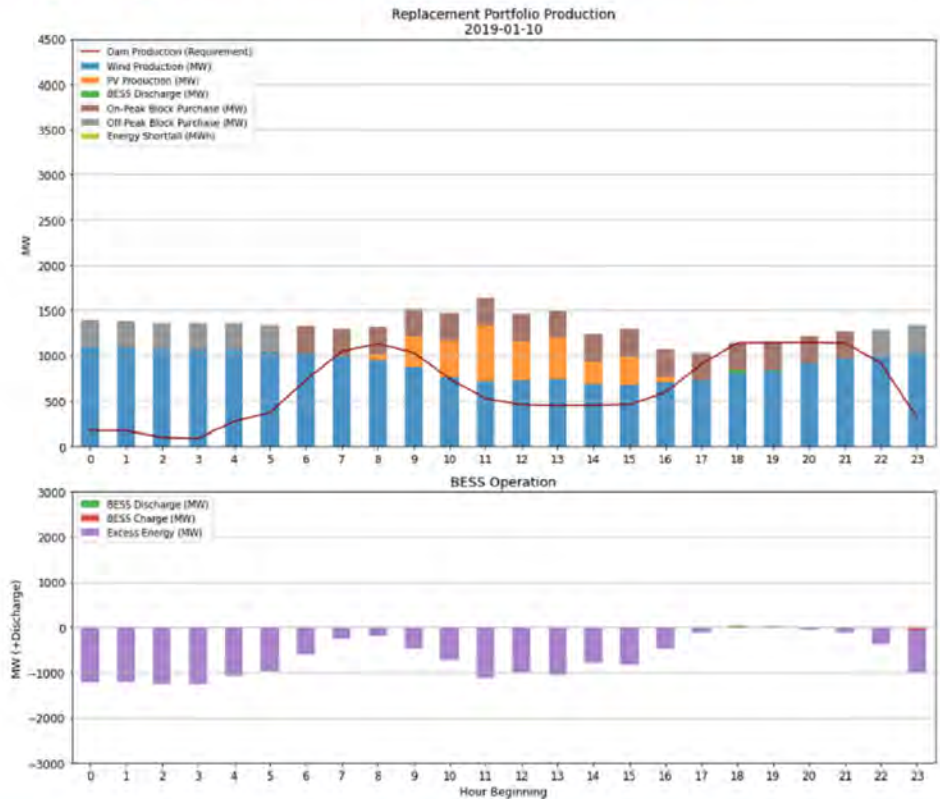
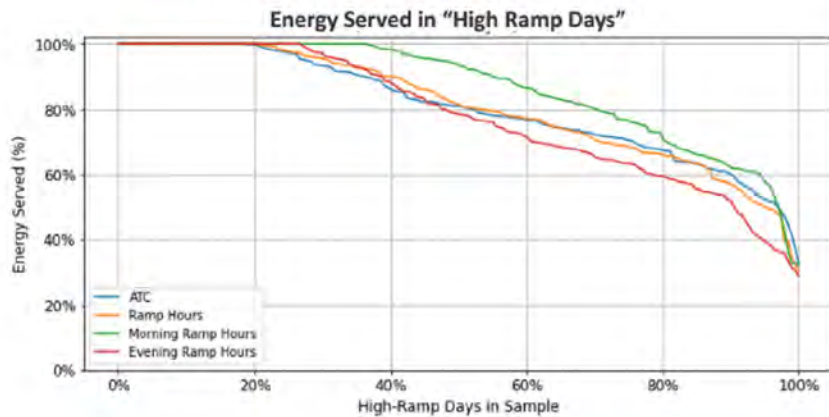
Ramping Analysis: BPA Load Shaping Sensitivity Portfolio

(300 MW BESS)

- Observations:**

- ❖ In this sample day, wind power provides around-the-clock power that meets a majority of dam energy
- ❖ Implementation of 300 MW of battery storage into the portfolio drastically improves ramp-hour energy served for a majority of high ramp days

- Average RH Energy Served: 81% (Viable)**



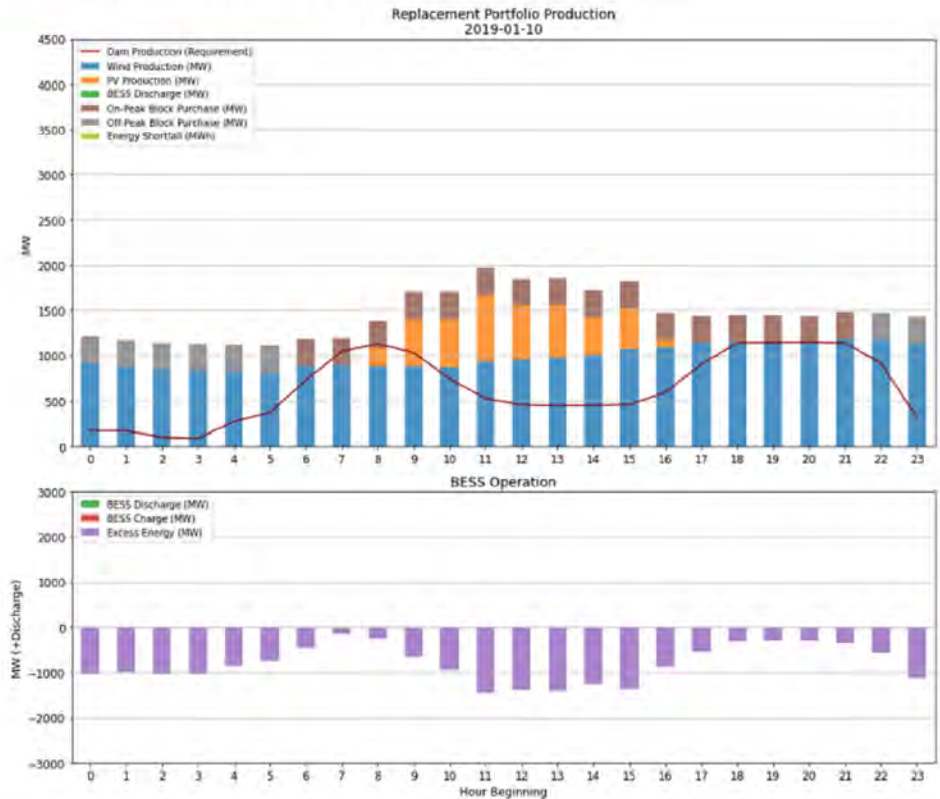
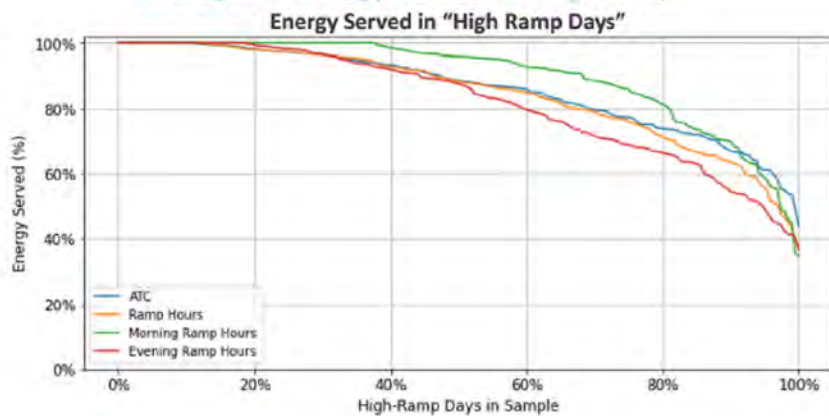
Ramping Analysis: BPA Net Position Sensitivity

(200 MW BESS)

• **Observations:**

- ❖ In this sample day, wind power provides around-the-clock power that meets a majority of dam energy
- ❖ Implementation of 200 battery storage into the portfolio drastically improves ramp-hour energy metrics for a majority of high ramp days

• **Average RH Energy Served: 85% (Viable)**



From: Johnson,G Douglas (BPA) - DK-7
Sent: Friday, July 8, 2022 2:33 PM
To: Scruggs,Joel L (BPA) - DK-7; Baskerville,Sonya L (BPA) - AIN-WASH; Leary,Jill C (BPA) - LN-7; Armentrout,Scott G (BPA) - E-4; Zelinsky,Benjamin D (BPA) - E-4; Goodwin,Summer G (BPA) - DKS-7; Godwin,Mary E (BPA) - LN-7; Koehler,Birgit G (BPA) - PG-5
Cc: Troiano, Charisma L; Mayorga, David
Subject: Clearing Up story on Council meeting cancelation

BPA Postpones Presentation on Potential LSRD Output Replacement

Dan Catchpole

A highly anticipated public presentation of a BPA-commissioned study on replacing the output from the four lower Snake River dams and other contributions to the power grid was unexpectedly cancelled on short notice.

The consultant that performed the study, Energy and Environmental Economics, was scheduled to share the results with the Northwest Power and Conservation Council on July 7. Late on July 6, the Council cancelled the virtual meeting, whose only agenda item was the presentation.

BPA and the Council agreed to reschedule the presentation to during the NWPCC's July 12 meeting in Spokane, Wash.

"E3's presentation to the Council on analysis of potential replacement resources and costs for the lower Snake River dams is being rescheduled," BPA spokesman Doug Johnson told Clearing Up on July 7. "We continue to coordinate with other federal agencies and officials on the broader release plan for the presentation and final study. We expect to have more information next week."

Johnson did not clarify which agencies and officials are coordinating with BPA. The White House Council on Environmental Quality held talks on the future of dams around the Northwest in 2021 and earlier this year.

The request to postpone came directly from BPA Administrator and CEO John Hairston, said NWPCC Executive Director Bill Edmonds.

"It was a reasonable request, so in consultation with [NWPCC] Chair [Guy] Norman, we've made the change," Edmonds said in an email to Clearing Up.

Scheduling is usually done directly with whoever is coming to make a presentation, Council staff member Chad Madron said.

The late cancellation caught Council members by surprise.

"I'm eager to hear what E3 has to say," said Council member Jeff Allen, who represents Idaho.

Idaho Gov. Brad Little, has publicly said the four dams provide too many benefits to the power grid, agriculture, transportation and recreation to remove.

"As a Council member, I follow my governor's lead," Allen said.

A [draft report](#) commissioned by two of Washington state's top elected officials—Gov. Jay Inslee and Sen. Patty Murray (D-Wash.)—said removing the dams is the best hope to save four Snake River salmonid species on the Endangered Species Act list. The report also said replacing the dams' contributions to the power grid would cost between \$10.3 billion and \$27.2 billion ([CU No. 2059 \[10\]](#)).

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Wednesday, May 25, 2022 8:47 AM
To: James, Eve A L (BPA) - PG-5; Koehler, Birgit G (BPA) - PG-5
Cc: Armentrout, Scott G (BPA) - E-4
Subject: E3 key messages

Importance: High

Hi Eve and Birgit – I'll follow up with a meeting if needed

Basically, we need to answer:

- What we are replacing
- How much it costs
- How long it will take

Those answers need to be right up front, easy to find, and not buried in any other narrative such as greenhouse gases, etc.

Here is more detail on those three questions:

- State **EXACTLY** what we are replacing. It's not 2,000 aMW, it's **3,483 of nameplate capacity**.
- State the costs, and be specific (We are the experts – narrow the cost to what is actually going to happen, not a big speculative range which raises more questions than it answers)
 - State **upfront costs** (not a wide range – get more specific like the Simpson Plan does)
 - State the **cost per year** that occur after the up front costs (not a wide range – get more specific)
- State **how long** it will take to replace the lost capacity of the four lower Snake River dams
- State **ALL of the ancillary services we are replacing** and the cost to replace each one of them
 - Voltage control \$XXX
 - Reactive power \$XXX
 - Black start \$XXX
 - Et cetera....

Katie Pruder Scruggs
Environmental Communication Specialist
Bonneville Power Administration
503-230-3111
(b)(6)

From: Koehler,Birgit G (BPA) - PG-5
Sent: Monday, July 11, 2022 9:42 PM
To: Zimmerman,Ryan J (BPA) - DKD-7
Cc: James,Eve A L (BPA) - PG-5; Habibi,Maryam A (BPA) - DKP-7
Subject: E3 report for posting, part 1
Attachments: E3 BPA LSR Dams_071122.pdf

Tracking:

Recipient

Recall

Zimmerman,Ryan J (BPA) - DKD-7

Failed: 7/12/2022 5:10 AM

James,Eve A L (BPA) - PG-5

Failed: 7/12/2022 7:17 AM

Habibi,Maryam A (BPA) - DKP-7

Failed: 7/12/2022 7:17 AM

Ryan,

I received the presentation from E3 at 5:15 pm with a note that they are still working on the report. I told them to not work all night, but take the time to QC. We need it by morning. Now it is 9:30 pm, and they are apparently still working on the report. I may go to bed soon and opt to get up early in time for you to have it by 5:30 am. If something comes up and we don't have the report in the morning, I suggest posting the presentation and writing a short note below it that the report will be posted shortly. However the going plan is still have both in your hands before 5:30 am.

For starters, here is the PDF of the presentation.

And then I am to send the link to the Council (Chad and Jennifer). I imagine I should send the link that you sent me earlier, which will have both included. We could send them two links for the presentation and report as an alternative. Thoughts?

[Hydropower Impact - Bonneville Power Administration \(bpa.gov\)](https://www.bpa.gov)

Birgit

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Tuesday, May 31, 2022 2:49 PM
To: James, Eve A L (BPA) - PG-5; Koehler, Birgit G (BPA) - PG-5
Subject: FW: LayPersonPPT 5 26 morning (before getting E3 copy back).pptx

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Friday, May 27, 2022 8:00 AM
To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: LayPersonPPT 5 26 morning (before getting E3 copy back).pptx

Here is some draft language to consider for the "E3 analysis not changing the decision" key message for the E3 study PPT.

Do the conclusions in the independent E3 analysis provide information that would **change the decision** in the Columbia River System Environmental Impact Statement Record of Decision?

- No. In fact, the E3 study **confirms the decision**, as well as provides updated information to show a more accurate picture of the energy landscape.
- Policy decisions and legislation in the region are having a very real-world effect to the amount of resources available to provide firm capacity to avoid power shortages. Specifically, fossil-fuel based resources, such as coal plants, are being removed. This is happening now.
- The E3 study also considers the availability of emerging technology in future scenarios. Even considering emerging technology such as battery storage, the **region would face power shortages if the four lower Snake River dams are breached**, given the path towards deep carbonization of the energy sector.

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, May 27, 2022 7:31 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: LayPersonPPT 5 26 morning (before getting E3 copy back).pptx

Great- thanks Katie!

From: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Friday, May 27, 2022 7:30 AM
To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: LayPersonPPT 5 26 morning (before getting E3 copy back).pptx

Yes, I guess not changing the decision is the bottom line. I can help with writing the message for the slide, if you like.

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, May 27, 2022 7:29 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: LayPersonPPT 5 26 morning (before getting E3 copy back).pptx

I know today is an early out so if we don't get it before then we'll worry about the materials on Tuesday. Aaron was working on them yesterday but I'll see if I can get an estimated time. Today I'll work with Rob on putting together a slide on how the E3 results compare with the results in the CRSO EIS to show they wouldn't change our decision on the alternative that was selected. Jill thinks that is important to include in the materials.

From: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Friday, May 27, 2022 7:23 AM
To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: LayPersonPPT 5 26 morning (before getting E3 copy back).pptx

OK, sounds good. When are you expecting that?

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, May 27, 2022 7:23 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: LayPersonPPT 5 26 morning (before getting E3 copy back).pptx

Thanks Katie- I'll forward along when we get the materials back from E3.

From: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Friday, May 27, 2022 6:43 AM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: LayPersonPPT 5 26 morning (before getting E3 copy back).pptx

Howdy and happy Friday! I was helping Ben Z with a PowerPoint that was due yesterday afternoon, so I wasn't able to address this at all. Do I have any follow up actions, or is there anything I can do to help with this today?

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, May 26, 2022 4:27 PM
To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: LayPersonPPT 5 26 morning (before getting E3 copy back).pptx

I don't think I captured anything that you both don't have already in email, but figured I'd send this on in case I'm not working tomorrow.

Birgit

From: Koehler,Birgit G (BPA) - PG-5
Sent: Wednesday, July 6, 2022 2:42 PM
To: Arne Olson
Subject: FW: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

FYI, we have until morning to get the slides to the Council

And I'm still waiting for clearance at my end.

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Wednesday, July 6, 2022 2:39 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Jennifer Light <JLight@NWCouncil.org>
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Cool, no worries! I just hadn't heard from him at all so I was worried he was perhaps not seeing my traffic. I appreciate you confirming. Even slides by 8am is ok if that is what needs to happen!

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, July 6, 2022 2:34 PM
To: Chad Madron <CMadron@NWCouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Chad,

Sorry for the delay. Yes, the slides are still being reviewed. I will do my utmost to make sure you get them in plenty of time for the meeting.

Birgit

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Wednesday, July 6, 2022 2:32 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: [EXTERNAL] FW: Memo/Background for Members ahead of July 7 E3 presentation for this Wed

Hi Birgit,

I haven't heard at all from Arne. Are you all still in edit mode on slides and such?

From: Chad Madron
Sent: Wednesday, July 6, 2022 10:10 AM
To: Ryan J (BPA) - PGPR-5 Egerdahl - BPA (<rijeerdahl@bpa.gov> <rijeerdahl@bpa.gov>; Arne Olsen (<arne@ethree.com> <arne@ethree.com>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; <bgkoehler@bpa.gov>
Cc: Jennifer Light - Northwest Power and Conservation Council (<JLight@NWCouncil.org> <JLight@NWCouncil.org>;

Kendra Coles (kcoles@nwcouncil.org) <kcoles@nwcouncil.org>

Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Good morning Arne and BPA folks,

Just a reminder that it is our preference for you to send slides shown tomorrow morning to me ahead of time - then I use our computer to present them, but give you "keyboard and mouse control" so you can advance them using your equipment. This makes it so you don't have to worry about presenting from your machine. If you are very comfortable presenting from your computer directly we can accommodate that, we just find we have more consistent results if we do it the other way as different folks have differing levels of comfort with different webinar technologies.

Thanks!

Chad

(b)(6)

From: Chad Madron

Sent: Monday, June 27, 2022 10:48 AM

To: Ryan J (BPA) - PGPR-5 Egerdahl - BPA (rjegerdahl@bpa.gov) <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Cc: Jennifer Light - Northwest Power and Conservation Council (JLight@NWCouncil.org) <JLight@NWCouncil.org>; Kendra Coles (kcoles@nwcouncil.org) <kcoles@nwcouncil.org>

Subject: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Ryan, Eve, and Arne,

I am working with Jenn on pulling together a memo and any other background material we can for Members ahead of the July 7 presentation on BPA's Snake River Dams study that is at 8:30am Pacific.

Can you confirm who from BPA and E3 will officially be presenting/speaking? Arne, I know you are giving the main presentation. Is there a report exec summary or any slides we could include with the memo to help them prepare? We will be sending them the prep memo THIS Wed by the middle of the day. Any info you can help us provide to help them be prepared is appreciated.

For July 7 – I will make sure you three all have calendar invites and panelist email/invites for the webinar.

Arne – speakers generally appear on camera, but it is not required. Our preference is for you to send me your slides and then I use our computer to present them, but give you "keyboard and mouse control" so you can advance them using your equipment. This makes it so you don't have to worry about presenting from your machine. If you are very comfortable presenting from your screen directly we can accommodate that, we just find we have more consistent results if we do it the other way as different folks have differing levels of comfort with different webinar technologies.

You should all get the GoToWebinar emails today! Those will have your UNIQUE entry links for the webinar. You will get the emails again 1 day and 1 hour before the meeting as reminders.

From: Koehler,Birgit G (BPA) - PG-5
Sent: Wednesday, July 6, 2022 4:47 PM
To: Baskerville,Sonya L (BPA) - AIN-WASH
Subject: FW: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

FYI, per Jill's direction, I contacted Council staff.

From: Koehler,Birgit G (BPA) - PG-5
Sent: Wednesday, July 6, 2022 4:46 PM
To: 'Jennifer Light' <JLight@NWCouncil.org>; Chad Madron <CMadron@NWCouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Jennifer and Chad,

I have some news for you, not the presentation you have been waiting for.

The E3 presentation to the Council tomorrow will **likely** be canceled. The current plan is to delay one week, potentially to the full Council meeting, but this still needs to be confirmed and coordinated. The Council Chair has already been contacted and is aware.

Should it turn out that we are delaying the presentation, is there availability on the agenda for July 12 or 13th? I'll also need to check with Arne Olson at E3 if he is available. For now, I've just given him the same alert that we are likely but not yet confirmed about delaying.

Sorry about all the swirl,
Birgit

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Wednesday, July 6, 2022 3:27 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Chad Madron <CMadron@NWCouncil.org>
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Fantastic. Thanks for confirming.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, July 6, 2022 3:27 PM
To: Jennifer Light <JLight@NWCouncil.org>; Chad Madron <CMadron@NWCouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hello Jennifer,

Yes, that's the current plan. There is still some coordination on our side, but unless you hear from me, please introduce Arne and pass it off to him. We engaged them to do an independent study, and so are happy to let them present independently.

Cheers,
Birgit

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Wednesday, July 6, 2022 3:24 PM
To: Chad Madron <CMadron@NWCouncil.org>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: [EXTERNAL] RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Birgit,

One more quick question. I just want to confirm the plan for the morning. My understanding is that it is Bonneville's preference that I just introduce Arne for the topic and him just diving right in, rather than first handing it off to someone at Bonneville to introduce him. I just want to make sure that I pass it to the right person.

Thanks!
Jennifer

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Wednesday, July 6, 2022 2:39 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Jennifer Light <JLight@NWCouncil.org>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Cool, no worries! I just hadn't heard from him at all so I was worried he was perhaps not seeing my traffic. I appreciate you confirming. Even slides by 8am is ok if that is what needs to happen!

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To: Ryan J (BPA) - PGPR-5 Egerdahl - BPA (rjegerdahl@bpa.gov) <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; bgkoehler@bpa.gov

Cc: Jennifer Light - Northwest Power and Conservation Council (JLight@NWCouncil.org) <JLight@NWCouncil.org>; Kendra Coles (kcoles@nwcouncil.org) <kcoles@nwcouncil.org>

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Good morning Arne and BPA folks,

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Thanks!

Chad

(b)(6)

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Sent: Monday, June 27, 2022 10:48 AM

To: Ryan J (BPA) - PGPR-5 Egerdahl - BPA (rjegerdahl@bpa.gov) <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Cc: Jennifer Light - Northwest Power and Conservation Council (JLight@NWCouncil.org) <JLight@NWCouncil.org>; Kendra Coles (kcoles@nwcouncil.org) <kcoles@nwcouncil.org>

Subject: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Hi Ryan, Eve, and Arne,

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From: Koehler,Birgit G (BPA) - PG-5
Sent: Thursday, June 9, 2022 10:26 AM
To: Diffely,Robert J (BPA) - PGPL-5; Egerdahl,Ryan J (BPA) - PGPR-5
Subject: FW: Proposed Public roll out of E3

FYI, related to my earlier email

From: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Thursday, June 9, 2022 9:08 AM
To: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Cc: Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Sweet,Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Leady Jr,William J (BPA) - PG-5 <wjleady@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>
Subject: Proposed Public roll out of E3

All – discussion this morning – we are proposing to offer a presentation of the E3 study to the Northwest Power and Conservation Council - Power Committee. This would be our public release plan. The next scheduled meeting is July (2nd week) – though we could offer a special meeting if they want it earlier. This closes the loop on release to the public in a specific forum plus honors our commitment to the council to share this study. We could inform CEQ that this is the release plan and they can offer that info to those wishing for the results. This is just a proposal and we welcome feedback. Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C (b)(6)



From: Baskerville, Sonya L (BPA) - AIN-WASH
Sent: Wednesday, July 13, 2022 12:15 PM
To: Zelinsky, Benjamin D (BPA) - E-4; Koehler, Birgit G (BPA) - PG-5; James, Eve A L (BPA) - PG-5; Leary, Jill C (BPA) - LN-7; Godwin, Mary E (BPA) - LN-7
Subject: FW: Potential response to PPC letter (DRAFT)

Hey there. I thought we already had talking points for the E3 study that we had worked with DOE?

Sonya Baskerville
BPA National Relations
(b)(6) m

From: Scruggs, Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>
Sent: Wednesday, July 13, 2022 2:57 PM
To: Hairston, John L (BPA) - A-7 <jlhairston@bpa.gov>; Cook, Joel D (BPA) - K-7 <jdcook@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <lbaskerville@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James, Daniel M (BPA) - D-7 <dmjames@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Johnson, G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:g djohnson@bpa.gov)>
Subject: Potential response to PPC letter (DRAFT)

PPC's claims of interference by CEQ will draw some interest and we will likely get calls from Clearing Up and potentially others. While I don't think we should address those claims head on, it's an opportunity to emphasize key takeaways from the E3 study since those findings are being overshadowed. We can also put some focus on the clean energy aspect. Here are some draft statements to consider. If we're comfortable providing a response, it might be safer to have it attributed to me or Maryam.

Please review these draft statements and provide your feedback.

"E3's study elevates our understanding of the complexities and costs involved in exploring replacement resources to the Lower Snake River dams. Given that Bonneville's utility customers and Northwest electric ratepayers would bear these costs through significantly higher rates, it's critical that the latest analysis of power supply options, projected costs and impacts are available and fairly presented alongside other information."

"We respect and appreciate the commitment of so many groups and leaders in this regional dialogue about long-term strategies that prioritize the protection and enhancement of salmon and steelhead. Ultimately, the region as a whole must continue to advance collaborative solutions while also preserving critical and essential services and purposes that the Northwest public, economy and society rely on."

"The demand for low-cost, dependable, clean energy is only increasing. From a practical standpoint, there simply aren't any realistic replacement options available today or in the foreseeable future that wouldn't increase carbon dioxide emissions, raise electricity bills for millions of Northwest residents and make our power grid less reliable. These are compelling impacts that federal officials and the entire should not ignore."

Joel Scruggs (He/Him)
Director of Communications | Communications (DK)
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-5511 | C (b)(6)



From: Armentrout,Scott G (BPA) - E-4
Sent: Tuesday, May 31, 2022 10:57 AM
To: Pruder Scruggs,Kathryn M (BPA) - E-4; Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5; Zelinsky,Benjamin D (BPA) - E-4
Subject: FW: Transmission considerations for E3 study

fyi

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C(b)(6)



From: Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>
Sent: Tuesday, May 31, 2022 10:24 AM
To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Shaheen,Richard L (BPA) - T-DITT-2 <rishaheen@bpa.gov>
Subject: Transmission considerations for E3 study

Scott,

I think we should strongly consider a separate slide on Transmission considerations from the BPA as part of the E3 presentation.

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Wednesday, May 25, 2022 8:20 AM
To: James, Eve A L (BPA) - PG-5; Koehler, Birgit G (BPA) - PG-5
Subject: FW: suggestions to make E3 study less technical for lay audience 5 24.pptx

Howdy. Let me know how I can help with this – for version control, I feel like you guys still own the master.

I think you guys are doing a great job of addressing Scott's (really good) input, and I'm here to help in any way I can.

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Wednesday, May 25, 2022 8:18 AM
To: Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Subject: RE: suggestions to make E3 study less technical for lay audience 5 24.pptx

I think the point is that while we are removing resources from the grid, load is increasing (replacing carbon emitting things with electric things) so the problem is exacerbated. I'll work with Birgit and Eve on this. They own the master and have sent it to E3, so I'll coordinate with them.

From: Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Wednesday, May 25, 2022 8:08 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Subject: RE: suggestions to make E3 study less technical for lay audience 5 24.pptx
Importance: High

Katie, here is another example I find confusing on our messaging:

- Policies and laws to decarbonize the region will **increase electricity use** (electric cars, replacing gas appliances, etc.)

This is on the conclusion and summary slide. To me this is a filler and not a fact about replacing the services of the LSRDs (so interesting but more a comment than a conclusion). Example the next two bullets:

- Acquiring replacement resources could require **building new renewable resources at an unprecedented rate.**
 - This would also require building transmission to bring the power from new resources to utilities (E3 one of your slides had current resource build rate for NW- maybe add that here?)
 - Replacing the dams comes at a **substantial cost** for new resource replacement

- This would have a meaningful impact on the rates of Bonneville Power Administration's public power customers.

To me, the conclusions of these two bullets are key – yet they also lack detail. Add in parens after substantial cost THE substantial number. Define unprecedented rate as flagged in the parens. Make this real stuff..... Finally on a conclusion slide I would be looking for something as an outsider that bottom lined what it would take, i.e,

\$\$ XXX Billion would be needed up front
\$\$ XX Billion more per year for so many years
Years to construct replacement transmission
ETC

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C (b)(6)



From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Tuesday, May 24, 2022 4:52 PM

To: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Subject: RE: suggestions to make E3 study less technical for lay audience 5 24.pptx

FYI- here's the version Birgit and I are sending to E3. Doug Johnson in communications who works on most of the LSN dam public reports we send out was also interested in helping with the narrative so I sent along to him as well. We'll see what they send back.

Thanks,
Eve

From: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>

Sent: Tuesday, May 24, 2022 2:26 PM

To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Subject: RE: suggestions to make E3 study less technical for lay audience 5 24.pptx

10-4. Nice work!

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Tuesday, May 24, 2022 2:25 PM

To: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Subject: RE: suggestions to make E3 study less technical for lay audience 5 24.pptx

Birgit and I are coordinating a few more edits so we'll keep the pen for now. Thanks for your help Katie!

From: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>

Sent: Tuesday, May 24, 2022 2:24 PM

To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: suggestions to make E3 study less technical for lay audience 5 24.pptx

Wow, that looks great. Do you want me to clean it up or are you good to go?

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, May 24, 2022 1:00 PM
To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: suggestions to make E3 study less technical for lay audience 5 24.pptx

Here's a pass at simplifying a little and pulling information up front. With the slide I put in the front not sure if we need the NWECC study slide- maybe put that in the appendix? Not sure E3's thoughts of addressing NWECC directly in their independent study slide deck and if not we should think about what a BPA response to the NWECC study might be.

From: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Tuesday, May 24, 2022 11:32 AM
To: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: suggestions to make E3 study less technical for lay audience 5 24.pptx

The way I am thinking about it is what question did we try to answer here. How much does it cost to fully replace all the services provided by the LSRDs? That should be up front. Then – here are the services we are talking about. Then – here is what they would cost to replace. The rest of the info is how we got to that number. Scott

SCOTT G ARMENTROUT
Executive Vice President, Environment, Fish & Wildlife, SES | E-4
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-3076 | C (b)(6)



From: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Tuesday, May 24, 2022 11:29 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: RE: suggestions to make E3 study less technical for lay audience 5 24.pptx

Should we keep the very high level summary and call it "key takaways" and have a separate "executive summary" slide with more details?

On May 24, 2022 11:12 AM, "Armentrout,Scott G (BPA) - E-4" <sgarmentrout@bpa.gov> wrote:
There is an awful lot of background info in here. The executive summary stuff is way too general. A couple thoughts – highlight the services we are talking about – power generation, reserves, ancillary services, black start capability, reg up, reg down etc. How much do these dams have and how much is it going to cost to replace them? Bottom line upfront. We don't want the viewer to have to extract anything – straight up. Anyway, I know this is difficult – however we need to work on it more. Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C (b)(6)



From: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>

Sent: Tuesday, May 24, 2022 9:59 AM

To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Cc: Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>

Subject: suggestions to make E3 study less technical for lay audience 5 24.pptx

Importance: High

Scott – this is FYI only. Eve and Birgit will likely have edits so this is still draft. However, I do welcome your comments at any point in the process.

Eve and Birgit – Here’s my first take on this. I’m available to continue working with you, but I need to be offline for a few hours over lunchtime for a personal errand. I will, however, have my BPA phone and will take calls and I’ll be back at my post this afternoon.

Katie Pruder Scruggs

Environmental Communication Specialist

Bonneville Power Administration

503-230-3111

(b)(6)

From: James,Eve A L (BPA) - PG-5
Sent: Wednesday, May 25, 2022 11:12 AM
To: Wisner, Ryan (CONTR); Capanna, Steve
Cc: Koehler,Birgit G (BPA) - PG-5
Subject: Fast action request for information
Attachments: InfoNeededforSlides.pptx

Importance: High

Deliberative; FOIA exempt

Attached are some very rough draft slides that we are preparing for CEQ and other briefings. Most of the information will come from E3 but there may be some transmission grid pieces that you will be able to provide. The green boxes are where we were thinking DOE might have expertise in this area.

Thanks,
Eve James

From: Armentrout, Scott G (BPA) - E-4
Sent: Tuesday, July 12, 2022 7:25 AM
To: Scruggs, Joel L (BPA) - DK-7; Baskerville, Sonya L (BPA) - AIN-WASH; Hairston, John L (BPA) - A-7; Koehler, Birgit G (BPA) - PG-5; Zelinsky, Benjamin D (BPA) - E-4; Leary, Jill C (BPA) - LN-7; Godwin, Mary E (BPA) - LN-7; Habibi, Maryam A (BPA) - DKP-7
Subject: From the CEQ website

[Federal Agencies Announce Two New Analyses to Help Inform Restoration of Columbia River Basin Salmon and Long-Term Energy Planning in the Pacific Northwest | The White House](#)

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife. SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C(b)(6)



What it would take to replace the output of breaching the four lower Snake River dams

- What are we losing?
 - 3,483 MW of nameplate capacity
 - Peaking capability of **more than 2,000 MW** to avoid power shortages during cold weather events
- How much would it cost to replace benefits of the four lower Snake River dams?
 - Upfront costs: up to \$XXX **E3 would need to fill in these numbers. first number is construction, second is O&M and fuel? Use S1**
 - Total cost per year after that: \$XX.
 - These costs could quadruple with aggressive carbon reduction policies absent commercially available technology breakthroughs
- Rate impacts to Public Power Customers
 - Could increase public power costs by up to 65%
 - Could raise residential electricity costs by up to \$850 per year
- How long would it take to replace the services from breaching the four lower dams?
 - XXX years **E3 would need to fill in these numbers, including transmission**

DOE: could you estimate transmission timeline?

	Nameplate Capacity (MW)*
Lower Granite	930
Little Goose	930
Lower Monumental	930
Ice Harbor	693
Total = 3,483	

What it would take to replace the output of breaching the four lower Snake River dams

- What are the services we need to replace, and what is the cost of each?

- Energy:
 - Instantaneous and sustained capacity :
 - Reserve carrying capacity:
 - Fast ramping:

These costs are included in model results XX MW.XXS from previous slide

- Transmission grid reliability services:
 - Voltage and reactive power: XXX MW for \$XXX
 - Frequency and inertial response: XXX MW for \$XXX
 - Blackstart capability: XXX MW for \$XXX
 - Short-Circuit and Grounding Contribution: XXX MW for \$XXX
 - Voltage and Frequency Excursion Ride-Through : XXX MW
 - Participation in Remedial Action Schemes: XXX MW for \$XXX

Can DOE provide cost estimate for this? This is example text so feel free to take out MW or \$ and give order of magnitude if the costs won't move the needle.

Plant	Nameplate Capacity (MW)*
Lower Granite	930
Little Goose	930
Lower Monumental	930
Ice Harbor	693
Total = 3,483	

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Thursday, May 26, 2022 6:38 AM
To: Koehler, Birgit G (BPA) - PG-5; James, Eve A L (BPA) - PG-5
Subject: Input from Scott

Importance: High

Input from Scott – I have a noon deadline for something I’m working on with Ben Zelinsky, so I have to multi task, but I’ll be available to talk. Can you guys try to track his request down?

From: Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Thursday, May 26, 2022 6:35 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: lay-person ppt
Importance: High

I like the first slide. The area that talks about cost per year – is it bounded, i.e. forever or for a certain amount of years? Starting and ending when? I wonder what the fuel limited capacity is? Surely there is number produced in the data – maybe we can find that number and just use the factual number? So if it EVER produced 3000 or more megawatts, we just say it has generated UP TO XXXX MW with the nameplate capacity of..... Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

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From: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Wednesday, May 25, 2022 4:21 PM
To: Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: FW: lay-person ppt

Hi Scott,

This is an iterative process -- here is where we are now. Eve has sent this to E3 so they can start tracking down some of the requests. We will find out on Thursday if we need this by Friday, and we are doing our best to stay on top of it.

Let me know if this is more of what you are looking for. I have a personal commitment for this evening that I can’t get out of, but I’m available first thing in the morning to discuss. I can be available very early.

Katie Pruder Scruggs
Environmental Communication Specialist
Bonneville Power Administration
503-230-3111
(b)(6)

From: Hairston,John L (BPA) - A-7
Sent: Monday, July 18, 2022 8:05 AM
To: Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5; Armentrout,Scott G (BPA) - E-4
Cc: Zelinsky,Benjamin D (BPA) - E-4; Godwin,Mary E (BPA) - LN-7; Leary,Jill C (BPA) - LN-7
Subject: Interagency briefing on E3 study and salmon report

Thanks Scott,

I am heading to Hood River for customer meeting and will likely miss this meeting. I think it is best to let E3 handle the discussion and we weigh in on an as needed basis. You are on point in my absence.

Thanks
John

On Jul 18, 2022 6:33 AM, "Armentrout,Scott G (BPA) - E-4" <sgarmentrout@bpa.gov> wrote:
I was not asked about this but it appears to be scheduled. I would prefer E3 do the talking on the study if possible – but since it is today I have no idea what was planned or expected. Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

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From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Wednesday, May 25, 2022 10:07 AM
To: James, Eve A L (BPA) - PG-5; Koehler, Birgit G (BPA) - PG-5
Subject: LayPersonPPT 5 25.pptx
Attachments: LayPersonPPT 5 25.pptx

From: Godwin, Mary E (BPA) - LN-7
Sent: Friday, June 17, 2022 4:39 PM
To: Koehler, Birgit G (BPA) - PG-5; Pruder Scruggs, Kathryn M (BPA) - E-4; James, Eve A L (BPA) - PG-5; Armentrout, Scott G (BPA) - E-4
Cc: Cooper, Suzanne B (BPA) - P-6; Leady Jr, William J (BPA) - PG-5; Zelinsky, Benjamin D (BPA) - E-4
Subject: Next steps on BPA deck

Just wanted let you all know that DOE shared the E3 PowerPoint with CEQ. I thought the additional points were helpful so I shared those as well.

Thanks,
Mary

On Jun 17, 2022 7:01 AM, "Armentrout, Scott G (BPA) - E-4" <sgarmentrout@bpa.gov> wrote:
Good morning. Sounds like Eve is going to get final deck from E3 and we will lock down their presentation to council soon. My feeling is we could revamp our "response deck" into more of key talking points and maybe some supporting info (that supports their conclusions like the cold snap graphs). Anyway, our new deadline is prior to the public appearance of the deck. Katie is back and can assist. I really appreciate what you guys did for the deck to make it successful yesterday! Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

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Title slide

What it would take to replace the output of removing the four lower Snake River dams

- What are we replacing?
 - 3,483 MW of nameplate capacity
- How much would it cost to replace 3,483 of nameplate capacity?
 - Total cost per year: \$XXX
 - Upfront costs after that: \$XXX
- How long would it take to replace the 3,483 of lost capacity from removing the four lower Snake River dams?
 - XXX years
- What are the services we need to replace, and what is the cost of each?
 - Energy: XXX MW for \$XXX
 - Instantaneous and sustained capacity : XXX MW for \$XXX
 - Reserve carrying capacity: XXX MW for \$XXX
 - Fast ramping: XXX MW for \$XXX
 - Voltage and reactive power: XXX MW for \$XXX
 - Frequency and Inertial response: XXX MW for \$XXX
 - Blackstart capability: XXX MW for \$XXX
 - Short-Circuit and Grounding Contribution: XXX MW for \$XXX
 - Voltage and Frequency Excursion Ride-Through: XXX MW for \$XXX
 - Participation in Remedial Action Schemes: XXX MW for \$XXX

Plant	Nameplate Capacity (MW)*
Lower Granite	930
Little Goose	930
Lower Monumental	930
Ice Harbor	693
Total = 3,483	

How much does it cost to replace Lower Snake River Dam capabilities?

- Replacing the carbon-free energy, capacity, and operational benefits of the dams requires investment in new resources at increased total system costs
- Costs range between over \$400 million to nearly \$2 billion per year depending on available technologies and carbon reduction policies
 - Could increase public power costs by 8% (best case scenario with emerging tech) to 85%
 - Could raise residential electricity costs by ~\$100–850 per year
- The above cost estimates do not include replacement of **all essential transmission reliability** services such as voltage, reactive power, inertia, black start, etc...
- New replacement resources and transmission take a long time to develop... E3 please rephrase or add any timeline info

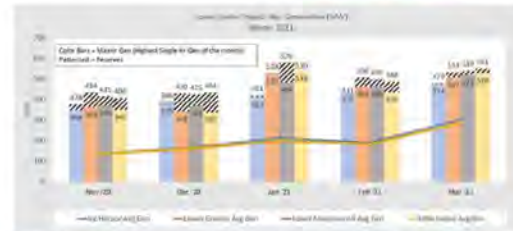
Incremental LSR Dam Replacement Resources	
Scenario	2040-2050 Dam Costs (Mill \$)
S0: No Policy (Reference)	207
S1: 100% Clean-Retail Rates (No carbon price)	377
S1a: 100% Clean-Retail Rates (with carbon price)	370
S1b: 100% Clean-Retail Rates (with carbon price)	302
S2: Deep Decarb. w/ Emerging Tech	1,038
S2a: Deep Decarb. w/ Emerging Tech	2,088
S2b: Deep Decarb. w/ Emerging Tech	2,088
S2c: Deep Decarb. w/ Emerging Tech	2,088
S2d: Deep Decarb. w/ Emerging Tech	2,088
S2e: Deep Decarb. w/ Emerging Tech	2,088
S2f: Deep Decarb. w/ Emerging Tech	2,088
S2g: Deep Decarb. w/ Emerging Tech	2,088
S2h: Deep Decarb. w/ Emerging Tech	2,088
S2i: Deep Decarb. w/ Emerging Tech	2,088
S2j: Deep Decarb. w/ Emerging Tech	2,088
S2k: Deep Decarb. w/ Emerging Tech	2,088
S2l: Deep Decarb. w/ Emerging Tech	2,088
S2m: Deep Decarb. w/ Emerging Tech	2,088
S2n: Deep Decarb. w/ Emerging Tech	2,088
S2o: Deep Decarb. w/ Emerging Tech	2,088
S2p: Deep Decarb. w/ Emerging Tech	2,088
S2q: Deep Decarb. w/ Emerging Tech	2,088
S2r: Deep Decarb. w/ Emerging Tech	2,088
S2s: Deep Decarb. w/ Emerging Tech	2,088
S2t: Deep Decarb. w/ Emerging Tech	2,088
S2u: Deep Decarb. w/ Emerging Tech	2,088
S2v: Deep Decarb. w/ Emerging Tech	2,088
S2w: Deep Decarb. w/ Emerging Tech	2,088
S2x: Deep Decarb. w/ Emerging Tech	2,088
S2y: Deep Decarb. w/ Emerging Tech	2,088
S2z: Deep Decarb. w/ Emerging Tech	2,088

E3 would need to take out scenarios not used in public deck for this table

Lower Snake River Dam capabilities

- Lower Snake River Dams are ~10% of the Northwest hydro capacity and provide **low cost**, reliable, **carbon-free energy**, and high flexibility
- Provide **more than 2,000 MW** of sustained peaking capabilities during the winter
- Provide a quarter of Bonneville's current reserves holding capability which is **important for integrating variable generating resources** such as wind and solar.
- Also provide **essential transmission reliability** services such as voltage, reactive power, inertia, black start, etc...

Plant	Nameplate Capacity (MW)	Cost*
Lower Granite	930	E3 need to delete "All-in" since it doesn't include a few other BPA program costs
Little Goose	930	\$15.71
Lower Monumental	930	\$12.58
Ice Harbor	693	\$15.84
Total =		3,483 MW
		Avg = \$17/MWh



<https://www.bpa.gov/-/media/About/Publications/news-releases/20210616-pr-08-21-lower-snake-river-dams-provide-critical-energy-and-reserves-in-winter-2021.pdf>

Confidential, predecisional, FDM, exempt

Do we need to explain Capacity, energy, nameplate capacity?

Doug Johnson- thoughts on this for lay readers? Birgit thinks this is needed to ground reader

Transition to next slide- study that E3 conducted sustained capacity was the most critical replacement needed from power perspective particularly for multi-day winter cold weather events

About this study

- E3 conducted an independent analysis of replacing the power output from the four lower Snake River dams in the context of Pacific Northwest resource requirements.
- BPA contracted E3 to conduct the study, which includes independent analysis about the value of the four lower Snake River dams to the Northwest energy system, including the **cost** and **resource requirements** for replacement.
- This study takes a regional view of electricity supplies and uses E3's RESOLVE electricity planning model to optimize electricity resource requirements for the Northwest through 2045.



What's new in this study compared to CRSO EIS

Updated resource pricing and included emerging technology. The study uses an optimizer to determine the least-cost replacement resources for the four lower Snake River dams subject to **reliability** and **policy** constraints.

- **Reliability example:** The E3 modelling considers multiple variables – not just cost. For example, the modelling considers how much capacity a resource actually has, and then prioritizes it based on its ability to provide reliable electricity when needed.
 - During extended cold-weather periods the wind isn't always blowing and the sun goes down at night
 - Even if those resources are the cheapest, the optimizer doesn't choose them because the capacity is not always available to provide power when needed
- **Policy example:** E3's modelling considers the effects of regional policy decisions and legislation to reduce carbon emissions
 - Includes aggressive clean energy laws which remove fossil fuel-based power resources from the grid all along the west coast (such as retiring coal plants)
 - Compounding the situation from removing fossil fuel resources, decarbonizing the region will result in increased electricity use in transportation and building heating/cooling

Maybe too much info but was trying to make the "reliability and policy constraints" language understandable to non-resource planners

Added from technical presentation since thought it added valuable context



Policy Landscape: Washington, Oregon, California







	RPS or Clean Energy Standard?	Coal Prohibition?	Cap-and-Trade?	New Gas?	Economy-Wide Carbon Reduction?
WA	✓ Carbon neutral by 2030, 100% carbon free electricity by 2045	✓ Eliminate by 2025	✓ Cap-and-invest program established in 2021, SCC in utility planning	✓ Does this mean new Natural Gas? Best to always be clear	✓ mission reduction below 1990 levels and achieve net zero emissions by 2050
OR	✓ 50% RPS by 2040, 100% GHG emission reduction by 2040, relative to 2010 levels	✓ Eliminate by 2030	✓ Climate Protection Plan adopted by DEQ in 2021 (power sector not included)	✗ HB 2021 bans expansion or construction of power plants that burn fossil fuels	✓ 90% GHG emission reduction from fossil fuel usage relative to 2022 baseline
CA	✓ 50% RPS by 2030, 100% clean energy by 2045	✓ Coal-fired electricity generation already phased out	✓	✗ CPUC IRP did not allow in recent procurement order	✓ 40% GHG emission reduction below 1990 levels by 2030 and 80% by 2050

Deliberative, predecisional, FDM, exempt

Modeling Step 1 is model scenarios without removing the lower Snake River dams, context of Pacific Northwest resource requirements in light of climate policies and changing resource mix from decarbonization/electrification

Or maybe add to Key modeling assumptions that

Key Modeling Assumptions

Element	Study Approach	Impact on Dams Replacement Needs
 Study Years	<ul style="list-style-type: none"> 2025 through 2045, including fuel price forecasts and declining renewable + storage costs 	Considers long-term needs
 Clean Energy Policy Scenarios	<ul style="list-style-type: none"> Aggressive OR+WA legislation reflected, including coal retirements + carbon pricing Two electric emissions scenarios considered: <ol style="list-style-type: none"> 100% clean retail sales (~85% carbon reduction*) Zero-emissions (100% carbon reduction) 	Clean energy policy requires long-term replacement of LSR dams with GHG-free energy
 Load Growth Scenarios	<ul style="list-style-type: none"> Two load scenarios: <ol style="list-style-type: none"> Baseline (per NWPOC 8th Power Plan) High electrification load growth (to support economy-wide decarbonization) 	Higher load scenarios increase the value of LSR dams energy + firm capacity
 Reliability Needs <small>DCM-E39 EAJ1</small>	<ul style="list-style-type: none"> Modeling ensures reliability needs during extreme conditions (e.g. high loads + low hydro) Captures ability (and limits) of renewables, battery storage, and demand response to support system reliability 	Reliability needs require replacement of LSR dams firm capacity contributions
 Consideration of Emerging Technologies	<ul style="list-style-type: none"> Broad range of dam replacement technology options considered: <ul style="list-style-type: none"> Baseline technologies: solar, wind, battery + pumped storage, energy efficiency, demand response, dual fuel natural gas + hydrogen combustion plants Sensitivities: <ul style="list-style-type: none"> Emerging technologies No New Combustion 	Technology available for LSR dams replacement determines cost + feasibility
 Distributed Energy Resource Options	<ul style="list-style-type: none"> Energy efficiency, demand response, and customer solar embedded into modeling inputs Additional energy efficiency and demand response can be selected 	Demand resource can help replace LSR dams, though low-cost supply is limited

* A 100% clean retail sales target allows emitters for electric generation beyond that needed to serve "retail sales", i.e. losses during transmission to retail loads and exported energy

Deliberative, pre-decisional, FOM, exempt

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Two clean energy scenarios – with different electricity use assumptions and emerging technology availability

Maybe call Load Growth "increased electricity use or demand"

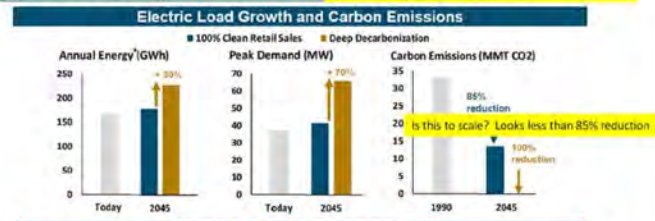
- Scenario 1: 100% Clean Retail Sales (S1)**
 - 100% of retail sales met with clean energy by 2045, ~85% carbon reduction
 - Business-as-usual load growth
 - Can be achieved using existing mature technologies

- Scenario 2: Deep Decarbonization**
 - Zero carbon emissions remain in 2045

Change text to "Electricity use increases to decrease carbon emissions from other sectors of the economy such as transportation and buildings" or something like that. "Economy-wide carbon abatement" seems too wonky

growth y-wide arios are key bon-

Emerging "Clean Firm" technologies



is this to scale? Looks less than 85% reduction

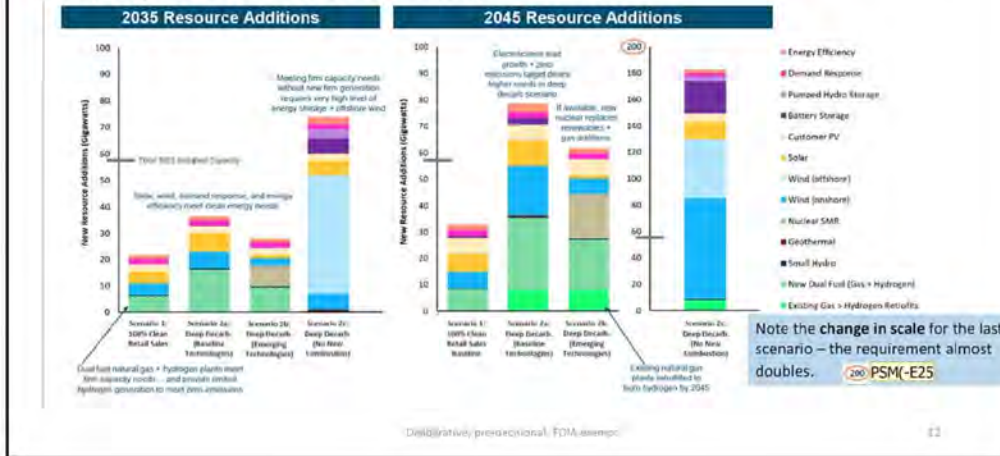
Emerging Technologies Considered

Technology	Description	S1 100% Clean	S2a Deep Decarb. Baseline	S2b Deep Decarb. Emerging Tech.	S2c Deep Decarb. No New Construction
Hydrogen (existing gas retrofits)	Burn green H ₂ in existing gas infrastructure				
Hydrogen (new dual fuel gas + hydrogen)**	Burn either natural gas or hydrogen in existing gas infrastructure				
Nuclear (small modular reactors)	Firm, dispatchable, using advanced technology				
Gas w/ Carbon Capture and Storage	Firm, dispatchable, 100% carbon capture				
Offshore Wind (floating)	High output w/ offshore waters				

For table use Natural Gas with carbon capture if that is what it means so not confused with other gases (hydrogen)
Also add check mark to green cells and X to red cells for color challenged folks

* Load based on 2021 MWPC Power Plan, shown as retail sales (after generation growth) in constant PV.
** Scenario 1: "dual fuel gas + hydrogen" but no hydrogen is utilized in that scenario

All scenarios show large levels of new resource additions for the region due to fossil-fuel plant retirements and increased electric demand (keeping lower Snake River dams)



Even before we consider taking out the four lower Snake River dams...

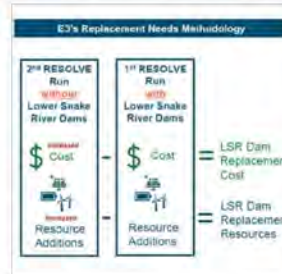
- Regional policy requirements and legislation to reduce emissions is removing resources fossil fuel resources from the grid. This is happening now.
- Consequently, with retiring coal and gas plants, the region is **already** facing resource adequacy issues.

Placeholder for
graphic showing
coal retirements

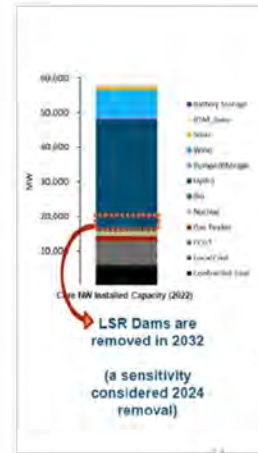
Replacing the lower Snake River dam capabilities

- RESOLVE model determines replacement needs and cost by optimizing regional requirements with the dams, and then again without the dams
- The model does not consider **essential reliability** services for the transmission grid, such as voltage, reactive power, inertia, black start, etc.
- The RESOLVE model shows that, without the four lower Snake River dams, the region will experience increased costs and increased requirement for resources.

Electric Grid Benefit	
GHG-free Energy Output (MWh)	GHG-free energy displaces the costs and carbon emissions of NW coal + gas generation or imported power
Reliable Capacity (MW)	Firm capacity contributions towards resource adequacy
Flexibility and Operating Reserves (MW)	Sub-hourly ancillary service provision and renewable integration benefits



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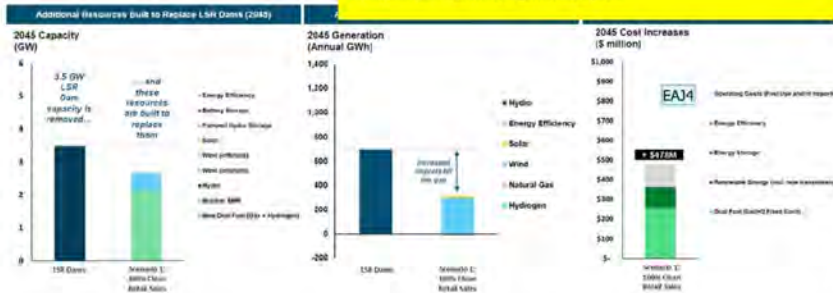


Scenario 1: 100% clean retail sales to replace lower Snake River dams

PSMR-E20
EAJ3 Bonneville's rates are structured to sell in long-term contracts the amount of electricity produced from a low water year since that can be assured. In average or high water conditions the system has additional power that Bonneville sells (often displacing fossil-fuel generators) to keep customer rates affordable.

- Capacity replaced with dual fuel natu
- Energy replaced by wind and net imp

Bullet point changes:
 - capacity replaced with 2,000 MW of dual fuel natural gas + hydrogen turbines and X GW wind
 - Wind and imports provide the most energy but the gas plant is needed for meeting winter cold weather events to avoid power shortages
 - E3 add bullet about Greenhouse gas emissions please



Scenario 2: deep carbonization/electrification (baseline technologies) to replace lower Snake River dams (does not eliminate all carbon emissions)

- + Capacity replaced w/ storage
- + Energy replaced by v

Bullet point changes:
 - This scenario includes electric use increases, for transportation and other sectors, however, natural gas is still permitted during high demand periods
 - Hydrogen generation is a key feature in this scenario and is assumed to be available, though it is not commercially available today
 - This scenario would cost \$860 million dollars per year, note high hydrogen fuel costs
 (the text in red is too small and wanted to highlight these points in the larger bullets)



U.S. Environmental Protection Agency (EPA)

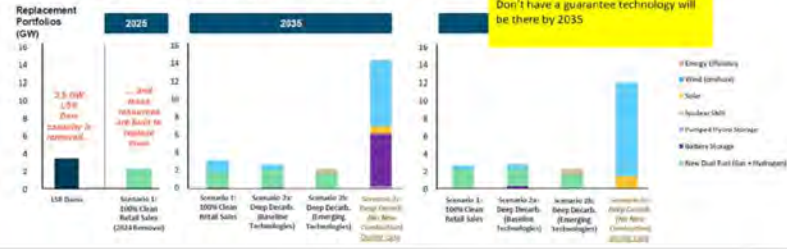
16

Comparing the scenarios: replacing four Lower Snake River dams' capacity

Capacity replacement for additional scenarios and years is shown below

- Scenario 1 (100% Clean Retail Sales, 2024 LSR Dam removal): similar to scenario 2b, but with hydrogen turbine replacement in 2025
- Scenario 2b (Deep Decarbonization, Emerging Technologies): small modular reactors, instead of additional wind power
- Scenario 2c (Deep Decarbonization, No New Combustion): very high replacement capacity to replace LSR dam firm capacity and zero-carbon energy output

Add to bullets: Scenario 1 does not eliminate carbon emissions, and scenario 2b still has natural gas and depends on emerging technologies that are not yet scalable commercially (let's not call 2c outlier, it's a bookend - if we want to get rid of carbon and don't have new technology this is what it looks like) Don't have a guarantee technology will be there by 2035



Deliberative, predecisional, FDM, exempt

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The cost of replacing power

- Replacing the greenhouse gas-free energy, capacity, and operational benefits of the dams requires investment in new resources at increased total system costs
 - Cost differences between scenarios driven by 2045 greenhouse gas ^{DSM-E26} energy replacement and the availability of "clean firm" emerging technologies ^{EA17}
- Costs are expected to fall on Bonneville Power Administration's public power customers
 - Could increase public power costs by 8% (best case scenario with emerging tech) to 65%
 - Could raise residential electricity costs by ~\$100–850 per year

	Total Costs	Annual Cost Increase			Incremental Public Power Costs (% increase vs. -6.5 cents/kWh NW average rates)
	2027 Net Present Value	2045	2058	2065	2065
Scenario 1: 100% Clean Retail Sales	\$1.3 billion	---	\$434 million	\$476 million	0.8 cents/kWh (+9%)
Scenario 1: 100% Clean Retail Sales (2014 dam renewal)	\$7.2 billion	\$495 million	\$466 million	\$500 million	0.8 cents/kWh (+9%)
Scenario 2a: Deep Decarb. (Scenario 1 technologies)	\$5.0 billion	---	\$466 million	\$883 million	1.5 cents/kWh (+18%)
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$1.0 billion	---	\$416 million	\$428 million	0.7 cents/kWh (+8%)
Scenario 2c: Deep Decarb. (No New Construction)	\$3.0 billion	---	\$1,003 million	\$1,188 million	3.5 cents/kWh (+55%)

Source: BPA

Notes:

- Cost increases account for replacement energy, capacity, and reserves as well as avoided LSR (capital) + expense, but do not include any costs for breaching the dams, which would be an additional cost.
- NPV and annual cost increase are shown for the Northwest Region as a whole, but the incremental costs are calculated relative to the BPA Tier 1 annual sales for public power customers.
- % increase versus average rates assumes OR + WA average retail rates are -6.5 cents/kWh. This does not exclude additional rate increases driven by higher loads or clean energy needs that increase regional rates as shown in the earlier DSM incremental cost chart.
- Annual residential customer cost impact assumes 1,200 kWh/month for average residential customers in Oregon and Washington (current ~1,000 kWh/month average + 20% from electrification load growth).

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Land use considerations

- Replacing the lost power with new resources would require roughly X acres (about X square miles) of land.

- Such a large build out of capacity would likely result in additional, but currently unknown impacts to natural and cultural resources, which may include vegetation, wildlife habitat, archeological resources, and traditional cultural properties (such as sites or land features that are important to tribes).

if possible to get this done, if not we can delete. Maybe Seattle map? Or LSN dam area? info to the right. Seattle is 142.55 square miles for reference (not sure if metro area). Different boxes to show how much of Seattle gets covered.

E3 can you do this or Doug can BPA comms folks do this?

PSM(-E7)



Year	E3						
	S0 No Policy	S1 100% Clean Retail Sales	S1a 100% Clean Retail Sales (no carbon price)	S2 - Deep Decarb	S2a1 - Deep no combust	S2a2 - Deep no gas	S2a3 - Deep Decarb emerging tech
Reliability Metric:	2035 PRM	2035 PRM	2035 PRM	2035 PRM	2035 PRM	2035 PRM	2035 PRM
Gas (MW)	2100	1800	2200	2000			3500 (42)
DR (MW)							
Solar (MW)			-500		1500	1600	
Batteries (MW)		100	100	200	6000	300	
Wind (MW)	200	1300		600	9400		600
Offshore Wind (MW)						18000	
Pumped Storage (MW)					300		
Conservation (MW)					10	10	
SMR (MW)							600
Wind (Sq Miles)	7.8	50.8	0.0	23.4	867.2	0.0	23.4
Offshore Wind (Sq Miles)						1204.4	
Solar (Sq Miles)		-1.3	0.0	0.0	4.0	4.3	0.0

Conclusion and summary

- The study considers two important factors in replacing power from the four lower Snake River dams:
 - Power must **provide firm capacity** (reliable energy that is available at all times) to avoid power shortages
 - Power must be **free of greenhouse gasses** to meet regional carbon policies
- Policies and laws to decarbonize the region will **increase electricity use** (electric cars, replacing gas appliances, etc.)
- Acquiring replacement resources could require **building new renewable resources at an unprecedented rate**.
 - This would also require building transmission to bring the power from new resources to utilities (E3 one of your slides had current resource build rate for NW- maybe add that here?)
- Replacing the dams comes at a **substantial cost** for new resource replacement
 - This would have a meaningful impact on the rates of Bonneville Power Administration's public power customers.
- The **availability of emerging technology** is a factor in achieving replacement resources that are free of greenhouse gasses and the pace of development is highly uncertain.

Deliberative, pre-decisional, FOIA exempt

20

- Loss of the four lower Snake River dams, or reductions in their flexibility, while there are still fossil fuel generators on the grid will increase the timeframe and costs associated with shifting to a carbon-free electricity sector.

We like highlighting this point as a closing statement but leave it to E3 to word or decide style wise how to incorporate

From: Zelinsky,Benjamin D (BPA) - E-4
Sent: Thursday, June 9, 2022 3:42 PM
To: Pruder Scruggs,Kathryn M (BPA) - E-4; Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5
Subject: RE: BPA E3 results takeaways slides

Thanks Katie.

Good reminder Birgit. I know we don't want to have a light touch on the E3 slides so am fine not including my comment, especially if they already fully describe that scenario and it's scenarios up front already. Will defer to you and Eve.

Ben

From: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Thursday, June 9, 2022 3:38 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: BPA E3 results takeaways slides

- I added a blue box to the slide and used Ben's words.
- I "chose" one of the map slides and deleted the other.
- I made a few small formatting nits.

This looks great! Good job landing it. 😊

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 9, 2022 3:22 PM
To: Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: BPA E3 results takeaways slides

Deliberative Process Privilege; FOIA-exempt.

I think we are suggesting it to E3 for their deck, but I didn't see it in ours, which now might be presented separately

From: Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Sent: Thursday, June 9, 2022 3:15 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: BPA E3 results takeaways slides

Deliberative Process Privilege; FOIA-exempt.

In keeping with our strategy of non-defensive objectivity, could we just in a matter of fact manner point out that the emerging technology scenario by definition relies on technologies that do not exist yet a scale and that the timing and availability of those technologies in the future is uncertain.

Or something like that – pretty sure you had a good bullet on that somewhere already.

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Sent: Thursday, June 9, 2022 2:34 PM

To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>

Subject: RE: BPA E3 results takeaways slides

Deliberative Process Privilege; FOIA-exempt.

I'm tempted to add a box on slide 4 that highlights our concern with the emerging technology. Seems especially important if we are putting the higher-cost, Joel-preferred one second. What do you all think? Keep? Rework?

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While it is conceivable to replace power benefits of the lower Snake River dams, it is expensive, lengthy and complex.

- **Expensive**
 - \$430 million to \$480 million per year for public power total without economy-wide decarbonization policies and with maturation of emerging technology, or up to \$2,000 million to \$3,200 million per year without maturation of emerging technology (all assuming paid for with debt financing)
 - \$100 per year per household without economy-wide decarbonization policies and with maturation of emerging technology or up to \$850 per year for each public power household
 - 2 million households affected
 - Potential environmental justice issue – lower income households would be disproportionately affected by increased costs because a larger portion of their income goes to the electric bill.
- **Lengthy**
 - **15 to 30 years total** for replacement resources – it is unknown where replacement resources will be located and how much transmission infrastructure would be needed.
 - Practically, likely 5 to 10 years for Congressional approval additional federal agency environmental compliance and Congressional appropriations
 - Roughly 5 years to replace the capacity resources
 - Realistically 15 to 20 years to build transmission, which includes providing compliance with the National Environmental Policy Act, siting, permits, etc., if no litigation on siting
- **Complex**
 - Policy requirements to reduce emissions are removing fossil fuel resources from the grid. Breaching the four lower Snake River dams significantly **adds to the deficit of resources** in the region.

Timeline and commercial viability of emerging technologies is uncertain

Acquiring replacement resources could require building new renewable resources at an unprecedented rate.

4
Deliberative, FOIA Exempt

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Thursday, June 9, 2022 2:17 PM

To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>

Subject: BPA E3 results takeaways slides

Deliberative, FOIA exempt

Attached is an updated slide deck of the BPA perspective on the E3 study results incorporating DOE feedback. Let me know if you have additional comments/edits. There is one slide that is duplicated- one version showing Seattle, and one showing map of LSN reservoirs- let me know which one looks better.

Thanks,
Eve

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, May 31, 2022 5:15 PM
To: James,Eve A L (BPA) - PG-5; Pruder Scruggs,Kathryn M (BPA) - E-4
Subject: RE: BPA bottom line perspective from the E3 study kps late afternoon.pptx

First cut: slides 1-4 come before E3.

Shorter version of slides 4(again) – 11 at the end.

Slide 10, the big quote we want to end with is not as noticeable in the gray box. I would make the font on the first two bullets smaller, font on the quote bigger and put it in a frame to stand out

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, May 31, 2022 5:11 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: BPA bottom line perspective from the E3 study kps late afternoon.pptx

Eve has a good point about the length. I think putting all our messages together first, then whittling down is the right approach.

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From: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
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Subject: BPA bottom line perspective from the E3 study kps late afternoon.pptx

Deliberative, FOIA Exempt

This version reflects our Tuesday afternoon edits plus a few little organizational suggestions from me.

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Sent: Wednesday, June 1, 2022 5:18 AM
To: Koehler, Birgit G (BPA) - PG-5; James, Eve A L (BPA) - PG-5
Subject: RE: BPA bottom line perspective from the E3 study kps late afternoon.pptx

OK, I can work on that this morning.

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To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
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From: Zelinsky,Benjamin D (BPA) - E-4
Sent: Thursday, June 2, 2022 2:03 PM
To: Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5
Subject: RE: BPA perspective on E3 study

That is all I have too. Sorry Eve.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 2, 2022 12:35 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Subject: RE: BPA perspective on E3 study

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Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: BPA perspective on E3 study

Deliberative, FOIA Exempt

Hi Ben (or Birgit)-

Do you have a copy of the ODOE analysis referred to in the table? I thought the ODOE compiled information from the CRSO EIS and NVEC and didn't have their own analysis but I can't find a copy of the slide deck.

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To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
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Ben

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SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

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From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
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To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Cc: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: BPA perspective on E3 study

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Good Morning Scott-

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Thanks,
Eve

From: James,Eve A L (BPA) - PG-5
Sent: Thursday, June 2, 2022 1:40 PM
To: Koehler,Birgit G (BPA) - PG-5; Zelinsky,Benjamin D (BPA) - E-4
Subject: RE: BPA perspective on E3 study

Deliberative, FOIA Exempt

Thanks Birgit- that was the one I was looking at that just pulled the results from NVEC and CRSO EIS- no new analysis or information on resource replacement (though they did confirm our concerns that decarbonization is very hard without them) so I'll take that one off the grid.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 2, 2022 12:35 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
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To: Armentrout,Scott G (BPA) - E-4 <sgarmtrout@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
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BONNEVILLE POWER ADMINISTRATION

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Subject: RE: BPA perspective on E3 study

You're good Katie!

From: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Thursday, June 2, 2022 1:18 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Subject: RE: BPA perspective on E3 study

How about this?

- Any consideration of dam breaching must be informed **best available information** on the objective **costs** associated with replacing the full capabilities of those dams, including:
 - Peaking capabilities
 - Transmission considerations
 - Reliability (ability to keep the lights on)
 - Land use
 - Affordability for homes and businesses
- Keep in mind that breaching, or reducing flexibility, while there are still fossil fuel generators on the grid will:
 - **Increase the time** for shifting to a carbon-free electricity sector
 - **Increase the costs** for shifting to a carbon-free electricity sector

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
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Ben, I do and I don't like your suggestion for the last slide. I like the message about best available information. (I'm tempted to throw something in there about timing, but that's not going to be a deal breaker for those wanting to breach.)

My vision for that last slide was to leave it as simple as possible, with just one sentence on there, which will stick with the viewer. Do you think there's a way to shorten your suggestion so we still get a simple final word in? I'm not seeing a succinct version readily, and maybe we decide to keep it as is.

Birgit

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Attachments: Oregon COUs - PNW Energy Landscape_Feb 2022.pdf

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Cc: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Subject: RE: BPA perspective on E3 study

Thanks – Ben and I were talking this morning. He probably will be contacting you to discuss how we want to describe this contextually with all the other studies. I.e. this is where the E3 study fits in to the NWECC, ODEQ, etc stuff out there. I will take a look at this..... Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

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From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Thursday, June 2, 2022 8:04 AM

To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>

Cc: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Subject: BPA perspective on E3 study

Deliberative, FOIA Exempt

Good Morning Scott-

Attached is a slide deck that has BPA's perspective on the E3 study- a big thanks to Katie and Birgit for all the great work! I am thinking these slides would go after E3's for takeaway messaging. There are a few places you will see red parentheses where we are waiting for some feedback from others before finalizing but want to get a sense from you if we are on the right track since we need to try and get the materials to DOE tomorrow. Let us know if you have any edits/comments.

Thanks,
Eve



Pacific Northwest Energy Landscape: *where we are today and where we are headed*

Adam Schultz
Lead, Electricity & Markets Policy Group



OREGON DEPARTMENT OF ENERGY

Leading Oregon to a safe, equitable, clean, and sustainable energy future.

Our Mission

The Oregon Department of Energy helps Oregonians make informed decisions and maintain a resilient and affordable energy system. We advance solutions to shape an equitable clean energy transition, protect the environment and public health, and responsibly balance energy needs and impacts for current and future generations.

What We Do

On behalf of Oregonians across the state, the Oregon Department of Energy achieves its mission by providing:

- A Central Repository of Energy Data, Information, and Analysis
- A Venue for Problem-Solving Oregon's Energy Challenges
- Energy Education and Technical Assistance
- Regulation and Oversight
- Energy Programs and Activities



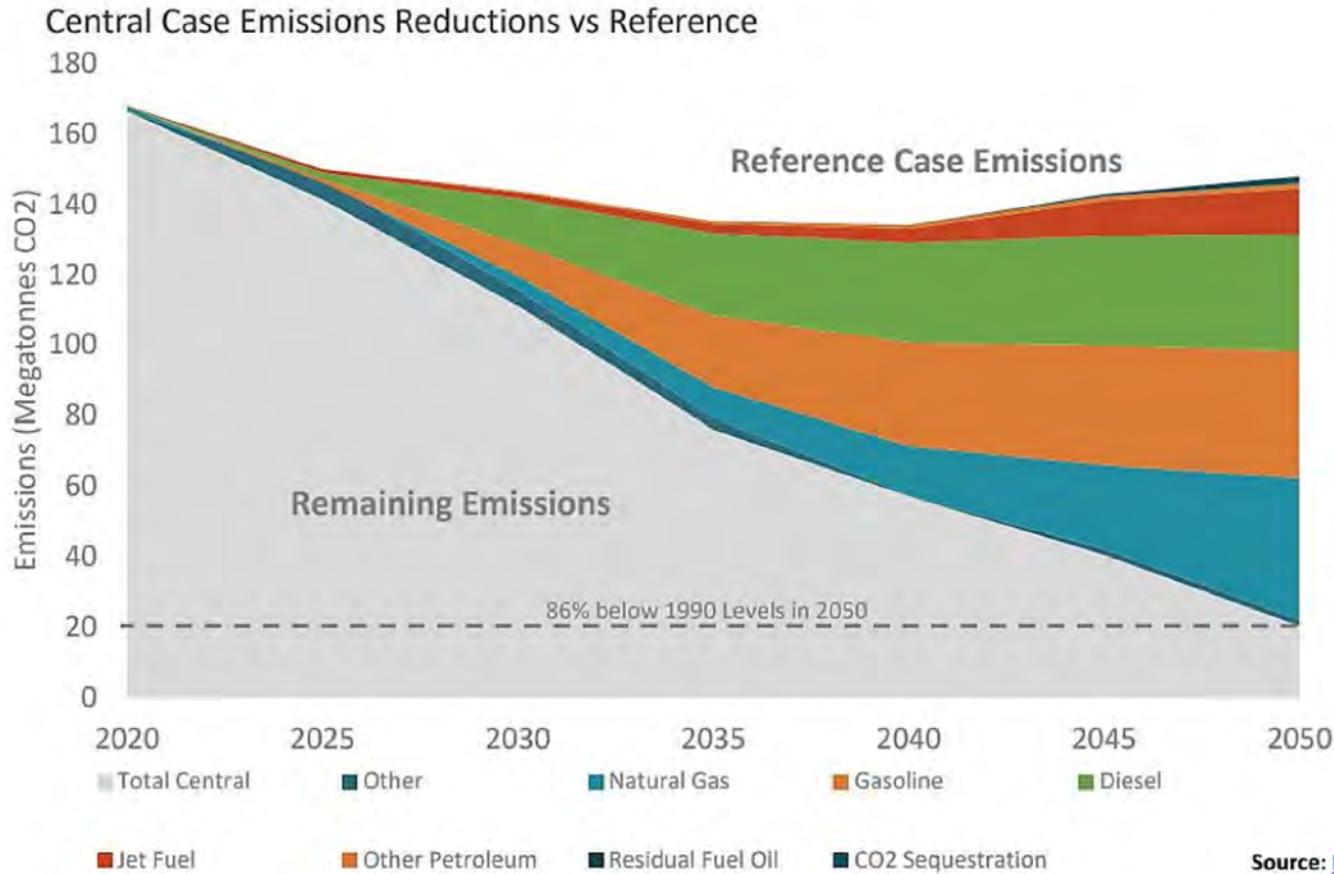
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GHG Reduction Targets: The Big Picture

Haystack Rock, Cannon Beach

3

Economy-wide Decarbonization in the PNW



Clean Energy
Transition Institute



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ENERGY
RESEARCH

Deep Decarbonization Pathways Study:

GHG emission reductions needed vs. reference case through 2050

Source: [Deep Decarbonization Pathways Study](#), p. 64

How do we get there?

Decarbonization Strategies

Clean Energy
Transition Institute



EVOLVED
ENERGY
RESEARCH

Deep Decarbonization Pathways Study:

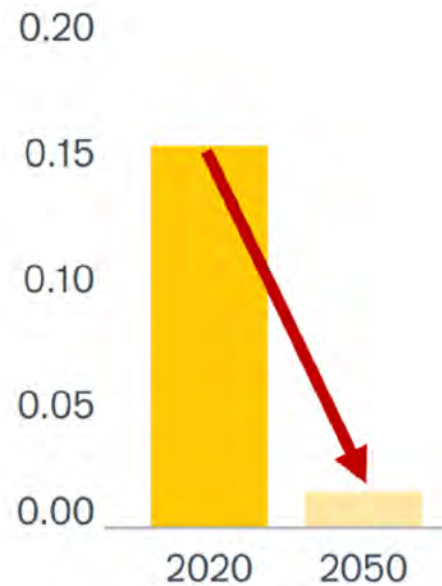
Five decarbonization strategies

- (1) Energy efficiency
- (2) **Electricity decarbonization**
- (3) Fuel decarbonization
- (4) **Electrification**
- (5) Carbon capture

Source: [Deep Decarbonization Pathways Study](#), p. 65

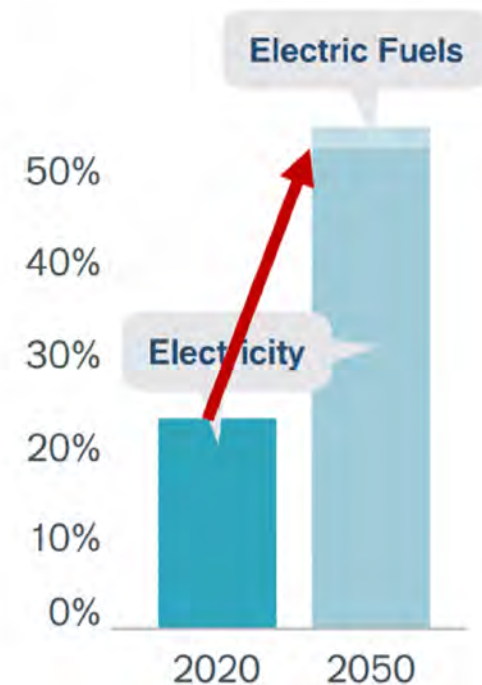
Electricity Decarbonization

Electricity Carbon Intensity (tonnes CO₂ per MWh)



Electrification

Electricity Share of Total Energy (percentage)





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Energy and Capacity

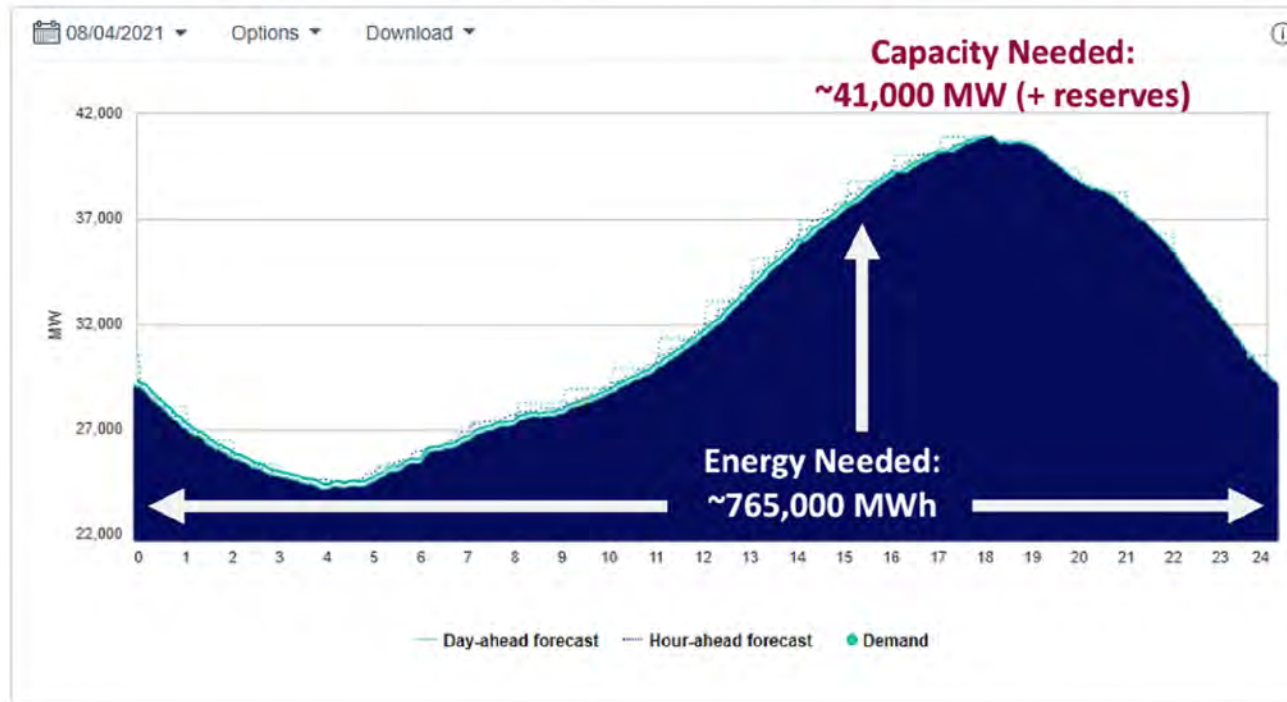


Mt. Angel Middle School | Mt. Hood

Energy vs. Capacity

Demand trend

System demand, in megawatts, compared to the forecasted demand in 5-minute increments.

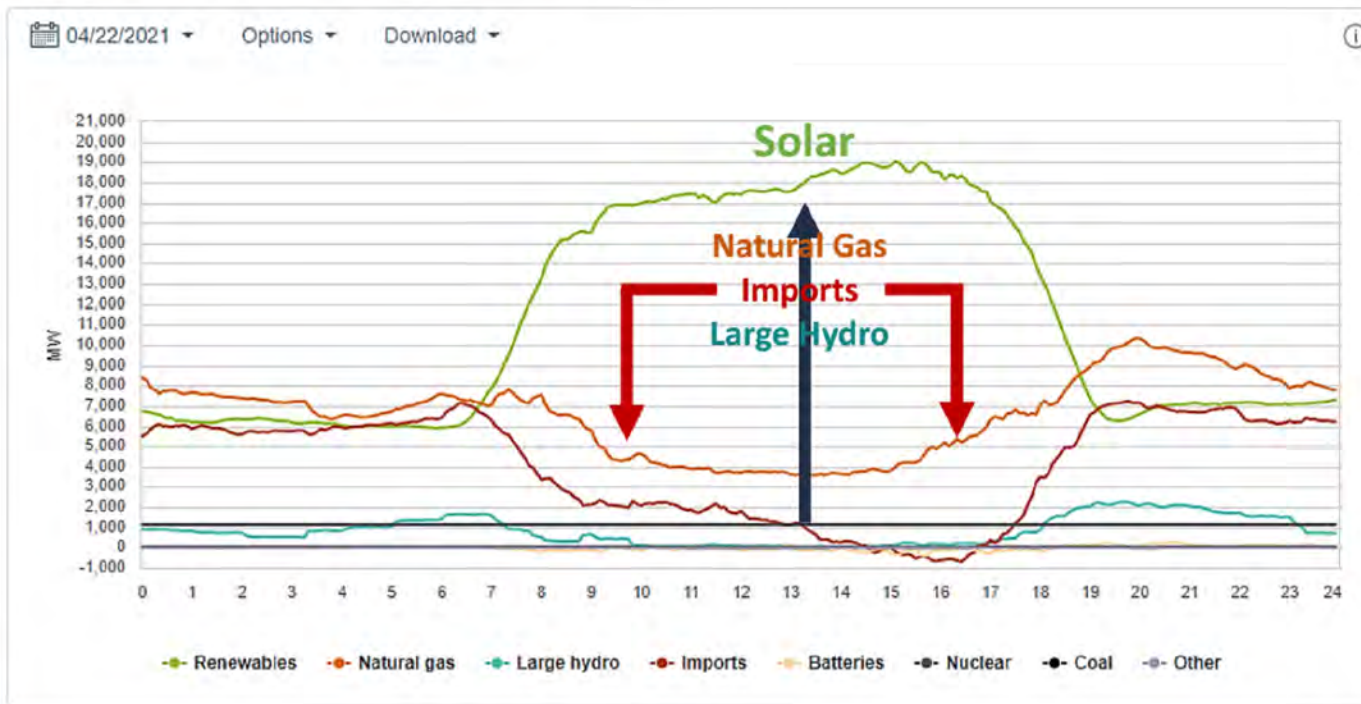


Source: [CAISO](#), Demand Trend, 08/04/2021

...plus Flexible Capacity

Supply trend

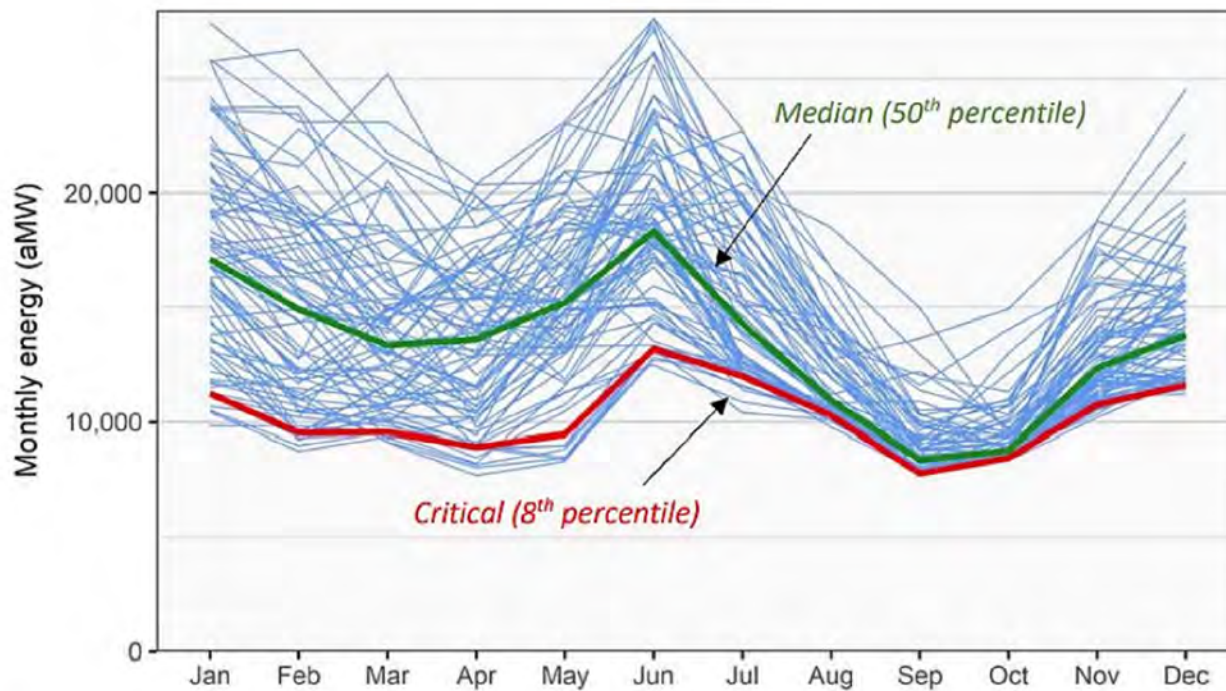
Energy in megawatts broken down by resource in 5-minute increments.



Source: [CAISO](#), Supply Trend, 04/22/2021

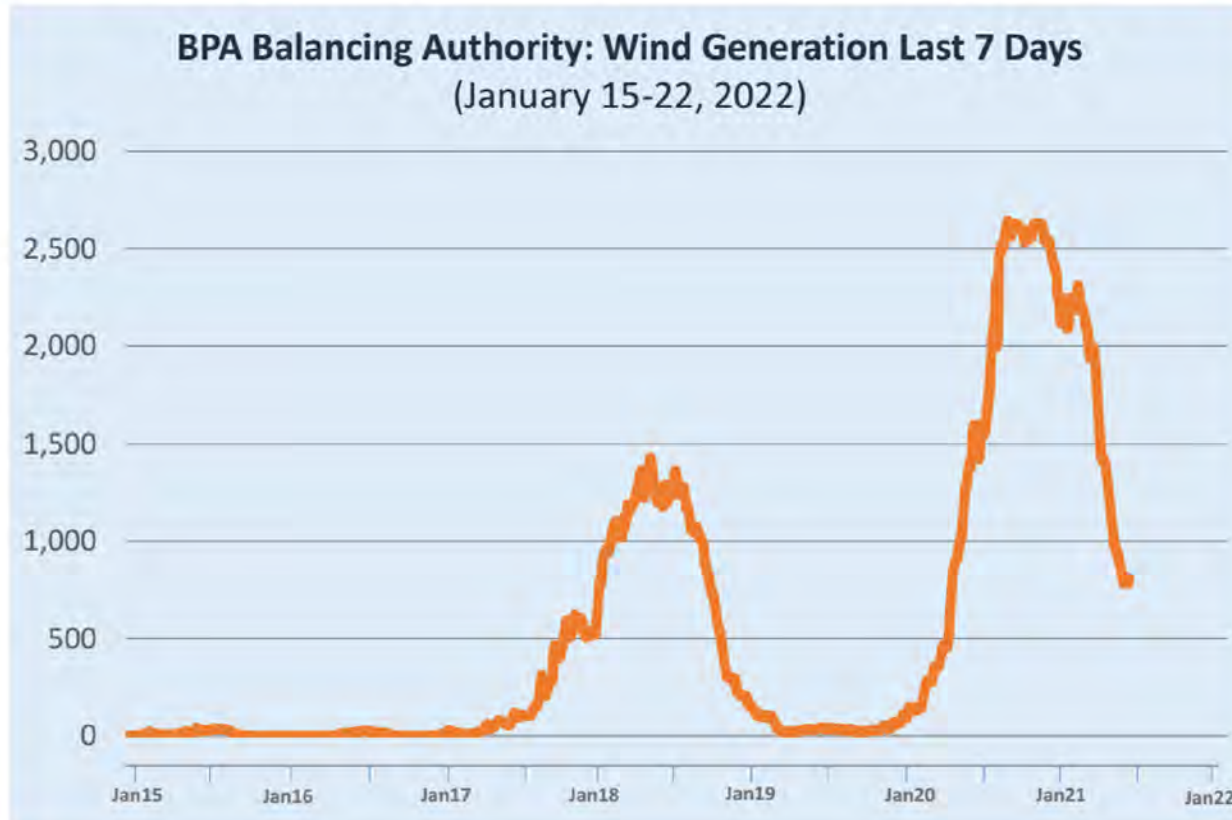
Annual Variability of Hydro Energy Output

Figure 12. 80 years of hydro generation



Source: [PNUCC](#), Fig. 12, p. 12

Daily Variability of Wind Energy Output



Source: [BPA](#)



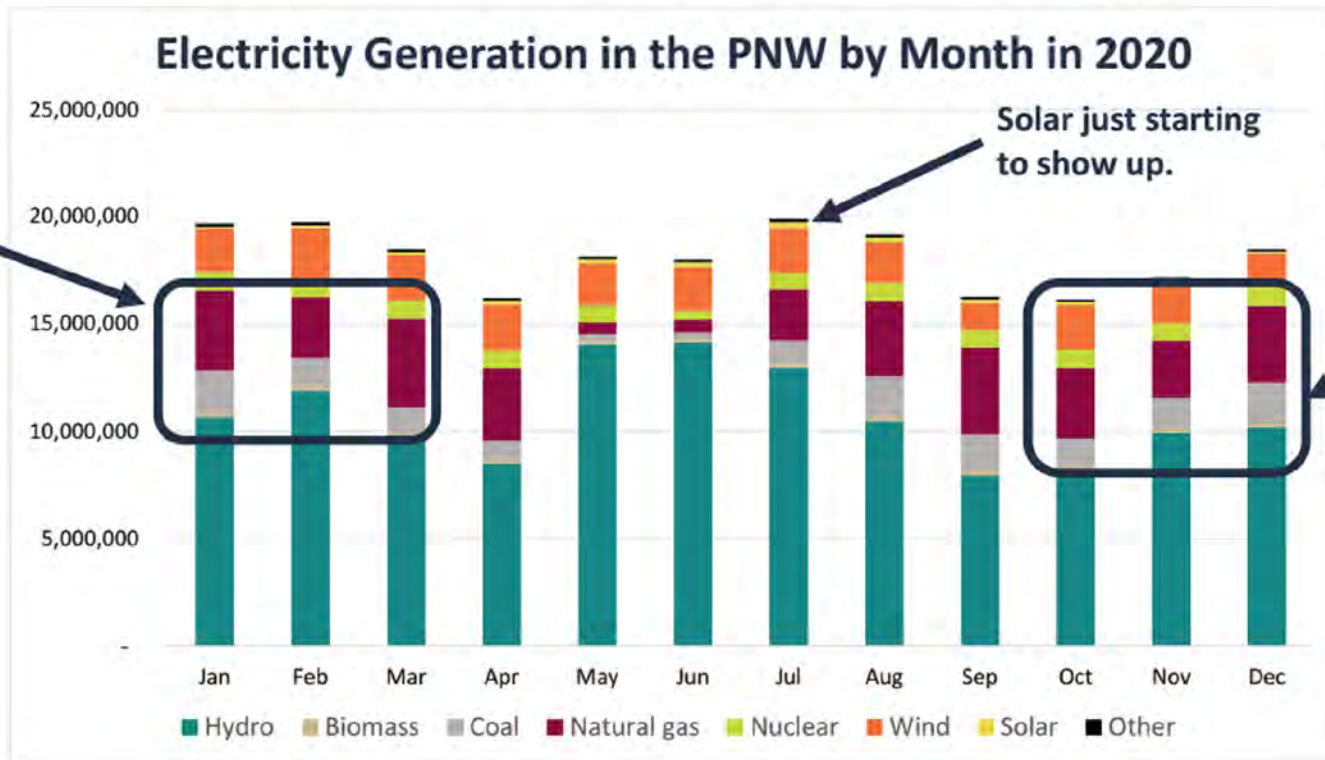
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Current Electricity Resources in the Pacific Northwest



Energy Generation in the PNW by Month (2020)

Electricity Generation in the PNW by Month in 2020



More challenging to find clean MWh to replace energy from coal/gas in winter

Solar just starting to show up.

Coal is retiring rapidly. These gray bars will be replaced.



Source: [EIA Form 923](#), 2020, page 1 and 4 (aggregate data for OR, WA, MT, ID)

Regional Winter Capacity Resources

Regional Capacity Resources

(for operating year 2022 under 1937 water conditions)

Sustained 120-hour peak capacity (January)	38,126 MW
Hydro	21,752 MW (57%)
Natural gas	6,825 MW (18%)
Coal	4,195 MW (11%)
Cogeneration	2,715 MW (7%)
Nuclear	1,169 MW (3%)
Imports	1,059 MW (3%)
Other renewables	206 MW (< 1%)
Wind	137 MW (< 1%)
Other miscellaneous resources	69 MW (< 1%)

More challenging to find clean capacity to replace coal/gas in winter.



Source: [BPA Fact Sheet](#), page 2



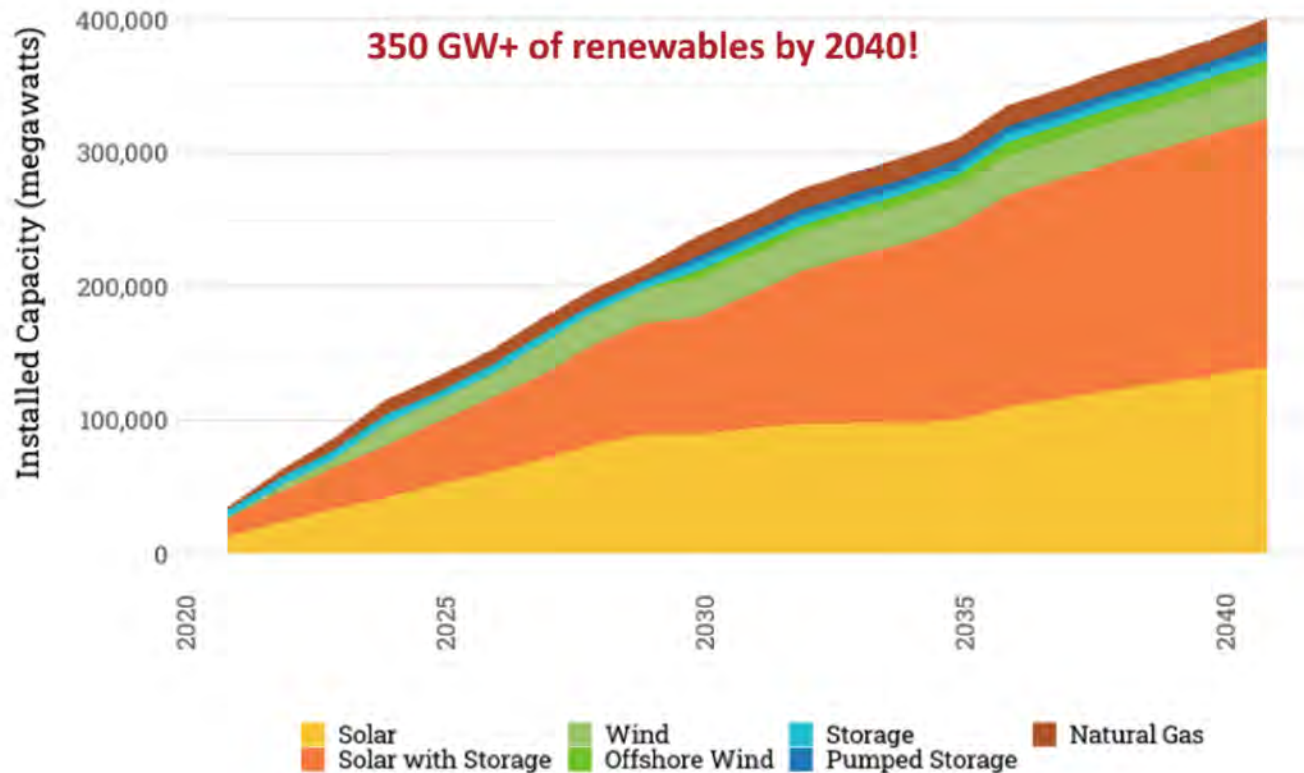
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Forecasting the Future: Electricity Resources Necessary to Achieve Decarbonization Goals

Trillium Lake, Mt. Hood

14

West-wide: How much is coming?

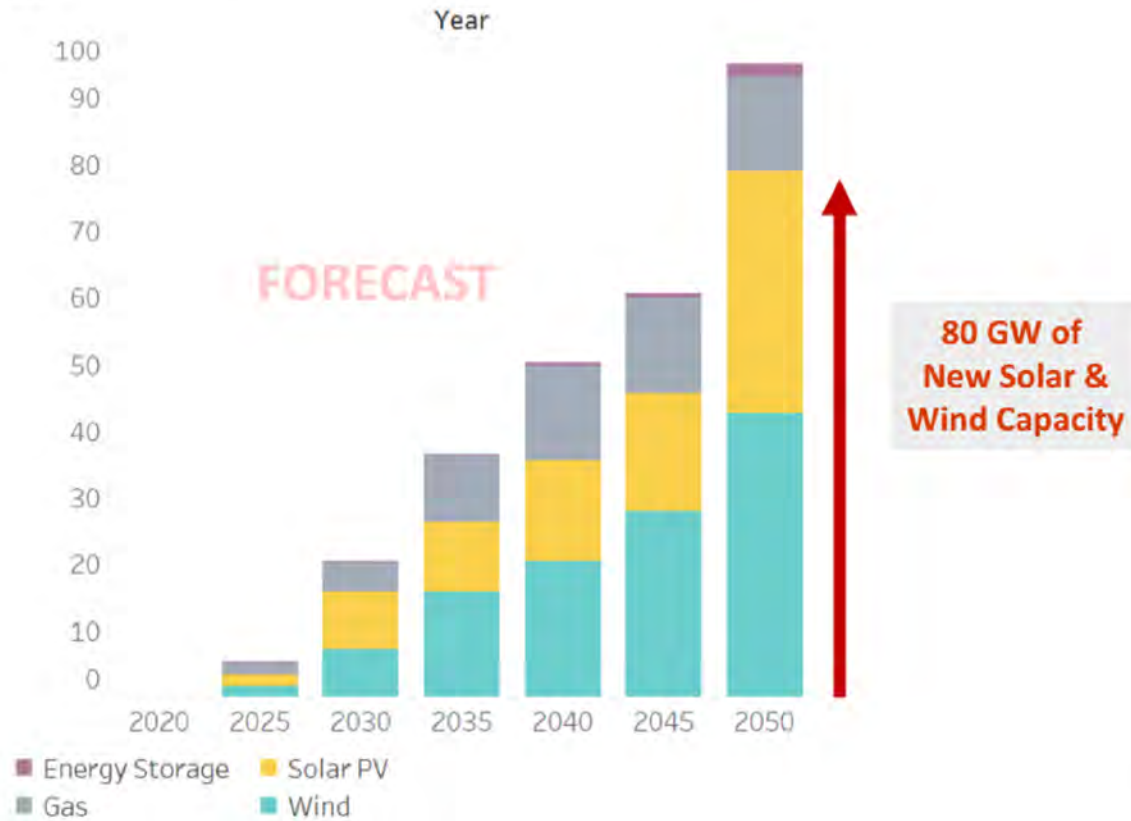


West-wide Projection:
Baseline projection for what will be required across western states to meet clean energy targets

Source: [Draft 2021 Plan](#), p. 6-45

Deep Decarbonization: Renewable Build in PNW

Cumulative New Resource Build
GW



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Transition Institute



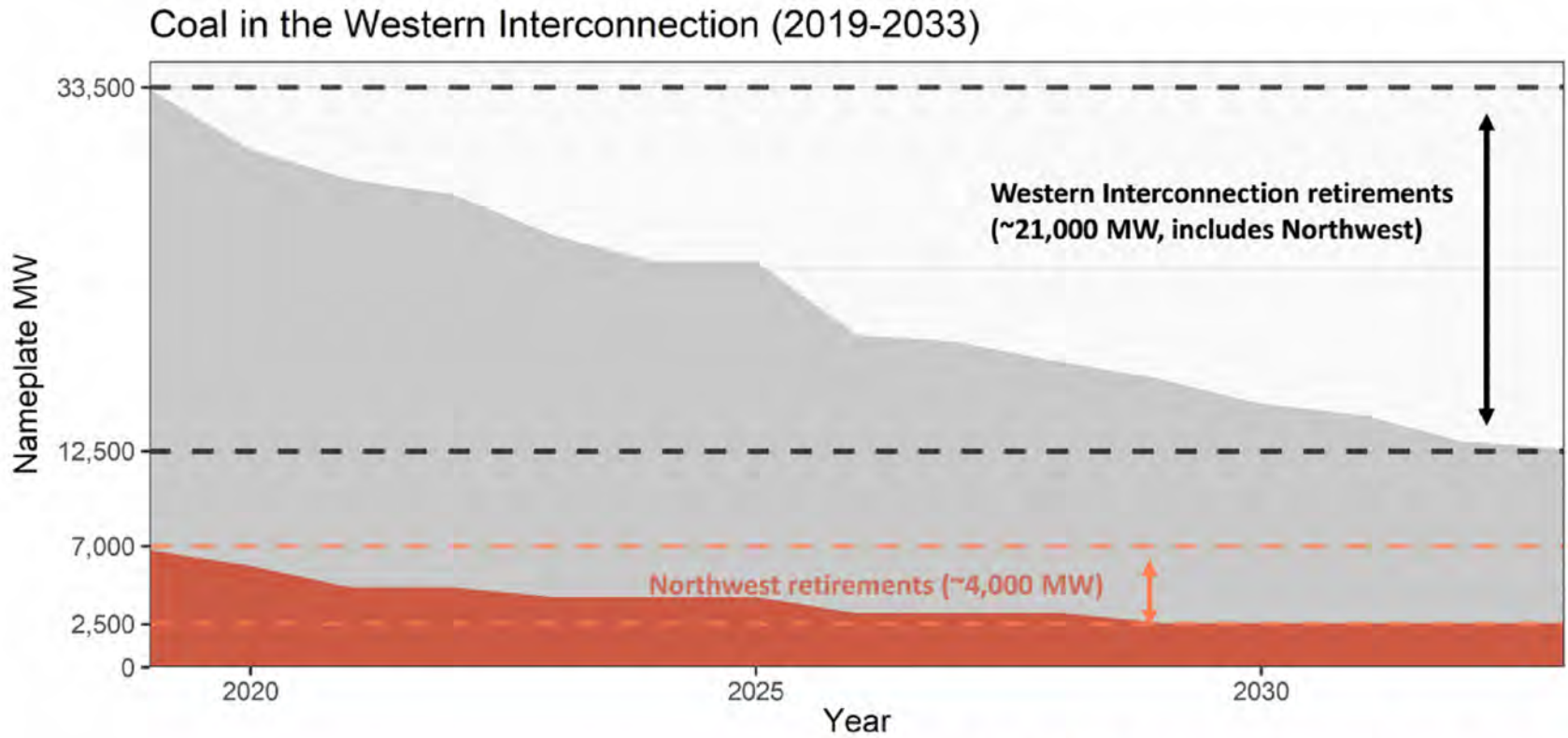
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Deep Decarbonization Pathways Study:

Cumulative new resource build (renewables, gas, and storage) through 2050 in the Pacific Northwest.

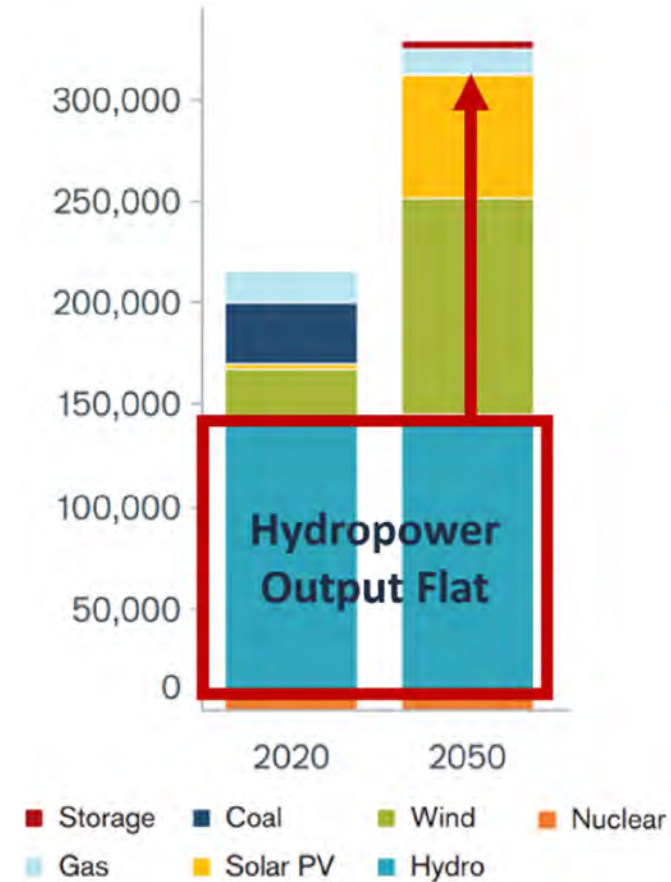
Source: [Deep Decarbonization Pathways Study](#), p. 73

Coal Retirements Across the West Continuing



Source: [PNUCC](#), Generating Resource Trends, slide 8

Electricity Generation
GWh



Pacific Northwest Electricity Mix in 2050

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Transition Institute



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Deep Decarbonization Pathways:
Projected electricity resource mix
in the Pacific Northwest in 2050

Source: [Pathways to a Clean Energy Future](#), Fig. 12, p. 34 18

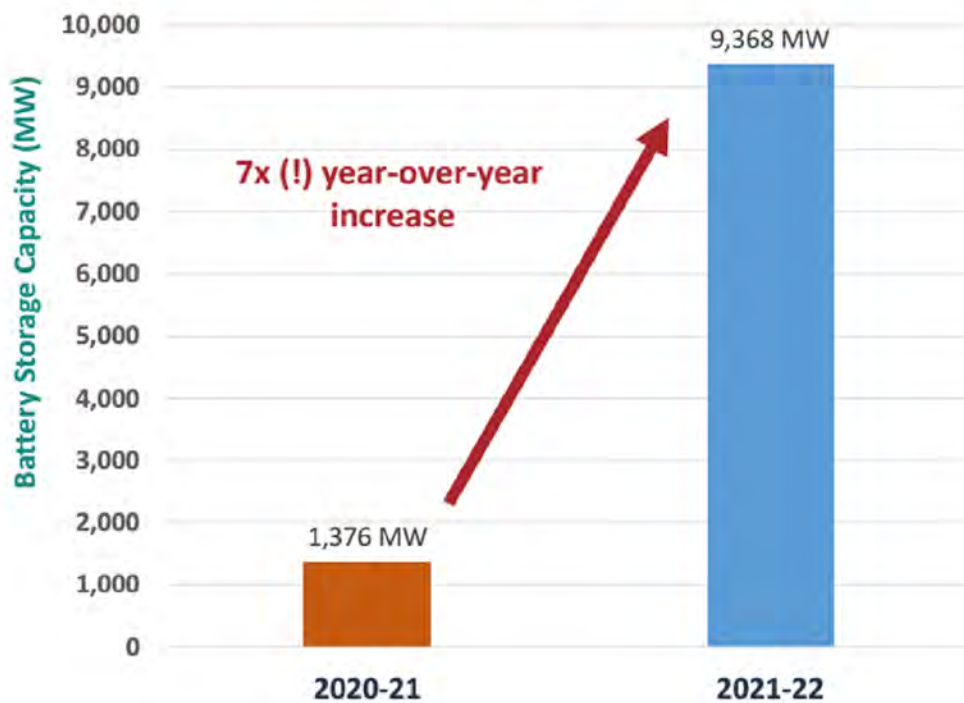
Powering the Future: Key Outstanding Questions

- **Challenges of Scale:** Workforce, supply chain, land use
- **Innovative Technologies:** Innovative technologies—such as batteries, offshore wind, enhanced geothermal, advanced nuclear—will likely be necessary to achieve deep decarbonization goals
- **Trade-offs:** All options on the table come with trade-offs
 - Land use (e.g., several acres per 1 MW of solar PV)
 - Extraction of rare earth minerals
 - Adverse impacts to fish and wildlife



One Example: Batteries are a fast-moving target

CAISO Transmission Planning Process:
Base Case Forecast of Battery Storage Capacity



Source: [CAISO](#), Slide 11





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Lower Snake River Dams

Harney County, Oregon

Power Contributions of Lower Snake River Dams

- **Energy:** 1,004 aMW
- **Nameplate Capacity:** 3,033 MW
- **Grid services:** Flexibility to integrate variable renewables. Also provides necessary reserves and services to maintain grid reliability.



Source: [NWECC](#)



Ice Harbor Dam

Source: [US Army Corps](#)

Source: BPA, [LSRD Fact Sheet](#)



NWEC Study: Can the LSRDs be replaced?



- **April 2018:** Found that replacing the power output of the LSRDs with clean energy resources is viable
- Identified a viable, carbon-free replacement portfolio:
 - 500 MW Demand Response
 - 160 aMW of energy efficiency
 - 1,250 MW of wind
 - 750 MW of solar
- Incremental power replacement cost (Balanced Plus) = **\$399 to \$464M / year**



CRSO EIS: Can the LSRDs be replaced?



Columbia River System Operations EIS

- **September 2020:** Found that replacing the power output of the LSRDs with clean energy resources is viable
- Identified a viable, carbon-free replacement portfolio:¹
 - 600 MW Demand Response
 - 980 MW of battery storage
 - 1,960 MW of solar
- Incremental power replacement cost = **\$394 to \$404M / year²**



1 – [CRSO EIS](#), App. H, p. H-2-15

2 – [CRSO EIS](#), App. H, Table 2-8, p. H-2-21

Unique Impact on Public Power Customers

- **Federal Base System:** Output of the Lower Snake River Dams comprise more than 10% of BPA's base system (based on average annual energy output) ¹



- **Public Power Preference:** Preference customers receive an allocation of the base system at a Tier 1 cost-of-service rate



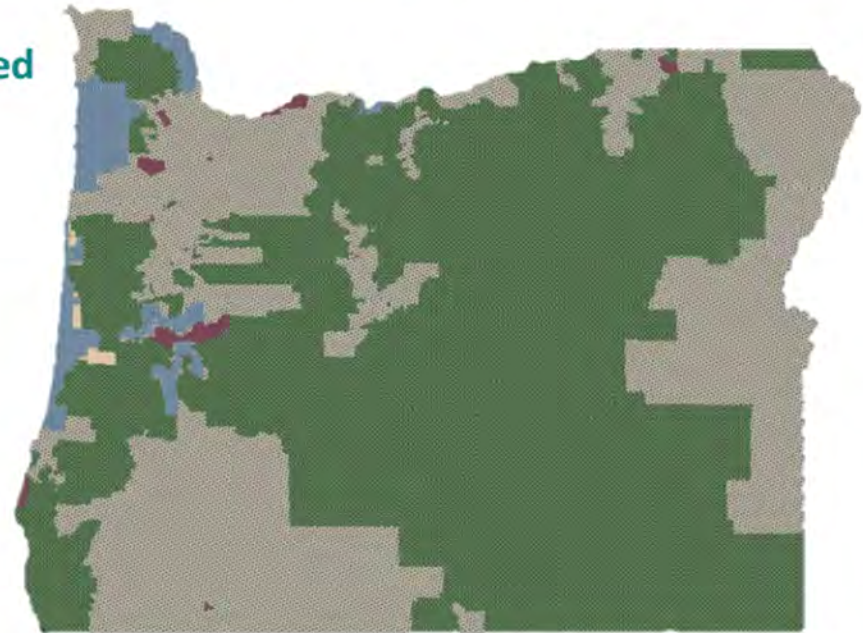
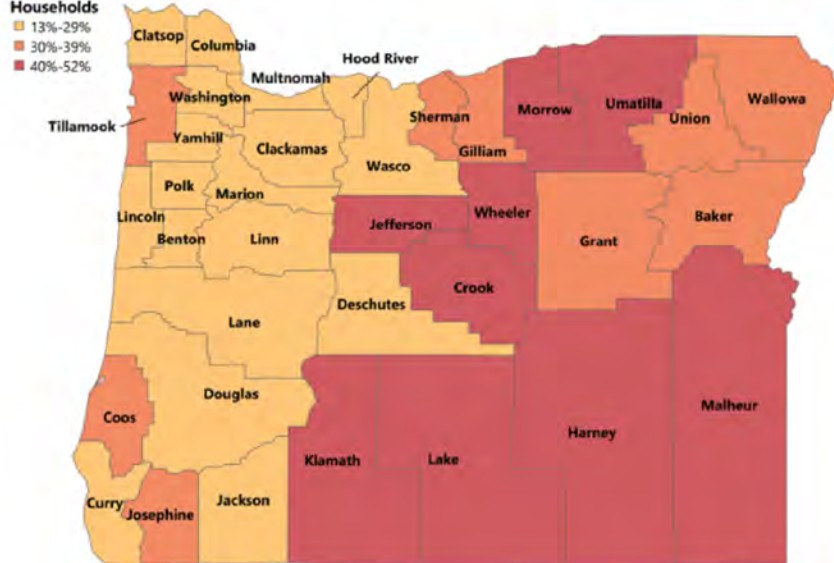
- **Reduced Output:** Any reduction in output from the federal base system would impact the Tier 1 resource available for preference customers

Public Power Customers in Oregon

Majority of counties with high-levels of energy burdened households are served by public power utilities.

Percentage of Oregon Households Considered Energy Burdened and Earning 200 Percent or Below Federal Poverty Level by County⁶

Percentage of Energy-burdened Households



Question #1: Who pays?

NWEC and CRSO EIS found that replacing the power system contributions of the LSRDs is viable, but that doing so comes at a significant cost. **Who pays for this cost?**

- Both studies identified similar costs: ~\$400 M/year
- **Who pays?**
 - **Preference Customer Impacts:** Absent a dedicated source of funding, the cost of LSRD power replacement would disproportionately impact BPA's preference customers
 - **Alternative Funding:** Can funding be secured to pay these costs so that this burden isn't placed upon electric ratepayers in some of Oregon's most energy burdened communities?

Question #2: Are replacement resources incremental?

Significant renewables development is already forecast for the PNW to achieve carbon goals. **Are LSRD replacement resources incremental to these already anticipated renewable resources?**

- **Renewable build-out:** Large-scale deployment of renewables is anticipated, but those resources are being built to achieve carbon objectives (e.g., replace coal) or serve increased loads (e.g., EVs)
- **Incremental addition:** Replacement of the LSRDs would need to be additive/incremental to the clean energy resources that would otherwise be developed—which assume existing hydropower remains
- **Total benefits:** Replacement should consider the total benefits of those projects to the regional power system (e.g., energy, capacity, and flexibility)

Concluding Thoughts

- **Who pays:** Without an alternative funding mechanism, BPA's public power customers in Oregon (and the region) would disproportionately bear the costs
- **Incremental addition:** A meaningful replacement of the LSRDs must replace the capacity, energy, and grid services of those projects AND be incremental to other clean energy resources that would be developed otherwise to meet carbon goals
- **Replacement options:** NWECC and EIS identified viability, but found different solution sets. In a rapidly evolving clean energy sector, there are options:
 - **Efficiency and demand response:** Any solution should consider the contribution of EE and DR
 - **Solar:** PNW solar is increasingly cost-effective
 - **Offshore wind:** An opportunity to lean into development of one of the world's premier offshore wind resources off Oregon's south coast with proximity to BPA's existing transmission system





Thank you!

Adam Schultz

Lead, Electricity & Markets Policy Group

Oregon Department of Energy

Adam.Schultz@energy.Oregon.gov

www.oregon.gov/energy



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From: Zelinsky, Benjamin D (BPA) - E-4
Sent: Thursday, June 2, 2022 2:04 PM
To: Pruder Scruggs, Kathryn M (BPA) - E-4; Koehler, Birgit G (BPA) - PG-5; Armentrout, Scott G (BPA) - E-4; James, Eve A L (BPA) - PG-5
Subject: RE: BPA perspective on E3 study

Looks good. Nice team work.

From: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Thursday, June 2, 2022 1:45 PM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmtrout@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: BPA perspective on E3 study

Thanks Birgit! You guys are the brains – I just make things shiny. 😊

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 2, 2022 1:36 PM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmtrout@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: BPA perspective on E3 study

You're good Katie!

From: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Thursday, June 2, 2022 1:18 PM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmtrout@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: BPA perspective on E3 study

How about this?

- Any consideration of dam breaching must be informed **best available information** on the objective **costs** associated with replacing the full capabilities of those dams, including:
 - Peaking capabilities
 - Transmission considerations
 - Reliability (ability to keep the lights on)
 - Land use
 - Affordability for homes and businesses
- Keep in mind that breaching, or reducing flexibility, while there are still fossil fuel generators on the grid will:
 - **Increase the time** for shifting to a carbon-free electricity sector

- **Increase the costs** for shifting to a carbon-free electricity sector

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 2, 2022 1:00 PM
To: Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: BPA perspective on E3 study

Ben, I do and I don't like your suggestion for the last slide. I like the message about best available information. (I'm tempted to throw something in there about timing, but that's not going to be a deal breaker for those wanting to breach.)

My vision for that last slide was to leave it as simple as possible, with just one sentence on there, which will stick with the viewer. Do you think there's a way to shorten your suggestion so we still get a simple final word in? I'm not seeing a succinct version readily, and maybe we decide to keep it as is.

Birgit

From: Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Sent: Thursday, June 2, 2022 11:25 AM
To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: BPA perspective on E3 study

Deliberative, FOIA Exempt

Thanks for sharing this and it looks good overall. Attached are a few edits in green to consider. I also added a new slide for consideration that tries to compare and contrast the various competing studies in a single table. Even if we just use that table for ourselves, Scott and I were hoping we could create something like it for Bonneville leadership at a minimum.

Ben

From: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Thursday, June 2, 2022 9:33 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
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SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

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Cc: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Subject: BPA perspective on E3 study

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Good Morning Scott-

Attached is a slide deck that has BPA's perspective on the E3 study- a big thanks to Katie and Birgit for all the great work! I am thinking these slides would go after E3's for takeaway messaging. There are a few places you will see red parentheses where we are waiting for some feedback from others before finalizing but want to get a sense from you if we are on the right track since we need to try and get the materials to DOE tomorrow. Let us know if you have any edits/comments.

Thanks,
Eve

From: Koehler,Birgit G (BPA) - PG-5
Sent: Thursday, June 9, 2022 4:36 PM
To: James,Eve A L (BPA) - PG-5
Subject: RE: DOE transmission comments on E3 study

Looks good

From: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Sent: Thursday, June 9, 2022 4:35 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: DOE transmission comments on E3 study

Changes per suggestions below: I think this works well but let me know if you don't like what I did on slide 4:

B O N N E V I L L E P O W E R A D M I N I S T R A T I O N

What power benefits do the four lower Snake River dams provide?

- Reliable power to avoid blackouts**
 - For region and for BPA
 - For regional human health and safety issues
- Carbon-free power to fight climate change**
 - In the Northwest, the hydropower system provides carbon-free power
 - Hydropower system enables addition of variable renewable resources, such as wind and solar, to the region
- 3,483 MW in maximum capacity*
– historically generation **has peaked at 3,431 MW**
- More than 2,000 MW of sustained peaking capabilities during cold winter weather events to **avoid power shortages**
- A quarter of Bonneville's current reserves holding capability which is **important for integrating variable generating resources** such as wind and solar
- **Essential grid reliability services and efficiency of power transmission** (such as voltage support, reactive power, inertia, black start, etc...)

Maintaining these carbon-free assets is an important component of shifting to a cleaner electricity grid. Loss of these assets, or reductions in their flexibility, while there are still fossil fuel generators on the grid will **increase the timeframe and costs associated** with shifting to a carbon-free electricity sector.

*Hydro facilities traditionally operate above nameplate and closer to overload which is typically ~13% above nameplate capacity. Deliberative, FOIA Exempt 3

While it is conceivable to replace power benefits of the lower Snake River dams, it is expensive, lengthy and complex.

- **Expensive**
 - \$430 million to \$480 million per year for public power total without economy-wide decarbonization policies and with maturation of emerging technology, or up to \$2,000 million to \$3,200 million per year without maturation of emerging technology (all assuming paid for with debt financing)
 - \$100 per year per household without economy-wide decarbonization policies and with maturation of emerging technology or up to \$850 per year for each public power household
 - 2 million households affected
 - Potential environmental justice issue – lower income households would be disproportionately affected by increased costs because a larger portion of their income goes to the electric bill.
- **Lengthy**
 - Practically, likely 5 to 10 years for Congressional approval additional federal agency environmental compliance and Congressional appropriations
 - Roughly 5 years to replace the capacity resources
 - Realistically 15 – 20 years to build transmission if needed, which includes providing compliance with the National Environmental Policy Act, siting, permits, etc., if no litigation on siting
- **Complex**
 - Policy requirements to reduce emissions are removing fossil fuel resources from the grid. Breaching the four lower Snake River dams significantly adds to the deficit of resources in the region

The emerging technology scenario, by definition, relies on technologies that do not exist yet at scale and that the timing and availability of those technologies in the future is uncertain.

Acquiring replacement resources could require building new renewable resources at an unprecedented rate.

4
Deliberative, FOIA Exempt

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 9, 2022 4:31 PM
To: Shaheen, Richard L (BPA) - T-DITT-2 <rlshaheen@bpa.gov>
Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: RE: DOE transmission comments on E3 study

Thanks Richard,

What about this for the first point?

**Essential grid reliability services and efficiency of power transmission such as voltage support, reactive power, inertia, black start, etc*

Then separately, we can reply to DOE that we agree with them that some of these services are local -- and that's exactly why we would need to replace these services near tri-cities (and other smaller load centers in the area?)

And your suggestion of not totaling the components of the timeline seems like an easy solution to both the second and third comment.

From: Shaheen, Richard L (BPA) - T-DITT-2 <rlshaheen@bpa.gov>
Sent: Thursday, June 9, 2022 4:12 PM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: RE: DOE transmission comments on E3 study

See feedback next to your comments.....

If you want to talk through any of this, just let me know.

Richard

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, June 8, 2022 3:09 PM
To: Shaheen,Richard L (BPA) - T-DITT-2 <rshaheen@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: DOE transmission comments on E3 study

DELIBERATIVE, FOIA EXEMPT

Good afternoon Richard,

DOE today sent us their feedback on the E3 slides and BPA's "Key Takeaways" slides. We could use your help with a couple of points. Eve worked with some of your staff to assemble the deck, but I think you better understand the agency goal with CEQ to tweak the final messaging.

Thanks,
Birgit

Here are DOE comments with my thoughts in red. Two slides from our deck attached.

[BPA slides] Key Takeaways:

Slide 3: Transmission reliability services – they mention black start, that's usually close held information, even working directly with the Corps they would not reveal this info. I'm thinking they are generalizing here. Also for voltage support, VARs don't travel all that far and if using the generators for VARs it further limits the MW output – can't have it both ways.

My understanding is that T relies on the LSN precisely because it is local VAR support that they need in the region. And I don't know how much it reduces MW generation. Any thoughts, either to edit the slide or for a response to DOE?

Yes, VAR support needs to be physically close to load centers needing voltage support – for example, Ice Harbor is very important to voltage support, thus reliability, for tri-cities. As for reduced generation due to higher VAR support, I don't know exactly what impact is, but it likely varies a little for different generating sources. I actually questioned in my mind the wording of the Transmission bullet at the end when I saw it earlier – not only is grid reliability impacted (better than saying "transmission"), but efficiency on power transfer (i.e. when reactive power is compromised, it's harder to transmit MW – kind of like pushing up hill versus a flat surface). Bottom line: Grid stability and reliability, and efficiency of power delivery. Not sure how best to word smith.....we can discuss further.

What about this?

**Essential grid reliability services and efficiency of power transmission such as voltage support, reactive power, inertia, black start, etc*

Instead of power delivery, I would use power transmission because for those of us not living and breathing transmission, this might cue us better to the intent.

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The BPA deck notes the challenges with transmission, driving a possible 35 year replacement timeline. But I see no transmission results in the E3 deck. In fact, since the replacement resources in all of the cases except the outlier noted above focus on H2 (with relatively little wind and solar), it seems unlikely that these cases would require much if any new transmission. On what basis should conclusions about viability be based on purported new transmission, when the study itself includes little emphasis on this—and the transmission needs are likely modest. **Part of their comment stems from the fact that this reviewer thinks that we can rely on emerging technology and not go to deep decarbonization, thus overall there would be less need for new resources and less need for transmission, both for the regional need and for LSN replacement specifically.**

Any transmission needs are completely tied to new generation resources or requirements, especially location. Also, recall that it was brought up at our Tuesday mtg that the E3 slides did not properly represent Transmission build times, etc. There is no debating that new transmission can take 15-20 years due to permitting, etc. As for upgrading existing infrastructure – it depends....some upgrades have very similar permitting as new transmission. Not sure what is being inferred or assumed by DOE comment. If no new transmission is needed, or minimal upgrades needed, all driven by generation, than transmission is of course not part of the scenario....it all depends on the generation.

- The BPA deck suggests a 35 year timeframe, driven in part by transmission – which as noted above, is problematic. Besides that, I would note that the E3 deck contains some information on timelines, which do not equal 35 years: so a possible discrepancy. It is also not clear why these timelines must be additive = generation + transmission. Some of these times could be happening in parallel, rather than in sequence. While noting timelines is important, the current presentation feels overly dramatic and inconsistent. **We fixed the timeframe to not include generation after sending to DOE. The slide below shows congressional time frame + TX timeframe, but that generation would be in parallel. Do you think we'd start transmission planning before congressional approval and would shorten the timeline further? Any suggested changes to the slide and/or comments back to DOE?**

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While it is *conceivable* to replace power benefits of the lower Snake River dams, it is *expensive, lengthy and complex.*

• Expensive

- Up to \$2,000 million to \$3,200 million per year for public power total, or \$430 million to \$480 million per year without decarbonization policies and with maturation of emerging technology (all assuming paid for with debt financing)
- Up to \$850 per year for each public power household or \$100 per year per household without decarbonization policies and with maturation of emerging technology
- 2 million households affected
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- **20 to 30 years total** for replacement resources
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• Complex

- Policy requirements to reduce emissions are removing fossil fuel resources from the grid. Breaching the four lower Snake River dams significantly **adds to the deficit of resources** in the region.

Acquiring replacement resources could require **building new renewable resources at an unprecedented rate.**

From: Shaheen,Richard L (BPA) - T-DITT-2
Sent: Thursday, June 9, 2022 4:41 PM
To: Koehler,Birgit G (BPA) - PG-5
Cc: James,Eve A L (BPA) - PG-5; Armentrout,Scott G (BPA) - E-4
Subject: RE: DOE transmission comments on E3 study

All sounds good !

Richard

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 9, 2022 4:31 PM
To: Shaheen,Richard L (BPA) - T-DITT-2 <rlshaheen@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: RE: DOE transmission comments on E3 study

Thanks Richard,

What about this for the first point?

**Essential grid reliability services and efficiency of power transmission such as voltage support, reactive power, inertia, black start, etc*

Then separately, we can reply to DOE that we agree with them that some of these services are local – and that’s exactly why we would need to replace these services near tri-cities (and other smaller load centers in the area?)

And your suggestion of not totaling the components of the timeline seems like an easy solution to both the second and third comment.

From: Shaheen,Richard L (BPA) - T-DITT-2 <rlshaheen@bpa.gov>
Sent: Thursday, June 9, 2022 4:12 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: RE: DOE transmission comments on E3 study

See feedback next to your comments.....

If you want to talk through any of this, just let me know.

Richard

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, June 8, 2022 3:09 PM
To: Shaheen,Richard L (BPA) - T-DITT-2 <rlshaheen@bpa.gov>

Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: DOE transmission comments on E3 study

DELIBERATIVE, FOIA EXEMPT

Good afternoon Richard,

DOE today sent us their feedback on the E3 slides and BPA's "Key Takeaways" slides. We could use your help with a couple of points. Eve worked with some of your staff to assemble the deck, but I think you better understand the agency goal with CEQ to tweak the final messaging.

Thanks,
Birgit

Here are DOE comments with my thoughts in red. Two slides from our deck attached.

[BPA slides] Key Takeaways:

Slide 3: Transmission reliability services – they mention black start, that's usually close held information, even working directly with the Corps they would not reveal this info. I'm thinking they are generalizing here. Also for voltage support, VARs don't travel all that far and if using the generators for VARs it further limits the MW output – can't have it both ways.

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From: James,Eve A L (BPA) - PG-5
Sent: Thu Jun 30 16:56:37 2022
To: Maslow,Jeffrey J (BPA) - EC-4; Diffely,Robert J (BPA) - PGPL-5
Cc: Leary,Jill C (BPA) - LN-7; Grange,Katey C (BPA) - EC-4; Koehler,Birgit G (BPA) - PG-5
Subject: RE: Draft Analysis
Importance: Normal
Attachments: image002.png; image003.png; image001.png

Microsoft Exchange Server;converted from html;
Confidential and privileged attorney client communication/FOIA-exempt
 Here's an updated table (thanks Rob!):

	CRSO EIS				E3				
	Least Cost	No Carbon	NC - Partial Coal	NC - No Coal	S1 100% Clean Retail Sales	S1b 100% Clean Retail Sales (2024 dam removal)	2a - Deep Decarb (Baseline)	2b - Deep Decarb (Emerging)	2c - Deep Decarb (no new combustion)
Year	2022	2022	2022	2022	2035	2035	2035	2035	2035
Reliability Metric	LOLP	LOLP	LOLP	LOLP	PRM	PRM	PRM	PRM	PRM
Duel Fuel (MW)	1120				1800	1800	2000	1700	
DR (MW)		600							
Solar (MW)		1960	3200	6000	-500	-500			1000
Batteries (MW)		980	1000	1000	100	100	100		1500
Wind (MW)					1300	1400	600		100
Offshore Wind (MW)									9100
Geothermal (MW)									300
SMR (MW)								600	
Annual Cost (\$2022 Millions)	\$ 199	\$ 379	N/A	N/A	\$ 434	\$ 466	\$ 496	\$ 415	\$ 1,953

CRSO MT Wind limited at 1696 MW (ATC Montana Wind Study); E3 Study better ELCCs for wind than solar (WY, MT, PNW, Offshore)
 CRSO conservation limited to cost effective 7th Power Plan; E3 some conservation above cost-effective in 8th Power Plan

	E3					E3				
	S1 100% Clean Retail Sales (2024)	S1b 100% Clean Retail Sales (2024)	2a - Deep Decarb (Baseline)	2b - Deep Decarb (Emerging)	2c - Deep Decarb (no new combustion)	S1 100% Clean Retail Sales (2024)	S1b 100% Clean Retail Sales (2024)	2a - Deep Decarb (Baseline)	2b - Deep Decarb (Emerging)	2c - Deep Decarb (no new combustion)
Year	2035	2035	2035	2035	2035	2045	2045	2045	2045	2045
Reliability Metric	PRM	PRM	PRM	PRM	PRM	PRM	PRM	PRM	PRM	PRM
Duel Fuel (MW)	1800	1800	2000	1700		2100	2100	2000	1500	
DR (MW)										
Solar (MW)	-500	-500			1000					1400
Batteries (MW)	100	100	100		1500			300		
Wind (MW)	1300	1400	600		100	500	500	400		10600
Offshore Wind (MW)					9100					
Geothermal (MW)					300					
Conservation (MW)								50		
SMR (MW)				600					700	
Wind (Sq Miles)	90.8	97.8	41.9	0.0	7.0	34.9	34.9	27.9	0.0	740.3
Offshore Wind (Sq Miles)	0.0	0.0	0.0	0.0	1165.9	0.0	0.0	0.0	0.0	0.0
Solar (Sq Miles)	-4.8	-1.3	0.0	0.0	9.5	0.0	0.0	0.0	0.0	13.3
Total (Sq Miles)	86.0	96.5	41.9	0.0	1182.5	34.9	34.9	27.9	0.0	753.7

Conversion data came from: Land Use by System Technology | Energy Analysis | NREL

From: James,Eve A L (BPA) - PG-5

Sent: Thursday, June 30, 2022 2:59 PM

To: Maslow,Jeffrey J (BPA) - EC-4 <jjmaslow@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>

Cc: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Grange,Katey C (BPA) - EC-4 <kcgrange@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 (bgkoehler@bpa.gov) <bgkoehler@bpa.gov>

Subject: Draft Analysis

Confidential and privileged attorney client communication/FOIA-exempt

Hi Jeff-

This was an earlier table Rob put together. Rob do you have a newer version at all that just uses the scenarios that are ending up in the final report? If not I can create a new one if you think this would be helpful to add to the Supplemental Analysis.

Rob- I thought there was also a chart that had estimates of land use comparison between EIS and E3 study? If there is a commonly used, citable conversion factor we can use that- if not we will delete that placeholder and not include that impact in the Supplemental Analysis.

	CRS Costs				ES						
	Least Cost	No Carbon	MC - Partial	MC - No Cost		\$1,100B	\$1a 100B		Stab1 - Deep	Stab2 - Deep	Stab3 - Deep
	LOLP	LOLP	LOLP	LOLP	SO No Policy	Clean Retail	Clear Retail	\$1 - Deep	Decarb no	Decarb no	Decarb
Year	2022	2022	2022	2022	2035	2035	2035	2035	2035	2035	2035
Reliability Metric	LOLP	LOLP	LOLP	LOLP	PRM	PRM	PRM	PRM	PRM	PRM	PRM
Gas (MW)	1120				2500	2600	2200	2000			1200 (-42)
DR (MW)		900									
Solar (MW)		1980	3370	6000		1500			1500	1600	
Batteries (MWh)		988	1000	1000		100	100	200	8000	300	
Wind (MW)					100	1300		600	2400		660
Offshore Wind (MW)										12000	
Pumped Storage (MW)									100		
Compressed Air (MW)									10	10	
SMR (MW)											900
Annual Cost (\$2022 Millions)	\$ 169	\$ 279	N/A	N/A	\$ 482	\$ 438	\$ 444	\$ 450	\$ 2891	\$ 3,283	\$ 400

CRSO NT Wind limited at 1695 MW (ATC Montana Wind Study); ES Study better ELCCs for wind than solar (MW, MWh, Offshore)
CRSO conservation limited to cost-effective 7th Power Plan ES some conservation above cost-effective in 8th Power Plan

From: Diffely,Robert J (BPA) - PGPL-5
Sent: Thursday, June 30, 2022 3:08 PM
To: James,Eve A L (BPA) - PG-5; Maslow,Jeffrey J (BPA) - EC-4
Cc: Leary,Jill C (BPA) - LN-7; Grange,Katey C (BPA) - EC-4; Koehler,Birgit G (BPA) - PG-5
Subject: RE: Draft Analysis

I can send you an update for both the MW and land use.

Rob

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Thursday, June 30, 2022 2:59 PM
To: Maslow,Jeffrey J (BPA) - EC-4 <jjmaslow@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Grange,Katey C (BPA) - EC-4 <kcgrange@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
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	CRSO EIS				E3				
	Least Cost	No Carbon	NC - Partial Coal	NC - No Coal	S0 No Policy	S1 100% Clean Retail Sales	S1a 100% Clean Retail Sales (no carbon price)	S2 - Deep Decarb	S2a1 - Decarb no combustio
Year	2022	2022	2022	2022	2035	2035	2035	2035	2035
Reliability Metric	LOLP	LOLP	LOLP	LOLP	PRM	PRM	PRM	PRM	PRM
Gas (MW)	1120				2300	1800	2200	2000	
DR (MW)		600							
Solar (MW)		1960	3200	6000		-500			1500
Batteries (MW)		980	1000	1000		100	100	200	600
Wind (MW)					200	1300		600	940
Offshore Wind (MW)									
Pumped Storage (MW)									300
Conservation (MW)									100
SMR (MW)									
Annual Cost (\$2022 Millions)	\$ 199	\$ 379	N/A	N/A	\$ 452	\$ 433	\$ 444	\$ 490	\$ 2,590

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 CRSO conservation limited to cost effective 7th Power Plan; E3 some conservation above cost-effective in 8th Power Plan

From: Koehler,Birgit G (BPA) - PG-5
Sent: Monday, May 16, 2022 3:48 PM
To: Diffely,Robert J (BPA) - PGPL-5; James,Eve A L (BPA) - PG-5; Egerdahl,Ryan J (BPA) - PGPR-5
Cc: Baskerville,Sonya L (BPA) - AIN-WASH; Petty,Robert J (BPA) - PGP-5; Hay,Kari C (BPA) - PGPL-5
Subject: RE: Draft CRSO and E3 chart

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Everyone, please also note that we should be using the disclaimer above for anything related to E3 that might be sensitive.

Rob, thanks for pulling this together. It is really helpful seeing the information side-by-side.

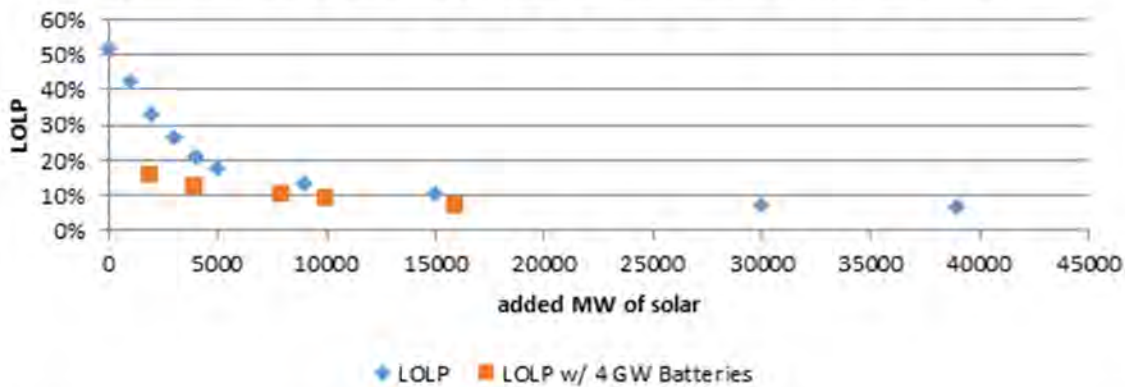
I hadn't noticed how little solar the E3 study was identifying when I looked at their results. (Too much info to digest that I missed this detail.)

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Sent: Friday, May 13, 2022 3:00 PM
To: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Petty,Robert J (BPA) - PGP-5 <rjpetty@bpa.gov>; Hay,Kari C (BPA) - PGPL-5 <kchay@bpa.gov>
Subject: RE: Draft CRSO and E3 chart

There was no cap on batteries – but studies were done by trial and error for the no and partial coal studies. We ran a multiple of studies to develop relationships between resources and LOLP.

For example: 2,000 MW of solar paired with 4 GW of batteries reduces the LOLP by 50 percent from batteries alone. The benefits decrease after that.

Summary of LOLP versus added MW solar (includes 1696 MW MT wind and 600 MW DR)



From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Friday, May 13, 2022 2:22 PM

To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>

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Petty,Robert J (BPA) - PGP-5 <rjpetty@bpa.gov>; Hay,Kari C (BPA) - PGPL-5 <kchay@bpa.gov>

Subject: RE: Draft CRSO and E3 chart

Thanks Rob- this is a good comparison table. Just curious if the CRSO EIS analysis had a 1000 MW cap on batteries or is that just a coincident that it caps at 1000 and puts the rest in solar?

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>

Sent: Friday, May 13, 2022 2:06 PM

To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>

Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>;

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Subject: Draft CRSO and E3 chart

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Batteries (MW)		980	1000	1000		100	100	200	600
Wind (MW)					200	1300		600	940
Offshore Wind (MW)									
Pumped Storage (MW)									300
Conservation (MW)									100
SMR (MW)									
Annual Cost (\$2022 Millions)	\$ 199	\$ 379	N/A	N/A	\$ 452	\$ 433	\$ 444	\$ 490	\$ 2,590

CRSO MT Wind limited at 1696 MW (ATC Montana Wind Study); E3 Study better ELCCs for wind than solar (WY, MT, PNW, Offshore)
CRSO conservation limited to cost effective 7th Power Plan; E3 some conservation above cost-effective in 8th Power Plan

From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Friday, May 13, 2022 9:54 AM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>;
Baskerville,Sonya L (BPA) - AIN-WASH <sibaskerville@bpa.gov>; Petty,Robert J (BPA) - PGP-5 <rjpetty@bpa.gov>;
Hay,Kari C (BPA) - PGPL-5 <kchay@bpa.gov>
Subject: RE: CRSO and E3

Yes, how about MWs and dollars with some description of the resources in those portfolios.
Thanks Rob

Ryan Egerdahl
Manager, Long Term Power Planning
BONNEVILLE POWER ADMINISTRATION
rjegerdahl@bpa.gov
| P 503.230.4732 | C(b)(6)

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Sent: Friday, May 13, 2022 9:52 AM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>;
Baskerville,Sonya L (BPA) - AIN-WASH <sibaskerville@bpa.gov>; Petty,Robert J (BPA) - PGP-5 <rjpetty@bpa.gov>;
Hay,Kari C (BPA) - PGPL-5 <kchay@bpa.gov>
Subject: RE: CRSO and E3

Sure MW and dollars?

From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Friday, May 13, 2022 9:50 AM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>;

Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Petty, Robert J (BPA) - PGP-5 <rjpetty@bpa.gov>;
Hay, Kari C (BPA) - PGPL-5 <kchay@bpa.gov>

Subject: CRSO and E3

Hi Rob. If you have not already done so with that bold Diffely self-start attitude, would you have some time next week to assemble a crosswalk between the CRSO replacement values (MO3 base, MO3 scenarios, least cost, least carbon, and full replacement) and the E3 study replacement values?

Others can chime in, but I am thinking the most helpful or immediate comparisons are simply on the replacement resource types & their associated costs that get the power system back to the respective adequacy standard. I am not asking to boil the ocean on assumptions, RA results, or modeling differences. Maybe that is also underway.

I'm happy to chat about this more too.

Thx

Ryan Egerdahl

Manager, Long Term Power Planning

BONNEVILLE POWER ADMINISTRATION

riegerdahl@bpa.gov

| P 503.230.4732 | C (b)(6)

From: Egerdahl,Ryan J (BPA) - PGPR-5
Sent: Friday, June 10, 2022 11:16 AM
To: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5; Diffely,Robert J (BPA) - PGPL-5
Subject: RE: E3

Sounds great. thx

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, June 10, 2022 9:59 AM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Subject: RE: E3

Hi Ryan- I sent a note to E3 to get ask about their schedules- I'll let you know when I hear back from them.

From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Friday, June 10, 2022 9:54 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Subject: E3

Hi. If the Council ends up having a special meeting just for this, what is our preferred timing on this? Last week of June or any other specific day/date? That might be the route on this given their existing meeting schedule. Thx

Ryan Egerdahl
Manager, Long Term Power Planning
BONNEVILLE POWER ADMINISTRATION
rjegerdahl@bpa.gov
| P 503.230.4732 | C (b)(6)

From: Byrne,Patricia H (BPA) - PGPR-5
Sent: Wednesday, July 13, 2022 11:56 AM
To: Egerdahl,Ryan J (BPA) - PGPR-5; Petty,Robert J (BPA) - PGP-5; James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5; Bellcoff,Steve (BPA) - PGPR-5; Diffely,Robert J (BPA) - PGPL-5
Subject: RE: E3 - lower snakes

I thought it was good, too. It would have been interesting to hear more about the assumptions around Hydrogen and all – think of all the energy spent “harvesting” it from water or whatever, so that we can burn it and make ... energy... Hmmm... but like they said, some of these potential replacement resources have not been fully realized and it is difficult to predict when/if they will be truly feasible.

From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Wednesday, July 13, 2022 11:27 AM
To: Petty,Robert J (BPA) - PGP-5 <rjpetty@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Byrne,Patricia H (BPA) - PGPR-5 <phbyrne@bpa.gov>; Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Subject: E3 - lower snakes

I thought the session went really well at the Council meeting. I see the members have more questions of E3, but I thought the information was portrayed very clearly so that is always good. Anyone hear anything about the session or had other views?

thx

Ryan Egerdahl
Manager, Long Term Power Planning
BONNEVILLE POWER ADMINISTRATION
rjegerdahl@bpa.gov
| P 503.230.4732 | C (b)(6)

From: Baskerville,Sonya L (BPA) - AIN-WASH
Sent: Thursday, July 14, 2022 3:31 PM
To: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5
Subject: RE: E3 Congressional briefings

Hey there. I've heard now from several Congressional staff that they would like to have the E3 briefing rescheduled. If you can get me a day/time that Arne and team can do it, that would be great. Typically Mondays and Fridays tend to work best. Lunch times also tend to be good times. All on eastern time. Thanks.

Sonya Baskerville
BPA National Relations
(b)(6) m

From: Baskerville,Sonya L (BPA) - AIN-WASH
Sent: Tuesday, July 12, 2022 10:43 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: E3 Congressional briefings

I have not rescheduled those given everything that happened, but I should pose that to the group. I did send the staff the link to listen to the Council, but it was really late eastern time.

Given what occurred this week, I think about so called coordinated roll out plan is BS anyway.

I will ask the group. Stay tuned.

Sonya Baskerville
BPA National Relations
(b)(6) m

On Jul 12, 2022 8:59 PM, "James,Eve A L (BPA) - PG-5" <eajames@bpa.gov> wrote:

Hi Sonya-

I'm still catching up from being out of the office- are there any Congressional staff briefings scheduled with E3 or were you just having staff call into the rescheduled Council meeting today? I am aware of a presentation on Thursday for some department heads but that is all I see on my calendar. Let me know and I can coordinate with E3.

Thanks,
Eve

From: James,Eve A L (BPA) - PG-5
Sent: Friday, June 17, 2022 9:45 AM
To: Johnson,G Douglas (BPA) - DK-7; Koehler,Birgit G (BPA) - PG-5; Scruggs,Joel L (BPA) - DK-7
Subject: RE: E3 briefings

Yes- Ryan Egerdahl is coordinating with Council staff to get E3 on the agenda for the July 6/7 meeting.

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Friday, June 17, 2022 8:41 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Subject: RE: E3 briefings

Are we planning to brief the Council et al at the Council's meeting the week of July 4?

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, June 17, 2022 8:39 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Cc: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: E3 briefings

I agree Birgit- they should be able to participate in the Council meeting where it is being briefed as a start and the final technical report will be available by then so they can review that as well. If they have follow-up questions we can consider something at that time but they might be able to get what they need from the technical materials. It might be better for them to reach out and engage E3 directly since this is an independent study and we don't want people to associate BPA as a gatekeeper of the results.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Friday, June 17, 2022 8:35 AM
To: Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: E3 briefings

My inclination would be not to plan on a separate briefing, but that is a good reminder that we should let them know once we have the Council briefing scheduled. They can then let us know if they have further follow-up questions. What do you all think? We haven't discussed doing any briefings other than in the DC/CRSO circuit and using the Council as a platform for a public briefing so far.

From: Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Sent: Friday, June 17, 2022 8:33 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: E3 briefings

Good morning, Eve and Birgit. Kurt Miller asked if we intend to brief the Murray-Inslee consultants on our E3 study findings, which they then could consider referencing in the final report. I've heard of other briefings. Have we considered this?

Thanks,

Joel Scruggs (He/Him)

Director of Communications | Communications (DK)

BONNEVILLE POWER ADMINISTRATION

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From: James,Eve A L (BPA) - PG-5
Sent: Thursday, June 23, 2022 2:04 PM
To: Baskerville,Sonya L (BPA) - AIN-WASH; Koehler,Birgit G (BPA) - PG-5; Armentrout,Scott G (BPA) - E-4; Godwin,Mary E (BPA) - LN-7; Leary,Jill C (BPA) - LN-7; Zelinsky,Benjamin D (BPA) - E-4; Sullivan,Leah S (BPA) - EWP-4; Egerdahl,Ryan J (BPA) - PGPR-5
Subject: RE: E3 presentation at Council meeting

Thanks Sonya- I'll touch base with E3 on their availability for an additional meeting that day or the following day.

From: Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Sent: Thursday, June 23, 2022 1:29 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <ssullivan@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: RE: E3 presentation at Council meeting

I don't think we should introduce them. E3 can explain that they were contracted to do work.

By the way, a quick survey of some Congressional staff is that they prefer their own briefing. If E3 has the time, it could be a day after the Council briefing or the same day.

Thanks.

Sonya Baskerville
BPA National Relations
(b)(6) m

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 23, 2022 4:24 PM
To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <ssullivan@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: RE: E3 presentation at Council meeting

One question: Does BPA introduce E3 or will it go straight to E3? If we introduce them, who should do that?

From: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Wednesday, June 22, 2022 12:53 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <ssullivan@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: RE: E3 presentation at Council meeting

There may be requests for more meetings. My initial thought was to premier at council and then wait for requests to schedule the next round. But I am open to other ideas.....

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C (b)(6)



From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Wednesday, June 22, 2022 12:49 PM

To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>

Subject: E3 presentation at Council meeting

Privileged and Confidential; FOIA Exempt; Do Not Distribute

Hello-

I heard back from council staff that the E3 presentation will be on the agenda for July 7 from 8:30 – 10 AM Pacific Time. I attended the NWECC briefing this morning and wanted to get feedback if we should try setting up a similar series for agency and delegation members with E3 or is the Council meeting something they can attend? There were 3 staff members from different Congressional representatives (Rep. DelBene, Rep. Schrier, and Rep. Stricklan(sp?)), 1 person from the Sierra Club, and then various NWECC staff (besides Mary, Josh Warner, and myself from BPA).

Thanks,
Eve

From: Baskerville, Sonya L (BPA) - AIN-WASH
Sent: Wednesday, June 22, 2022 12:52 PM
To: James, Eve A L (BPA) - PG-5; Armentrout, Scott G (BPA) - E-4; Koehler, Birgit G (BPA) - PG-5; Godwin, Mary E (BPA) - LN-7; Leary, Jill C (BPA) - LN-7; Zelinsky, Benjamin D (BPA) - E-4; Sullivan, Leah S (BPA) - EWP-4; Egerdahl, Ryan J (BPA) - PGPR-5
Subject: RE: E3 presentation at Council meeting

The Council meetings are open. I can make sure to get the info to the delegation staff. If E3 has the capacity to do another meeting, I certainly can set-up an additional meeting for delegation staff. Thanks.

Sonya Baskerville
BPA National Relations

(b)(6) m

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, June 22, 2022 3:49 PM
To: Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan, Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; Egerdahl, Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: E3 presentation at Council meeting

Privileged and Confidential; FOIA Exempt; Do Not Distribute

Hello-

I heard back from council staff that the E3 presentation will be on the agenda for July 7 from 8:30 – 10 AM Pacific Time. I attended the NWEC briefing this morning and wanted to get feedback if we should try setting up a similar series for agency and delegation members with E3 or is the Council meeting something they can attend? There were 3 staff members from different Congressional representatives (Rep. DelBene, Rep. Schrier, and Rep. Stricklan(sp?)), 1 person from the Sierra Club, and then various NWEC staff (besides Mary, Josh Warner, and myself from BPA).

Thanks,
Eve

From: James,Eve A L (BPA) - PG-5
Sent: Tuesday, July 12, 2022 5:20 PM
To: Koehler,Birgit G (BPA) - PG-5
Subject: RE: E3 presentation notes

Thanks Birgit- that's what I captured as well. I noticed at one point there were 210 participants.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 12, 2022 5:18 PM
To: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Subject: E3 presentation notes

Eve,

I don't know if this is useful at all, but I tried to capture the Q&A. Here are my notes in case that helps.

July 12 Council

- Slide 15 of portfolios selected
- Member KC Golden: Why does only Scenario 2a select extra EE?
 - Arne, Scenario 2 already has a lot of extra EE compared to Council 8th Plan, so what you see here is really experimental, advanced EE
- Golden: What is the most stressful situation that you are modeling? What loads or Planning Reserve Margin
 - Aaron, peak demand plus 15% PRM
- Member ___: electrification will drive load to winter, but then switching from resistive to heat pump will offset that. Is there a progressive movement going forward to get heat out of this technology? Or did you take today's current tech and move it forward?
 - Aaron: We are using the assumptions in WA's high-electrification scenario, which is a lot of heat pump conversion. But heat pumps become very inefficient at lowest temps, so you will see load growth with heat pump conversion.
 - Arne: WA did assume pretty aggressive improvement in heat pump technology
- Scenario 2b: that closely matches LSN capacity. Is it reasonable that is just because you are replacing firm capacity with firm capacity, or is there more?
 - Aaron, that's pretty much it, replacing firm capacity and energy
- Member Ellis: When are you anticipating that we will have dual fuel and SMRs available?
 - Aaron: dual fuel starting in the first year. So start with N gas, then transition to H2 over time. There's one today. SMR we are making available in 2035.
 - Arne That doesn't mean you can purchase a dual fuel tomorrow. There will probably be a while until you can buy enough hydrogen. So they start with Nat Gas
- Member Grath? I assume the hydrogen is from electricity. I assume you added that extra load for hydrogen in the electricity
 - Arne: we did not include that. We not do the extra resources needed to produce the clean hydrogen. But that really would increase the pressure on land, TX, etc. They did include the cost in the cost of hydrogen fuel
- Golden. DR is about identical between scenarios. (back on slide 14)
 - Aaron, generally yes
 - Arne: today's DR are mostly a few hours. That works well like batteries for a summer-type system. But here it is a winter-time 3-5 day cold event where a short DR or batteries don't help. But in NW, you have flexibility to

move energy around day/night with hydro system. So current DR doesn't help much. But DSIs or other DR that takes energy off for multiple days. Not sure what today would do that (maybe bitcoin?)

- Golden: Agree. By Scenario 2c you are contemplating a lot of heroic things.
- Arne: we don't have the data today for that type of DR, but hope we figure that out before we get to Scenario 2c.

• Slide 20

- McGraw-- there is a lot of subsidization of solar by taxpayers today. How did you treat that?
 - Aaron, wind and solar would be ramping down, solar to 10%
- ___ How did you handle transmission. Looks like you included local TX but not major new TX for new renewables
 - Aaron, appendix slide 36 has new renewables supply curve. Gray shows what the TX cost adders are for those resources. E.g. WY wind on new TX doubles the costs
 - Arne: question of how to build TX system to bring wind from far away is not well understood. e.g. how much on existing TX? How much TX build for overbuild of wind? We know new TX will be needed, but these are rough estimates. That's why Scenario 2c has that range. e.g. we don't know how to get 10 GW of wind from off-shore on east coast.
- ___ B2H, we might have that completed by 2045
 - Reply was just a smile
- McGraw, if we take a resource w TX to go in all directions, but if we replace it with WY intermittent wind, the more expensive TX is since you have to put corridors for all different directions when available. How did you handle that?
 - Arne...
- What is resolve good at and what are its limits?
 - Arne, good at exploring wide range of scenarios in an uncertain future. Finds optimal solutions. Less good ... we operate only 45 days of sampling. With some customers we take that output into another model like Plexos that has a lot more operational detail.
 - Resolve is not an RA model, but we try to make the PRM as robust as possible. Used Recap model to develop parameters for Resolve.
 - For utility working on an IRP, we take Resolve model back into Recap
 - Also, any model is as good as the input assumptions. We all don't have great data for the far ends of the supply curves.
 - Aaron, emerging tech costs uncertain. Used pretty aggressive cost curves, but they could turn out to be more expensive.
 - Arne: Scenario 2 might be a bit different if we don't go to 100%, assume carbon capture will get the last 2%, that can help
- Yost, It seems logical what you presented, I'm concerned about what will happen. We have the info, but I'm hesitant about breaching the dams until we have this in place and functioning. Or at least close enough to count on resources being there. Did you figure a timeline for us?
 - Arne. We are assuming breaching is far enough out that the technology will be available. But that could be a stretch. e.g. H2 CCT. We are seeing supply chain delaying project. But lots of money flowing into technology, but it is not a guarantee

Skype from Liz:

[7/12/2022 4:17 PM] Klumpp,Elizabeth C (BPA) - AIR-WSGL:

Birgit, If you see this. I'm not sure NPCC members get that the E3 LSR analysis is INCREMENTAL above the 2045 study with the LSRs. KC asking about EE means he's not getting it. The extra EE is in the base case for reaching 2045 goals w the dams still operating. Thanks.

[7/12/2022 4:18 PM] Koehler,Birgit G (BPA) - PG-5:

I do see your message. Good point. But we at BPA are going to try not to speak up. We want this to be E3's study

From: James,Eve A L (BPA) - PG-5
Sent: Thursday, June 23, 2022 2:47 PM
To: Armentrout,Scott G (BPA) - E-4; Baskerville,Sonya L (BPA) - AIN-WASH; Koehler,Birgit G (BPA) - PG-5; Godwin,Mary E (BPA) - LN-7; Leary,Jill C (BPA) - LN-7; Zelinsky,Benjamin D (BPA) - E-4; Sullivan,Leah S (BPA) - EWP-4; Egerdahl,Ryan J (BPA) - PGPR-5
Subject: RE: E3 presentation at Council meeting

E3 has conflicts up until 2 PM EDT on July 7 but are available any time on July 8.

From: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Thursday, June 23, 2022 1:52 PM
To: Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: RE: E3 presentation at Council meeting

Agreed

SCOTT G ARMENTROUT
Executive Vice President, Environment, Fish & Wildlife, SES | E-4
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-3076 | C (b)(6)



From: Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Sent: Thursday, June 23, 2022 1:29 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: RE: E3 presentation at Council meeting

I don't think we should introduce them. E3 can explain that they were contracted to do work.

By the way, a quick survey of some Congressional staff is that they prefer their own briefing. If E3 has the time, it could be a day after the Council briefing or the same day.

Thanks.

Sonya Baskerville
BPA National Relations
(b)(6) m

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 23, 2022 4:24 PM
To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <ssullivan@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: RE: E3 presentation at Council meeting

One question: Does BPA introduce E3 or will it go straight to E3? If we introduce them, who should do that?

From: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Wednesday, June 22, 2022 12:53 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <ssullivan@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: RE: E3 presentation at Council meeting

There may be requests for more meetings. My initial thought was to premier at council and then wait for requests to schedule the next round. But I am open to other ideas.....

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C (b)(6)



From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, June 22, 2022 12:49 PM
To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <ssullivan@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Subject: E3 presentation at Council meeting

Privileged and Confidential; FOIA Exempt; Do Not Distribute

Hello-

I heard back from council staff that the E3 presentation will be on the agenda for July 7 from 8:30 – 10 AM Pacific Time. I attended the NWECC briefing this morning and wanted to get feedback if we should try setting up a similar series for agency and delegation members with E3 or is the Council meeting something they can attend? There were 3 staff members from different Congressional representatives (Rep. DelBene, Rep. Schrier, and Rep. Stricklan(sp?)), 1 person from the Sierra Club, and then various NWECC staff (besides Mary, Josh Warner, and myself from BPA).

Thanks,
Eve

From: Leary, Jill C (BPA) - LN-7
Sent: Friday, June 3, 2022 2:40 PM
To: James, Eve A L (BPA) - PG-5
Cc: Koehler, Birgit G (BPA) - PG-5; Pruder Scruggs, Kathryn M (BPA) - E-4
Subject: RE: E3 study results presentations

Will do, thanks.

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, June 3, 2022 2:38 PM
To: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: E3 study results presentations

Deliberative, FOIA exempt

Hi Jill-

Attached are two PDFs of presentations- the E3 study results and BPA's perspective on the study results. Please send along to DOE for feedback.

Thanks,
Eve

From: Egerdahl,Ryan J (BPA) - PGPR-5
Sent: Monday, June 13, 2022 12:01 PM
To: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5; Diffely,Robert J (BPA) - PGPL-5
Subject: RE: E3

Hi again. I know we are checking with E3. Council has maybe July 6 and 7th open as part of some existing public meeting. Something to consider too. Thx

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, June 10, 2022 9:59 AM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Subject: RE: E3

Hi Ryan- I sent a note to E3 to get ask about their schedules- I'll let you know when I hear back from them.

From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Friday, June 10, 2022 9:54 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Subject: E3

Hi. If the Council ends up having a special meeting just for this, what is our preferred timing on this? Last week of June or any other specific day/date? That might be the route on this given their existing meeting schedule. Thx

Ryan Egerdahl
Manager, Long Term Power Planning
BONNEVILLE POWER ADMINISTRATION
rjegerdahl@bpa.gov
| P 503.230.4732 | C (b)(6)

From: Baskerville, Sonya L (BPA) - AIN-WASH
Sent: Thursday, July 14, 2022 10:48 AM
To: Renner, Marcella P (BPA) - E-4; Cook, Joel D (BPA) - K-7; McDonald, Thomas A (BPA) - C-7; Shaheen, Richard L (BPA) - T-DITT-2; Kennedy, David K (BPA) - EC-4; Koehler, Birgit G (BPA) - PG-5; Eraut, Michelle L (BPA) - EC-4; Zelinsky, Benjamin D (BPA) - E-4; James, Daniel M (BPA) - D-7; Welch, Dorothy W (BPA) - E-4; Harris, Marcus A (BPA) - F-2; Cogswell, Peter (BPA) - AI-7; James, Eve A L (BPA) - PG-5; Armentrout, Scott G (BPA) - E-4; Senters, Anne E (BPA) - LN-7; Pruder Scruggs, Kathryn M (BPA) - E-4; Alders, Kyna L (BPA) - K-7; Leady Jr, William J (BPA) - PG-5; Cooper, Suzanne B (BPA) - P-6; Sweet, Jason C (BPA) - EW-4
Cc: Sullivan, Leah S (BPA) - EWP-4; Key, Philip S (BPA) - LN-7; Case, Cynthia D (CONTR) - AIR-7; Communications; Wilson, David B (BPA) - DKS-7
Subject: RE: Executive Advisory Group (EAG)

Hello, all. Here is a link to the recording of the Council meeting where E3 briefed their report. For those of you who were unable to listen on Tuesday, scroll through about 2 to 3 hours; it was the last agenda item of the meeting. Thanks.

<https://nwcouncil.box.com/shared/static/zhw1qh20u3s4tgd2jk6s9ozruo9lg967.mp4>

Sonya Baskerville
BPA National Relations

(b)(6) m

-----Original Appointment-----

From: Renner, Marcella P (BPA) - E-4 <mprenner@bpa.gov>
Sent: Tuesday, January 25, 2022 9:27 AM
To: Renner, Marcella P (BPA) - E-4; Renner, Marcella P (BPA) - E-4; Cook, Joel D (BPA) - K-7; McDonald, Thomas A (BPA) - C-7; Shaheen, Richard L (BPA) - T-DITT-2; Kennedy, David K (BPA) - EC-4; Koehler, Birgit G (BPA) - PG-5; Eraut, Michelle L (BPA) - EC-4; Zelinsky, Benjamin D (BPA) - E-4; James, Daniel M (BPA) - D-7; Welch, Dorothy W (BPA) - E-4; Harris, Marcus A (BPA) - F-2; Cogswell, Peter (BPA) - AI-7; James, Eve A L (BPA) - PG-5; Armentrout, Scott G (BPA) - E-4; Senters, Anne E (BPA) - LN-7; Pruder Scruggs, Kathryn M (BPA) - E-4; Alders, Kyna L (BPA) - K-7; Leady Jr, William J (BPA) - PG-5; Cooper, Suzanne B (BPA) - P-6; Sweet, Jason C (BPA) - EW-4
Cc: Sullivan, Leah S (BPA) - EWP-4; Baskerville, Sonya L (BPA) - AIN-WASH; Key, Philip S (BPA) - LN-7; Case, Cynthia D (CONTR) - AIR-7; Communications; Wilson, David B (BPA) - DKS-7
Subject: Executive Advisory Group (EAG)
When: Tuesday, July 12, 2022 8:00 AM-9:00 AM (UTC-08:00) Pacific Time (US & Canada).
Where: Please see Webex and bridge information below

-----Original Appointment-----

From: Renner, Marcella P (BPA) - E-4 <mprenner@bpa.gov>
Sent: Tuesday, June 15, 2021 3:43 PM
To: Renner, Marcella P (BPA) - E-4; Cook, Joel D (BPA) - K-7; McDonald, Thomas A (BPA) - C-7; Shaheen, Richard L (BPA) - T-DITT-2; Kennedy, David K (BPA) - EC-4; Koehler, Birgit G (BPA) - PG-5; Eraut, Michelle L (BPA) - ECF-4; Sweet, Jason C (BPA) - PGB-5; Zelinsky, Benjamin D (BPA) - E-4; Welch, Dorothy W (BPA) - E-4; Harris, Marcus A (BPA) - F-2; Cooper, Suzanne B

(BPA) - P-6; James,Eve A L (BPA) - PG-5; Armentrout,Scott G (BPA) - E-4; Key,Philip S (BPA) - LN-7; Senters,Anne E (BPA) - LN-7; Pruder Scruggs,Kathryn M (BPA) - E-4; Alders,Kyna L (BPA) - K-7; Leady Jr,William J (BPA) - K-7; James,Daniel M (BPA) - D-7; Dunning,Christopher G (BPA) - F-2; Cogswell,Peter (BPA) - AI-7

Cc: Connolly,Kieran P (BPA) - PG-5; Sullivan,Leah S (BPA) - EWP-4

Subject: Executive Advisory Group (EAG)

When: Occurs every Tuesday effective 6/22/2021 from 8:00 AM to 9:00 AM (UTC-08:00) Pacific Time (US & Canada).

Where: Please see Webex and bridge information below

-- Do not delete or change any of the following text. --

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More ways to join:

Join from the meeting link

<https://mybpa.webex.com/mybpa/j.php?MTID=m8d5c5af3baca8faea620aeb1c0ce253a>

Join by meeting number

Meeting number (access code): (b)(6)

Meeting password: PPr5UCrZ7@2

Tap to join from a mobile device (attendees only)

+1-415-527-5035, (b)(6) ## US Toll

Join by phone

+1-415-527-5035 US Toll

[Global call-in numbers](#)

Join from a video system or application

Dial (b)(6) @mybpa.webex.com

Join using Microsoft Lync or Microsoft Skype for Business

Dial (b)(6) mybpa@lync.webex.com

If you are a host, [click here](#) to view host information.

Need help? Go to <https://help.webex.com>

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, July 12, 2022 8:26 AM
To: Renner,Marcella P (BPA) - E-4; Cook,Joel D (BPA) - K-7; McDonald,Thomas A (BPA) - C-7; Shaheen,Richard L (BPA) - T-DITT-2; Kennedy,David K (BPA) - EC-4; Eraut,Michelle L (BPA) - EC-4; Zelinsky,Benjamin D (BPA) - E-4; James,Daniel M (BPA) - D-7; Welch,Dorothy W (BPA) - E-4; Harris,Marcus A (BPA) - F-2; James,Eve A L (BPA) - PG-5; Armentrout,Scott G (BPA) - E-4; Senters,Anne E (BPA) - LN-7; Pruder Scruggs,Kathryn M (BPA) - E-4; Alders,Kyna L (BPA) - K-7; Leady Jr,William J (BPA) - PG-5; Cooper,Suzanne B (BPA) - P-6; Sweet,Jason C (BPA) - EW-4
Cc: Sullivan,Leah S (BPA) - EWP-4; Baskerville,Sonya L (BPA) - AIN-WASH; Key,Philip S (BPA) - LN-7; Case,Cynthia D (CONTR) - AIR-7
Subject: RE: Executive Advisory Group (EAG), today's Council meeting registration

If you want to join the Council meeting today, register w your name and email
[Council Meeting | Northwest Power and Conservation Council \(nwcouncil.org\)](#)

Tuesday, July 12

- Council members will be on a tour the morning of Tuesday, July 12

Council Meeting – 1:30pm (PDT) / 2:30pm (MDT) – Pavilion Room

General Webinar ATTENDEES should use [this link to register](#). After registering, you will receive a confirmation email containing information about joining the webinar. (How to [join a Webinar](#)). Contact [ITHelps](#) with any technical questions.

	1:30– 1:45pm	Reports from Fish and Wildlife, Power and Public Affairs committee chairs: Jeffery Allen, chair, fish and wildlife committee; Jim Yost, chair, power committee and Louie Pitt Jr., chair, public affairs committee.
1.	1:45 – 2:30pm	Update on Pacific lamprey runs in the Columbia River Basin and translocation successes: Laurie Porter and Jon Hess, Columbia River Inter-Tribal Fish Commission.
2.	2:30 – 3:15pm	Presentation by Avista: Jason Thackston and Heather Rosentrater, Avista.
	3:15 – 3:30pm	Break
3.	3:30 – 5pm	Energy and Environmental Economics (E3) study on Lower Snake River Dams Power Replacement: Arne Olsen, E3.

Wednesday, July 13

Council Meeting continued – 8:30am (PDT) / 9:30am (MDT) – Pavilion Room

General Webinar ATTENDEES should use [this link](#) to register. After registering, you will receive a confirmation email containing information about joining the webinar. (How to [join a Webinar](#)). Contact [ITHelps](#) with any technical questions.

- | | | |
|-----|----------------------|--|
| 4. | 8:30 –
9am | Overview of Bonneville Low-Income Program : Amy Burke, Bonneville Power Administration. |
| 5. | 9 –
9:30am | Overview of Washington Weatherization Program : Amanda Rains, Washington Department of Commerce. |
| 6. | 9:30 –
10am | Community Action Agency Presentation on Delivering Energy Efficiency to Low-Income Households : <ul style="list-style-type: none">• Spokane Neighborhood Action Partners: Kirby Weythman and Michelle Howard. |
| 7. | 10 –
10:30am | Briefing by Kelly Susewind, Director, Washington Department of Fish and Wildlife : Kelly Susewind, Washington Department of Fish and Wildlife. |
| | 10:30 –
10:45am | Break |
| 8. | 10:45 –
11:15am | Spring Chinook Salmon Update : <ul style="list-style-type: none">• 2022 Return Update: Patty O'Toole, Division Director, Fish and Wildlife.• Tucannon River Spring Chinook Salmon Status Update and Next Steps to Recovery: Joe Bumgarner and Chris Donley, Washington Department of Fish and Wildlife. |
| 9. | 11:15am –
12:15pm | Presentation from the Upper Columbia United Tribes (UCUT) : DR Michel and Laura Robinson, Upper Columbia United Tribes; Tom Biladeau, Coeur d'Alene Tribe; Casey Baldwin, Confederated Tribes of the Colville Reservation; Deane Osterman, Kalispel Tribe of Indians; Shawn Young, Kootenai Tribe of Idaho and Conor Giorgi, Spokane Tribe of Indians. |
| 10. | 12:15pm | Council Business : <ul style="list-style-type: none">• Council approval of the June 2022 Council Meeting minutes• Council decision on FY2023 Revised and FY2024 Budget (SH) |

- [Approval of Industrial Energy Efficiency Measure Development](#) Contract (KS)

Public comment on any issue before the Council Note: Please sign up prior to the Council Meeting to provide comment by sending an email to the Council at meetingorganizer@nwcouncil.org with your name. Any person participating in the meeting should review and abide by the [Code of Conduct](#) expected of all who participate in the Council's public forums

- [Presentation tips and information for guest presenters](#)

-----Original Appointment-----

From: Renner, Marcella P (BPA) - E-4 <mprenner@bpa.gov>

Sent: Tuesday, June 15, 2021 3:43 PM

To: Renner, Marcella P (BPA) - E-4; Renner, Marcella P (BPA) - E-4; Cook, Joel D (BPA) - K-7; McDonald, Thomas A (BPA) - C-7; Shaheen, Richard L (BPA) - T-DITT-2; Kennedy, David K (BPA) - EC-4; Koehler, Birgit G (BPA) - PG-5; Eraut, Michelle L (BPA) - EC-4; Zelinsky, Benjamin D (BPA) - E-4; James, Daniel M (BPA) - D-7; Welch, Dorothy W (BPA) - E-4; Harris, Marcus A (BPA) - F-2; Cogswell, Peter (BPA) - AI-7; James, Eve A L (BPA) - PG-5; Armentrout, Scott G (BPA) - E-4; Senters, Anne E (BPA) - LN-7; Pruder Scruggs, Kathryn M (BPA) - E-4; Alders, Kyna L (BPA) - K-7; Leady Jr, William J (BPA) - PG-5; Cooper, Suzanne B (BPA) - P-6; Sweet, Jason C (BPA) - EW-4

Cc: Sullivan, Leah S (BPA) - EWP-4; Baskerville, Sonya L (BPA) - AIN-WASH; Key, Philip S (BPA) - LN-7; Case, Cynthia D (CONTR) - AIR-7

Subject: Executive Advisory Group (EAG)

When: Tuesday, July 12, 2022 8:00 AM-9:00 AM (UTC-08:00) Pacific Time (US & Canada).

Where: Please see Webex and bridge information below

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Meeting password: PPr5UCrZ7@2

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Join using Microsoft Lync or Microsoft Skype for Business
Dial (b)(6) mybpa@lync.webex.com

If you are a host, [click here](#) to view host information.

Need help? Go to <https://help.webex.com>

From: Koehler,Birgit G (BPA) - PG-5
Sent: Monday, July 11, 2022 9:46 AM
To: Egerdahl,Ryan J (BPA) - PGPR-5
Subject: RE: I see now E3 was pushed out til tomorrow

Quite a story!

From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Monday, July 11, 2022 9:45 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: I see now E3 was pushed out til tomorrow

time. Notable R&W topics are shown below.

Tuesday 7/12 - [GoToWebinar link](#) – meeting begins at **1330 hrs** Pacific time

- (1345 – 1430 hrs) [Update on Pacific lamprey](#) runs in the Columbia River Basin and translocation successes: Lauri
- (1530 – 1700 hrs) [Energy and Environmental Economics \(E3\) study](#) on Lower Snake River Dams Power Replacem

From: Godwin, Mary E (BPA) - LN-7
Sent: Monday, July 18, 2022 6:59 AM
To: Armentrout, Scott G (BPA) - E-4; Koehler, Birgit G (BPA) - PG-5; James, Eve A L (BPA) - PG-5
Cc: Leary, Jill C (BPA) - LN-7; Zelinsky, Benjamin D (BPA) - E-4; Hairston, John L (BPA) - A-7
Subject: RE: Interagency briefing on E3 study and salmon report

Hi Scott,
Eve contacted Aaron Burdick from E3 and he is available. Eve or Birgit will introduce Aaron.

Thanks,
Mary

From: Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Monday, July 18, 2022 6:34 AM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Hairston, John L (BPA) - A-7 <jlhairston@bpa.gov>
Subject: Interagency briefing on E3 study and salmon report

I was not asked about this but it appears to be scheduled. I would prefer E3 do the talking on the study if possible – but since it is today I have no idea what was planned or expected. Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C (b)(6)



From: Koehler,Birgit G (BPA) - PG-5
Sent: Wednesday, June 1, 2022 10:27 AM
To: Neuls,Esther T (BPA) - PGPR-5; James,Eve A L (BPA) - PG-5; Bellcoff,Steve (BPA) - PGPR-5
Cc: Egerdahl,Ryan J (BPA) - PGPR-5
Subject: RE: LSR request for Birgit

Hello Esther,

Thanks for finding these. I'm impressed with how high our generation has been. Peaking near 3,000 MW in 2014 after we started spilling in the mid-late-1990s is impressive. We definitely want to highlight this in our presentation to CEQ which we are finalizing this week.

From: Neuls,Esther T (BPA) - PGPR-5 <etneuls@bpa.gov>
Sent: Wednesday, June 1, 2022 7:21 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: RE: LSR request for Birgit

Good morning!

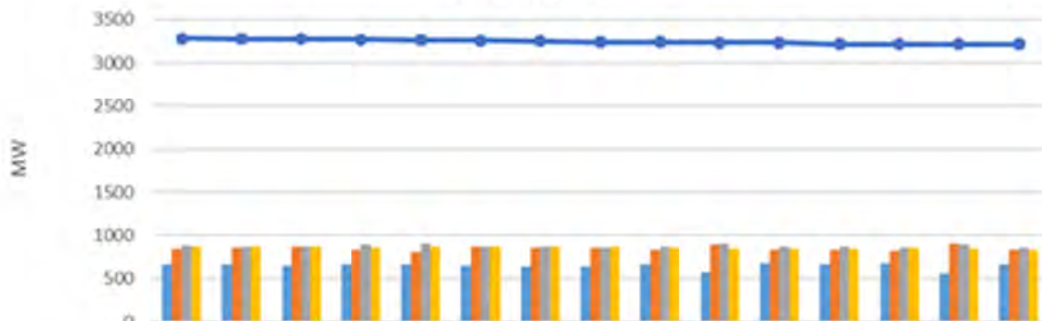
Here are the top 15 highest single hourly generation from LSR from 1990-2021...

- All 15 highest hourly gen came from 1990 and 1991 late May to early June.
- There were 323 single hour generations >= 2955 MW all happened prior to 2000, **except 2014 had several single hour gen that were > 2955**. Also included below are single Max Hourly Gen of LSN from 1990-2021.

Please let me know if you have any questions or need anything additional. Also, I am happy to share the data file if you think it'll help speed up the investigation. It takes time to communicate back and forth, please just keep in mind that this is a big file with 46 years of hourly data.

I am happy to support in any way!
Have a great hump day!
Esther

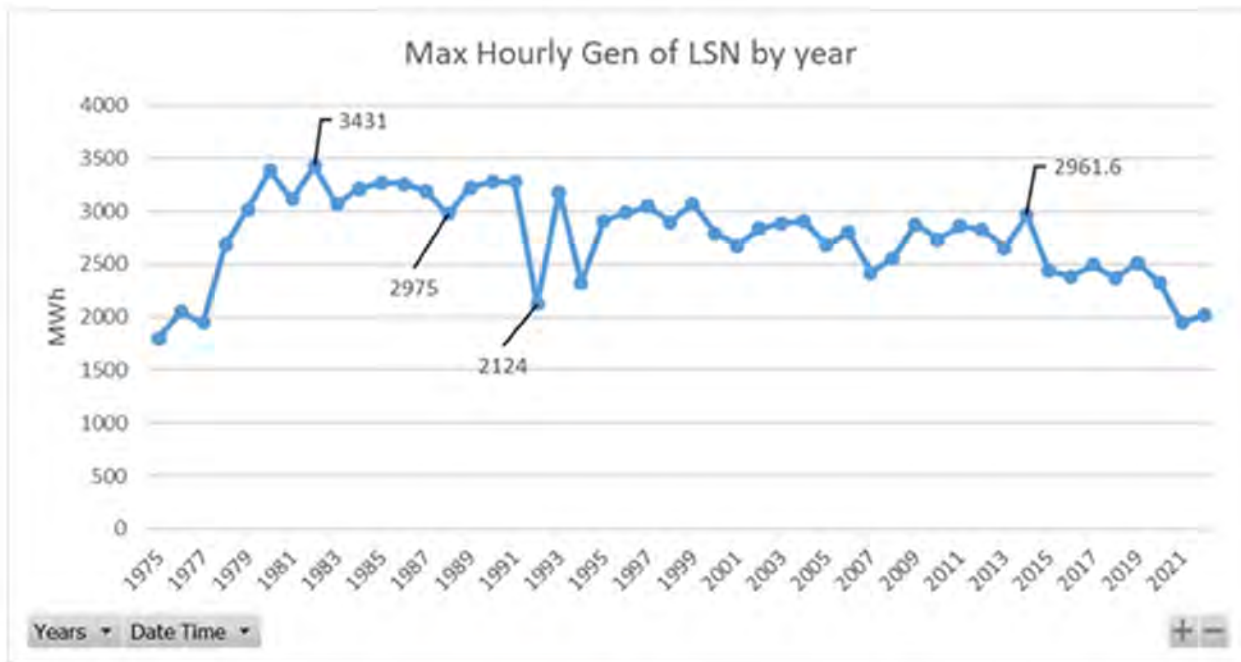
Lower Snake River Projects
Top 15 Single Hour Generations (MW)
1990 to 2021



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
IHR.Power.Total.1Hour[MW]	666	672	653	671	663	649	641	639	667	574	674	666	674	560	668
LGS.Power.Total.1Hour[MW]	854	860	876	832	816	867	866	864	835	898	832	832	820	904	838
LMN.Power.Total.1Hour[MW]	885	875	877	900	914	868	875	865	872	911	878	874	861	900	866
LWG.Power.Total.1Hour[MW]	874	870	870	864	868	870	870	870	864	850	846	844	860	850	842
Total LSN	3279	3277	3276	3267	3261	3254	3252	3238	3238	3233	3230	3216	3215	3214	3214

Top 15-hour of Total LSN Generation 1990-2021

	Date Time	IHR.Power	LGS.Power	LMN.Pow	LWG.Pow	Total LSN
1	5/20/1991 14:00	666	854	885	874	3279
2	6/2/1990 15:00	672	860	875	870	3277
3	6/2/1990 16:00	653	876	877	870	3276
4	5/20/1991 17:00	671	832	900	864	3267
5	5/20/1991 0:00	663	816	914	868	3261
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7	6/2/1990 17:00	641	866	875	870	3252
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From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, May 31, 2022 4:42 PM
To: Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Neuls,Esther T (BPA) - PGPR-5 <etneuls@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: RE: LSR request for Birgit

Thanks- could you look at the top hour from more recent data. Maybe once fish operations happened on the projects so 1990 – 2021? I have some look back data that has a high value of 2955 MW- is there any data higher than that for that date range?

Thanks,
 Eve

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Sent: Thursday, May 26, 2022 3:41 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Neuls,Esther T (BPA) - PGPR-5 <etneuls@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: FW: LSR request for Birgit
Importance: High

Birgit/Eve

Below is some information that Esther pulled together after I had a conversation with Birgit across a wall (I know a strange concept these days 😊)
 Related to the maximum single hour of generation..

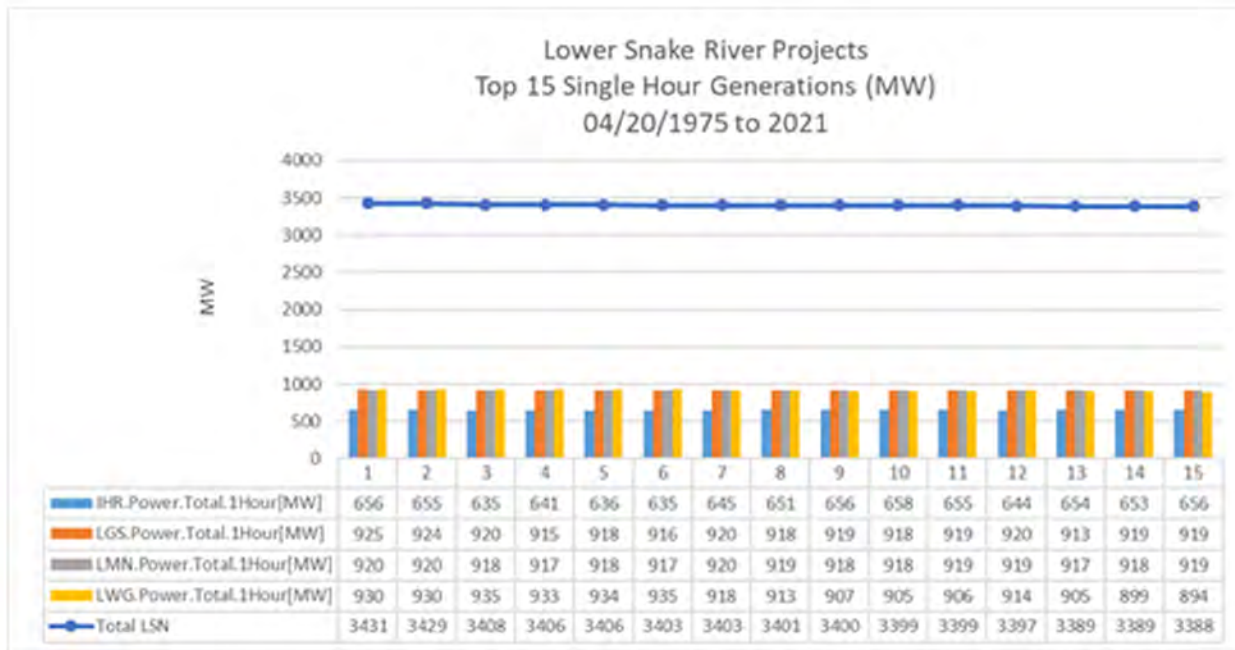
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- Data gathered from the publically accessible COE dataquery site
- All top 15 single hour generation came from March and April of 1982, data table also included below.

If we want to modify what data we are looking for, restrict to more recent years or specific months any combination can likely be pulled.

Top single hour generations details from individual LSR projects are also available below.



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11	4/5/1982 16:00	655	919	919	906	3399
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14	4/12/1982 17:00	653	919	918	899	3389
15	4/14/1982 3:00	656	919	919	894	3388

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, May 31, 2022 5:17 PM
To: James,Eve A L (BPA) - PG-5; Bellcoff,Steve (BPA) - PGPR-5
Cc: Neuls,Esther T (BPA) - PGPR-5; Egerdahl,Ryan J (BPA) - PGPR-5
Subject: RE: LSR request for Birgit

Eve and I have been so heads-down focused on our presentation that I failed to say THANK YOU for the fast turn-around. Joel Cook will be hugely pleased to see these high numbers in the powerpoint. Very cool!

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, May 31, 2022 4:42 PM
To: Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Neuls,Esther T (BPA) - PGPR-5 <etneuls@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: RE: LSR request for Birgit

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Thanks,
Eve

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To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Neuls,Esther T (BPA) - PGPR-5 <etneuls@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: FW: LSR request for Birgit
Importance: High

Birgit/Eve

Below is some information that Esther pulled together after I had a conversation with Birgit across a wall (I know a strange concept these days 😊)
Related to the maximum single hour of generation..

Esther was able to pull historical hourly generation for the four Lower Snake dams from 4/20/1975 to 12/31/2021.

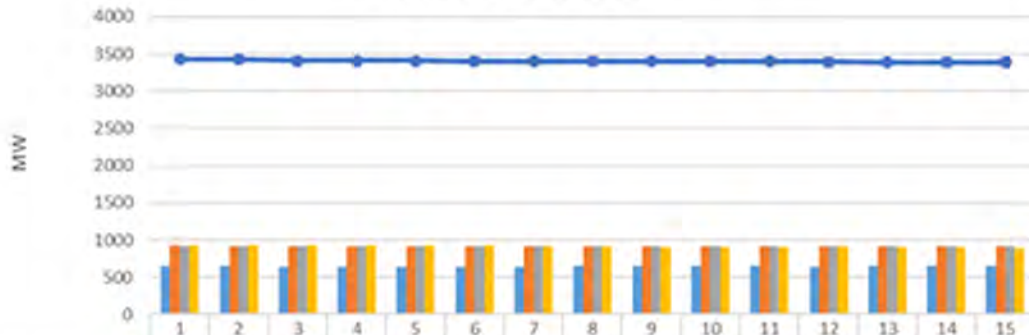
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- All top 15 single hour generation came from March and April of 1982, data table also included below.

If we want to modify what data we are looking for, restrict to more recent years or specific months any combination can likely be pulled.

Top single hour generations details from individual LSR projects are also available below.

Lower Snake River Projects
 Top 15 Single Hour Generations (MW)
 04/20/1975 to 2021



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
IHR.Power.Total.1Hour[MW]	656	655	635	641	636	635	645	651	656	658	655	644	654	653	656
LGS.Power.Total.1Hour[MW]	925	924	920	915	918	916	920	918	919	918	919	920	913	919	919
LMN.Power.Total.1Hour[MW]	920	920	918	917	918	917	920	919	918	918	919	919	917	918	919
LWG.Power.Total.1Hour[MW]	930	930	935	933	934	935	918	913	907	905	906	914	905	899	894
Total LSN	3431	3429	3408	3406	3406	3403	3403	3401	3400	3399	3399	3397	3389	3389	3388

Top 15-hour of Total LSN Generation

	Date Time	IHR.Power	LGS.Power	LMN.Pow	LWG.Pow	Total LSN
1	3/15/1982 16:00	656	925	920	930	3431
2	3/15/1982 17:00	655	924	920	930	3429
3	3/18/1982 19:00	635	920	918	935	3408
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14	4/12/1982 17:00	653	919	918	899	3389
15	4/14/1982 3:00	656	919	919	894	3388

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, May 31, 2022 5:10 PM
To: James,Eve A L (BPA) - PG-5
Subject: RE: LSR request for Birgit

Oh, I had missed that email from Steve (b)(6)

(b)(6)

Interesting that these were all 1982. Clearly no spill, and some are 3 hours. We can find a way to say that we have generated over 3,400 MW somewhere in our presentations. I'll try to look at them with a fresh eye in the morning.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, May 31, 2022 4:42 PM
To: Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Neuls,Esther T (BPA) - PGPR-5 <etneuls@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: RE: LSR request for Birgit

Thanks- could you look at the top hour from more recent data. Maybe once fish operations happened on the projects so 1990 – 2021? I have some look back data that has a high value of 2955 MW- is there any data higher than that for that date range?

Thanks,
Eve

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To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Neuls,Esther T (BPA) - PGPR-5 <etneuls@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: FW: LSR request for Birgit
Importance: High

Birgit/Eve

Below is some information that Esther pulled together after I had a conversation with Birgit across a wall (I know a strange concept these days 😊)

Related to the maximum single hour of generation..

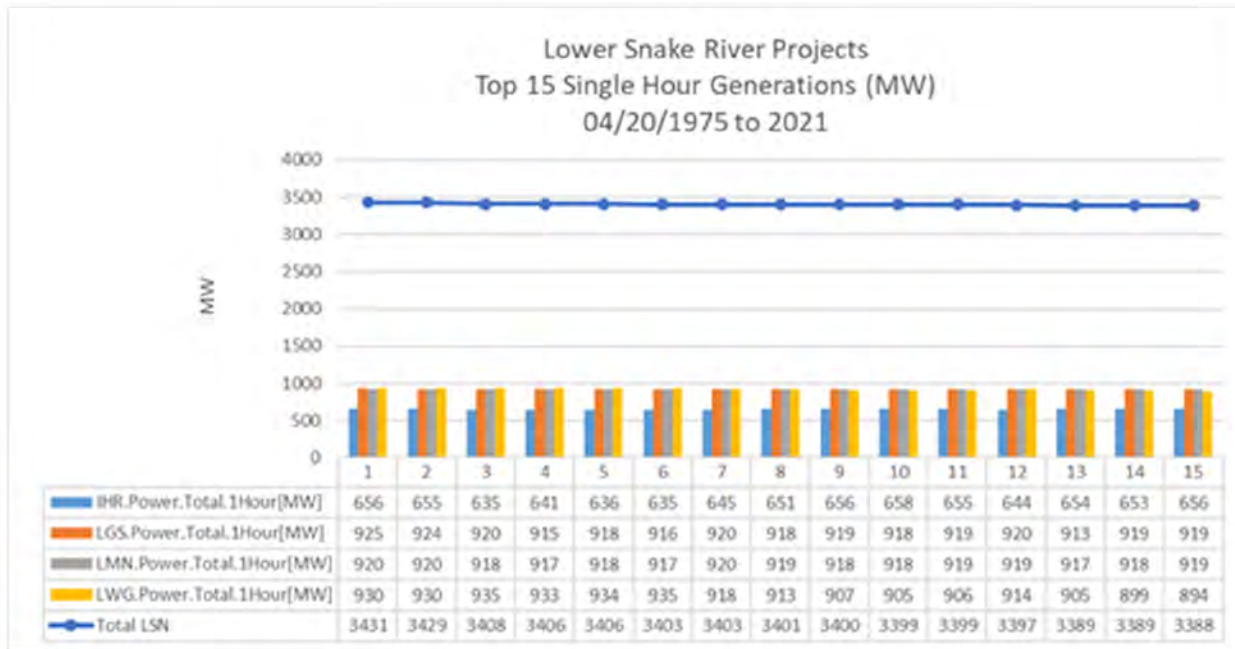
Esther was able to pull historical hourly generation for the four Lower Snake dames from 4/20/1975 to 12/31/2021.

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14 4/12/1982 17:00	653	919	918	899	3389	
15 4/14/1982 3:00	656	919	919	894	3388	

From: Neuls, Esther T (BPA) - PGPR-5
Sent: Wednesday, June 1, 2022 1:21 PM
To: James, Eve A L (BPA) - PG-5; Bellcoff, Steve (BPA) - PGPR-5; Koehler, Birgit G (BPA) - PG-5
Cc: Egerdahl, Ryan J (BPA) - PGPR-5
Subject: RE: LSR request for Birgit

No problem! Narrowing down the data to what we need is best!

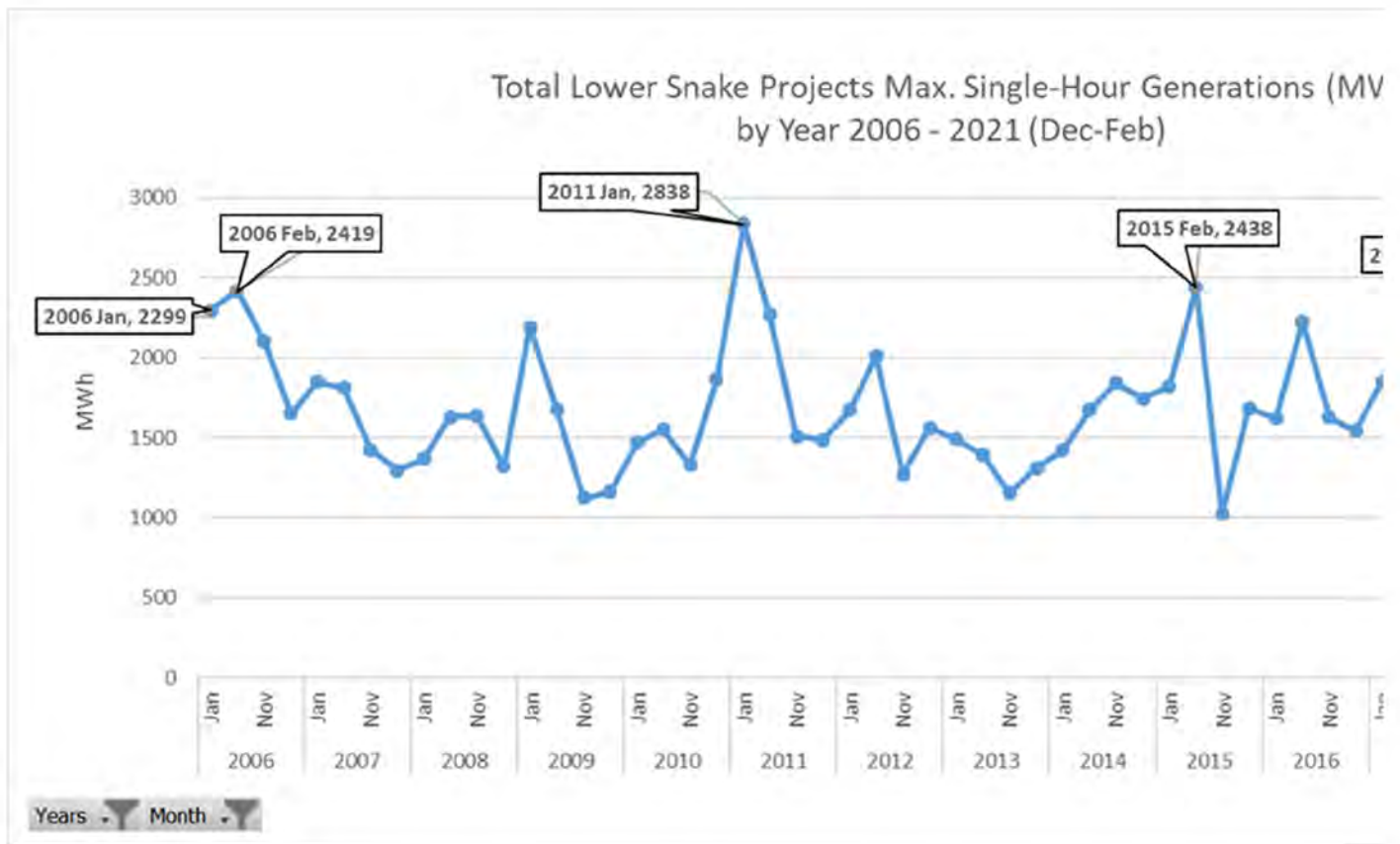
The Max Hour Gen in 2014 (2962 MW) happened in the month of March, just as you suspected...

If only looking at months of Dec to Feb, here are the top 5 Max Hour gen for 2006 – 2021:

Top 5 Single-hr Gen	MWh
1 Jan - 2011	2838
2 Feb - 2015	2438
3 Feb - 2006	2419
4 Jan - 2006	2299
5 Feb - 2017	2299

Please let me know if you have any questions or additional request.

Thanks
 Esther



From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, June 1, 2022 10:53 AM
To: Neuls,Esther T (BPA) - PGPR-5 <etneuls@bpa.gov>; Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Egerdahl,Ryan J (BPA) - PGPR-5 <riegerdahl@bpa.gov>
Subject: RE: LSR request for Birgit

Thanks Esther- I'm assuming the peak generation values on your chart occurred in March before spring spill but could you let me know if that assumption is correct? We are working on a slide responding to the NWECC study on the LSR replacement that just came out. Their data set is from 2006 – 2021. Could we use that same time period to determine the peak generation for Dec – Feb months? Thanks for all your help on this- honing this message before we share our results is very important 😊

From: Neuls,Esther T (BPA) - PGPR-5 <etneuls@bpa.gov>
Sent: Wednesday, June 1, 2022 7:21 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Bellcoff,Steve (BPA) - PGPR-5 <srbellcoff@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Egerdahl,Ryan J (BPA) - PGPR-5 <riegerdahl@bpa.gov>
Subject: RE: LSR request for Birgit

Good morning!

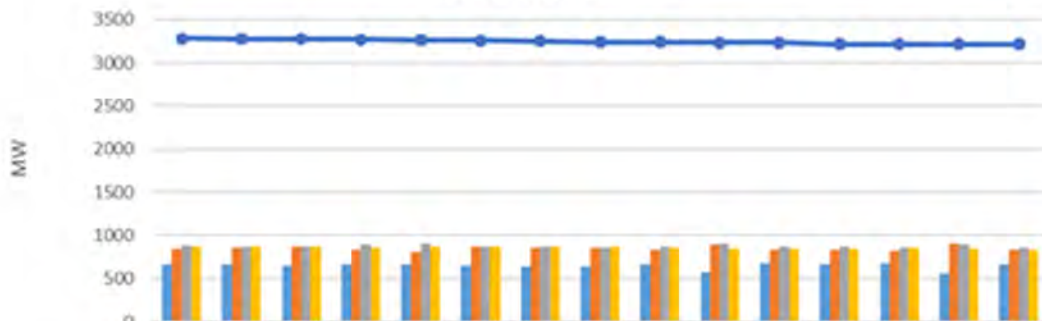
Here are the top 15 highest single hourly generation from LSR from 1990-2021...

- All 15 highest hourly gen came from 1990 and 1991 late May to early June.
- There were 323 single hour generations >= 2955 MW all happened prior to 2000, **except 2014 had several single hour gen that were > 2955**. Also included below are single Max Hourly Gen of LSN from 1990-2021.

Please let me know if you have any questions or need anything additional. Also, I am happy to share the data file if you think it'll help speed up the investigation. It takes time to communicate back and forth, please just keep in mind that this is a big file with 46 years of hourly data.

I am happy to support in any way!
Have a great hump day!
Esther

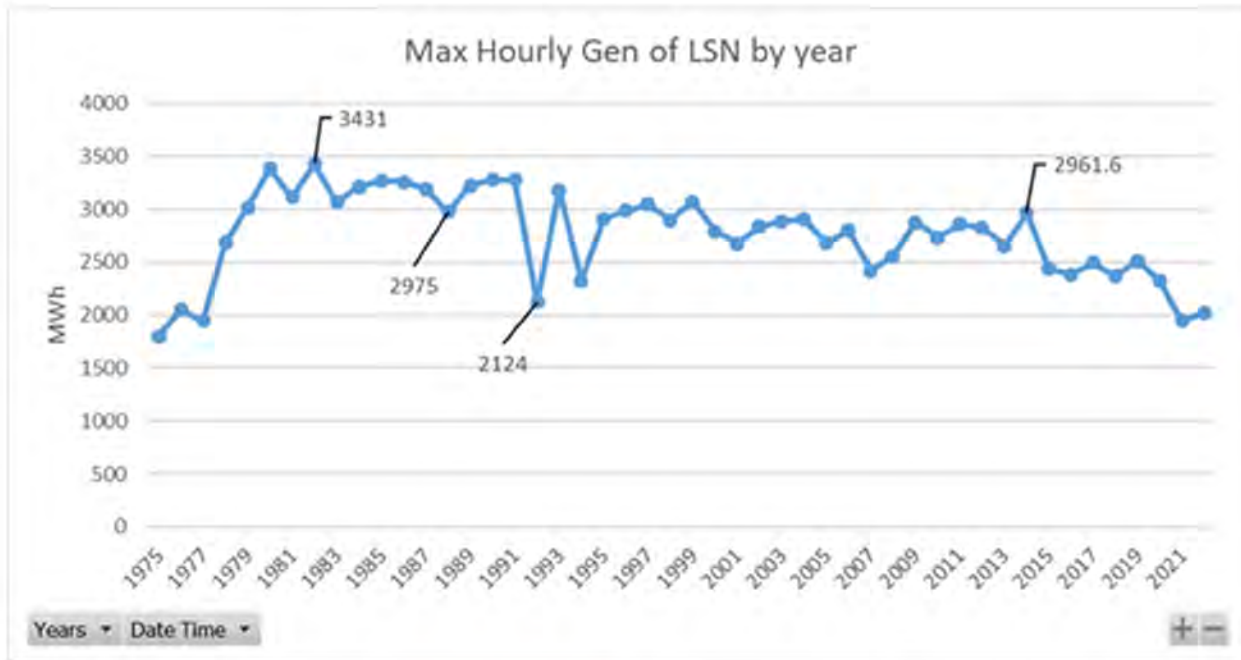
Lower Snake River Projects
Top 15 Single Hour Generations (MW)
1990 to 2021



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
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LGS.Power.Total.1Hour[MW]	854	860	876	832	816	867	866	864	835	898	832	832	820	904	838
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Total LSN	3279	3277	3276	3267	3261	3254	3252	3238	3238	3233	3230	3216	3215	3214	3214

Top 15-hour of Total LSN Generation 1990-2021

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3	6/2/1990 16:00	653	876	877	870	3276
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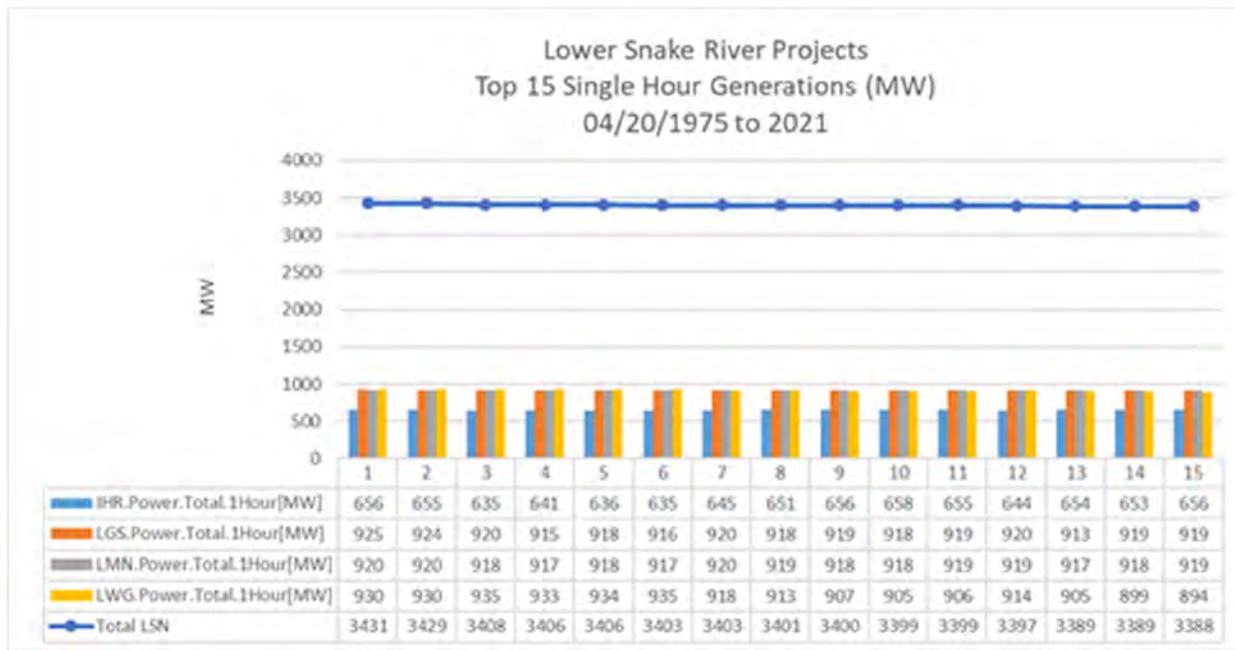
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11	4/5/1982 16:00	655	919	919	906	3399
12	3/30/1982 17:00	644	920	919	914	3397
13	4/5/1982 15:00	654	913	917	905	3389
14	4/12/1982 17:00	653	919	918	899	3389
15	4/14/1982 3:00	656	919	919	894	3388

From: Habibi, Maryam A (BPA) - DKP-7
Sent: Friday, July 8, 2022 10:09 AM
To: Leary, Jill C (BPA) - LN-7; Johnson, G Douglas (BPA) - DK-7; Goodwin, Summer G (BPA) - DKS-7; Scruggs, Joel L (BPA) - DK-7
Cc: Godwin, Mary E (BPA) - LN-7; Baskerville, Sonya L (BPA) - AIN-WASH; Zelinsky, Benjamin D (BPA) - E-4; Koehler, Birgit G (BPA) - PG-5
Subject: RE: Latest on E3 Comms package

Thank you, Jill!

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C (b)(6)

From: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>
Sent: Friday, July 8, 2022 10:08 AM
To: Johnson, G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>; Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs, Joel L (BPA) - DK-7 <jscruggs@bpa.gov>
Cc: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: Latest on E3 Comms package

From DOE:

I just heard from CEQ – they expect White House comms to reach out this afternoon with a comms package.

From: Johnson,G Douglas (BPA) - DK-7
Sent: Friday, July 8, 2022 10:15 AM
To: Leary,Jill C (BPA) - LN-7; Goodwin,Summer G (BPA) - DKS-7; Habibi,Maryam A (BPA) - DKP-7; Scruggs,Joel L (BPA) - DK-7
Cc: Godwin,Mary E (BPA) - LN-7; Baskerville,Sonya L (BPA) - AIN-WASH; Zelinsky,Benjamin D (BPA) - E-4; Koehler,Birgit G (BPA) - PG-5
Subject: RE: Latest on E3 Comms package

It's like Christmas in July.

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Sent: Friday, July 8, 2022 10:08 AM
To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jscruggs@bpa.gov>
Cc: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: Latest on E3 Comms package

From DOE:

I just heard from CEQ – they expect White House comms to reach out this afternoon with a comms package.

From: Koehler,Birgit G (BPA) - PG-5
Sent: Monday, June 27, 2022 1:06 PM
To: Chad Madron
Cc: James,Eve A L (BPA) - PG-5
Subject: RE: Link! RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Thanks!

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Monday, June 27, 2022 12:24 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Jennifer Light <JLight@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegeerdahl@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Kendra Coles <kcoles@nwcouncil.org>; Donahue,Scott L (BPA) - EWP-4 <sldonahue@bpa.gov>; Walker,Danielle N (BPA) - EW-4 <dnwalker@bpa.gov>; Moody,David F (BPA) - PEH-6 <dfmoody@bpa.gov>
Subject: [EXTERNAL] RE: Link! RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Birgit, I will add you as a panelist in case you want to say anything like "here's Arne!"

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Monday, June 27, 2022 12:15 PM
To: Chad Madron <CMadron@NWCouncil.org>; Jennifer Light <JLight@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegeerdahl@bpa.gov>
Cc: Kendra Coles <kcoles@nwcouncil.org>; Donahue,Scott L (BPA) - EWP-4 <sldonahue@bpa.gov>; Walker,Danielle N (BPA) - EW-4 <dnwalker@bpa.gov>; Moody,David F (BPA) - PEH-6 <dfmoody@bpa.gov>
Subject: RE: Link! RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Thanks Chad- I will be out of the office that week. Can I forward this information to Birgit Koehler who will be filling in for me or do you need to send it to her bgkoehler@bpa.gov

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Monday, June 27, 2022 12:13 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Jennifer Light <JLight@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegeerdahl@bpa.gov>
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Subject: [EXTERNAL] Link! RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Eve, I added you and Arne as panelists. I know you probably won't speak, but that way you can if you need to! You should've gotten the unique entry emails just now and will again 1 day and 1 hour before the event.

For everyone else here is general registration info you can pass around. This will also be posted on our website this Wed afternoon when we post the full agenda

Please register for Council Meeting - July 7, 2022 on Jul 7, 2022 8:30 AM PDT at:

<https://attendee.gotowebinar.com/register/8177247620192779277> (Arne and Eve do NOT need to do this!)

After registering, you will receive a confirmation email containing information about joining the webinar.

Brought to you by GoTo Webinar®

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Monday, June 27, 2022 11:52 AM
To: Jennifer Light <JLight@NWCouncil.org>; Chad Madron <CMadron@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>
Cc: Kendra Coles <kcoles@nwcouncil.org>; Donahue,Scott L (BPA) - EWP-4 <sldonahue@bpa.gov>; Walker,Danielle N (BPA) - EW-4 <dnwalker@bpa.gov>; Moody,David F (BPA) - PEH-6 <dfmoody@bpa.gov>
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

I will coordinate with Arne on materials and get back to you.

Thanks,
Eve

From: Jennifer Light <JLight@NWCouncil.org>
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Is there a name for the study I can reference or any executive summary or other material we can share with the members in advance? I am working on a packet memo, and any information you can provide that will help the members prepare would be appreciated.

Thanks,
Jennifer

Jennifer Light (she/her)
Interim Director of Power Planning
Office: 503-222-5161 | Direct: (b)(6)
www.nwcouncil.org | [LinkedIn](#)



From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Monday, June 27, 2022 10:58 AM
To: Chad Madron <CMadron@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Arne Olsen (arne@ethree.com) <arne@ethree.com>

Cc: Jennifer Light <JLight@NWCouncil.org>; Kendra Coles <kcoles@nwcouncil.org>

Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Thanks Chad- no one from BPA will be presenting. Arne will be presenting the E3 study results.

From: Chad Madron <CMadron@NWCouncil.org>

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Hi Ryan, Eve, and Arne,

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Can you confirm who from BPA and E3 will officially be presenting/speaking? Arne, I know you are giving the main presentation. Is there a report exec summary or any slides we could include with the memo to help them prepare? We will be sending them the prep memo THIS Wed by the middle of the day. Any info you can help us provide to help them be prepared is appreciated.

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From: Baskerville, Sonya L (BPA) - AIN-WASH
Sent: Monday, June 27, 2022 1:26 PM
To: Koehler, Birgit G (BPA) - PG-5; James, Eve A L (BPA) - PG-5; Godwin, Mary E (BPA) - LN-7; Leary, Jill C (BPA) - LN-7; Armentrout, Scott G (BPA) - E-4
Cc: Zelinsky, Benjamin D (BPA) - E-4
Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

Thanks. Will be back in touch.

Sonya Baskerville
BPA National Relations
(b)(6) m

On Jun 27, 2022 4:22 PM, "James, Eve A L (BPA) - PG-5" <eajames@bpa.gov> wrote:

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Arne is available after 2 PM EDT on July 7 or any time on July 8.

From: Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>

Sent: Monday, June 27, 2022 1:21 PM

To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmtrout@bpa.gov>

Cc: Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>

Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

I just need to know their availability after the Council presentation. I thought I saw a suggested time, but if they could give a few options, that would be ideal. Thanks!

Sonya Baskerville
BPA National Relations
(b)(6) m

On Jun 27, 2022 3:49 PM, "James, Eve A L (BPA) - PG-5" <eajames@bpa.gov> wrote:

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Sonya-

Did we hear anything more about scheduling a Congressional Delegation presentation? I'll let Arne know the timing when I reach out about the council materials if we have one.

Thanks,

Eve

From: James, Eve A L (BPA) - PG-5

Sent: Monday, June 27, 2022 12:45 PM

To: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmtrout@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

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Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

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OK- I can touch base with Arne to let him know we need some coordination about if we share materials prior to the meeting or not.

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To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

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Subject: RE: Memo/Background for Members ahead of July 7 E3 presentation for this Wed.

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Gabe is speaking with CEQ tomorrow on the E3 study, so let's wait to hear the outcome of that discussion. I think if we share the PPT this early, we need to be prepared to start fielding incoming questions and for the information to be shared with others. We may want to think about whether we are ready for that or want to set expectations with the Council that we may not have information to share ahead of the presentation.

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Monday, June 27, 2022 11:56 AM

To: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

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Sorry- adding Birgit

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Sent: Monday, June 27, 2022 11:55 AM

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Jennifer Light (she/her)

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Sent: Monday, June 27, 2022 12:50 PM
To: Leary,Jill C (BPA) - LN-7; Godwin,Mary E (BPA) - LN-7; Baskerville,Sonya L (BPA) - AIN-WASH; Armentrout,Scott G (BPA) - E-4; Koehler,Birgit G (BPA) - PG-5
Cc: Zelinsky,Benjamin D (BPA) - E-4
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Interim Director of Power Planning

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www.nwcouncil.org | [LinkedIn](#)



Northwest Power and
Conservation Council

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From: James,Eve A L (BPA) - PG-5
Sent: Tuesday, May 31, 2022 5:04 PM
To: Koehler,Birgit G (BPA) - PG-5
Subject: RE: Missed conversation with Koehler,Birgit G (BPA) - PG-5

Doug Johnson was thinking the communication plan would include talking points and a website write-up prior to posting the public slide deck. I believe he is already thinking through timing and checking with website folks on their workload. I have time on the Customer AE meeting on June 2 to give them some more information on the E3 study and timelines since the Earth Justice FAQ's are on the public website (your notes match mine from the EAG for E3 results).

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, May 31, 2022 5:00 PM
To: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Subject: RE: Missed conversation with Koehler,Birgit G (BPA) - PG-5

We haven't talked much about the public roll-out. All focus has been on CEQ.

Here are my notes from this morning:

- What's next:
 - Finalize with E3
 - Work on BPA reaction slides
 - Make sure DOE is comfortable with presentation before CEQ Booked. Get it to DOE by end of week.
 - Work on this Friday: Book a presentation to CEQ asap, no later than the dep secretary meeting, now in mid-late-June?
 - Decide whether to hold it within 408 for a while or release publicly

Who would participate in on preparing a proposal for public release? First we deal with the strategy question, then details. Does that go to EAG? I feel like we are missing a forum for conversations one level below EAG.

From: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Sent: Tuesday, May 31, 2022 4:56 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Missed conversation with Koehler,Birgit G (BPA) - PG-5

OK- just an FYI- Arne said E3 was getting questions about if the results would be public in time for the Inslee/Murray process and they were asking about timeline for the public info to be released at last Friday's meeting. I thought maybe the public slide deck would be available after briefing CEQ we would schedule a public meeting. If the Execs want to hold off for longer for a peer review I will let them know.

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, May 31, 2022 4:48 PM
To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: Missed conversation with Koehler, Birgit G (BPA) - PG-5

I don't know if we will get it in time for the Inslee/Murray stuff, even if we tried.

I think Scott, John, others will want peer review before we go public.

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, May 31, 2022 4:44 PM
To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Missed conversation with Koehler, Birgit G (BPA) - PG-5

I see your note about peer review. For what timeline? If we want numbers to inform the Inslee/Murray process we need to get the info out sooner than later. They are converting the CRSO EIS stuff to NPV for comparisons. It might be good to get the E3 study out there as well.

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, May 31, 2022 4:16 PM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: Missed conversation with Koehler, Birgit G (BPA) - PG-5

James, Eve A L (BPA) - PG-5 6:55 AM:

Hi Birgit- did you see the updated E3 slide deck? Who do you think I should forward that around to this morning?

Koehler, Birgit G (BPA) - PG-5 6:56 AM:

Let me take a look

What is your impression?

Koehler, Birgit G (BPA) - PG-5 6:59 AM:

I'd say, let's have you, Katie, and I look for glaring flaws, then we send to Scott... I don't know. Let me start with step one and look at it. Why don't you send to Scott now too. He's on early and would have time to look before the 8 am

James, Eve A L (BPA) - PG-5 6:59 AM:

OK

Koehler, Birgit G (BPA) - PG-5 7:02 AM:

I'm 1/3 through, and so far am pretty happy with it

James, Eve A L (BPA) - PG-5 7:03 AM:

Yes- I think it's pretty good. Some of the statements we had in our notes suggestions they weren't comfortable putting in since the study wasn't about that topic specifically and they want to keep the slides clean and independent from BPA messaging

Koehler, Birgit G (BPA) - PG-5 7:05 AM:

Not too surprising or unrealistic, but we would want to capture those. Maybe we would have a couple of supplemental slides that have BPA's logo.

Like what the OR governor's office did together with the ODOE presentation. Only we'd try not to bend the conclusion of central study

James, Eve A L (BPA) - PG-5 7:05 AM:

That'

s exactly what I was thinking too

Koehler,Birgit G (BPA) - PG-5 7:22 AM:

Scott's note.... we should be prepared to discuss at 8 am.

(but I need to spend time reviewing PGB applications right now. Need to select whom to interview)

James,Eve A L (BPA) - PG-5 7:23 AM:

Yes- some of that comes from the same feedback they had from DOE as well that the build out of new resources covers those TX grid services so they do list them in a grey box but not highlighted

Sounds good- I'll stub bugging you on this - PGB interviews are important!

Koehler,Birgit G (BPA) - PG-5 7:24 AM:

I did notice that little gray box. Scott was probably looking for a bigger highlight. It's worth mentioning when we discuss this morning so all are clear on that.

From Scott:

[5/31/2022 7:25 AM] Armentrout,Scott G (BPA) - E-4:

I think we will have to spell out the NPV cost. That is a big number but it doesn't necessarily mean anything to me or how it would materialize.

Scott: I think numbers like that are easily disregarded in the world of narratives unless we make it more real.

Koehler,Birgit G (BPA) - PG-5 7:29 AM:

from Scott, After going through it again, I suspect Joel would be very unhappy we don't list the services being replaced in a clean way upfront - no pun intended - lol

and my reply: TX services are in a gray box on Slide 5. We suggested to E3 to highlight them more, but DOE pointed out that many of the services are provided by the replacement resources

more from Scott: [5/31/2022 7:28 AM] Armentrout,Scott G (BPA) - E-4:

I don't think we should distribute to Joel till we reconcile the services being replaced otherwise I agree it is probably about time to close the deal

I see your rec on BPA narrative

its a good idea

[5/31/2022 7:29 AM] Armentrout,Scott G (BPA) - E-4:

Something like here is BPAs reaction to the data

Also, we will have to strategize who presents this to CEQ. Finally, DOE needs to see the final version to close the loop on the agency review

Before we drop it

[5/31/2022 7:30 AM] Armentrout,Scott G (BPA) - E-4:

on the region

James,Eve A L (BPA) - PG-5 7:31 AM:

Yes and we know RESOLVE didn't capture them so it seems weird to highlight them

E3 also mentioned they are starting to get questions of when the info will be released publicly so there is time to include it in Inslee/Murray process

Inslee/Murray is putting everything into NPV costs for comparisons

Koehler,Birgit G (BPA) - PG-5 7:32 AM:

maybe we can add a note on the side of the gray box that some are replaced by the new resources. That would implicitly acknowledge that not all are replaced too

Interesting on the NPV

Koehler,Birgit G (BPA) - PG-5 7:37 AM:

[5/31/2022 7:31 AM] Armentrout,Scott G (BPA) - E-4:

its not as straightforward as you guys had but its ok

Does this mean that those TX services have not been valued?

[5/31/2022 7:33 AM] Koehler,Birgit G (BPA) - PG-5:

E3 is supposed to qualitatively describe them. DOE made it clear that the dollar value is quite small compared to the energy/capacity value.

Eve just told me that the Inslee/Murray report is putting everything into NPV for comparison between studies

[5/31/2022 7:35 AM] Armentrout, Scott G (BPA) - E-4:

Not surprised - NPV is so obscure though it needs to be put into real world dollars and sense when explained

[5/31/2022 7:35 AM] Koehler, Birgit G (BPA) - PG-5:

It doesn't seem so obscure to me

Koehler, Birgit G (BPA) - PG-5 12:30 PM:

I only found the ODOE presentation, not the OR governor (Jim McKenna?) piece

James, Eve A L (BPA) - PG-5 2:44 PM:

I'm calling into the bridge

Koehler, Birgit G (BPA) - PG-5 2:44 PM:

OK

Hydro meeting done?

Koehler, Birgit G (BPA) - PG-5 4:13 PM:

I hate to do this, but I think we need to pursue the peer review again. If the timing doesn't work, we can pull the plug before we commit to contracting. But I do think we need to get moving. We keep getting asked about this.

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Thursday, May 26, 2022 7:18 AM
To: James, Eve A L (BPA) - PG-5; Koehler, Birgit G (BPA) - PG-5
Subject: RE: More input from Scott

That sounds like a good solution.

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Thursday, May 26, 2022 7:17 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: More input from Scott

Getting the max number isn't the problem on this note- the issue is the fuel limited number when it is needed most in winter and summer. Yes- in the spring when flows are high the LSN projects generate a lot but the criticism is the region is flush with power and low load so it isn't needed. That is why we focus on the sustained winter amount (Resource Adequacy folks would further constrain the value to the sustained winter amount in dry water years). We can find the highest we generated during winter months and add to the slide.

From: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Thursday, May 26, 2022 6:43 AM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: More input from Scott
Importance: High

From: Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Thursday, May 26, 2022 6:39 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: lay-person ppt

The key principle to use is identification of the max here. We don't need to say they HAVE to replace the full amount – but we certainly want to show what the LSRDs produce. Its facts. For some reason we are hesitant to show the amount and I don't know why. I suspect the data is there on the max number ever produced. Lets go get it!!!!

SCOTT G ARMENTROUT
Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C (b)(6)



From: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Thursday, May 26, 2022 6:37 AM
To: Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: RE: lay-person ppt

Got it. I'll work with Eve and Birgit to track that down.

From: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Thursday, May 26, 2022 6:35 AM
To: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: lay-person ppt
Importance: High

I like the first slide. The area that talks about cost per year – is it bounded, i.e. forever or for a certain amount of years? Starting and ending when? I wonder what the fuel limited capacity is? Surely there is number produced in the data – maybe we can find that number and just use the factual number? So if it EVER produced 3000 or more megawatts, we just say it has generated UP TO XXXX MW with the nameplate capacity of..... Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C (b)(6)



From: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Wednesday, May 25, 2022 4:21 PM
To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: FW: lay-person ppt

Hi Scott,

This is an iterative process -- here is where we are now. Eve has sent this to E3 so they can start tracking down some of the requests. We will find out on Thursday if we need this by Friday, and we are doing our best to stay on top of it.

Let me know if this is more of what you are looking for. I have a personal commitment for this evening that I can't get out of, but I'm available first thing in the morning to discuss. I can be available very early.

Katie Pruder Scruggs
Environmental Communication Specialist
Bonneville Power Administration
503-230-3111
(b)(6)

From: Goodwin,Summer G (BPA) - DKS-7
Sent: Thursday, July 14, 2022 4:00 PM
To: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5
Cc: Johnson,G Douglas (BPA) - DK-7; Scruggs,Joel L (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7
Subject: RE: Northwest RiverPartners' campaign on "The Story" tonight

I like your recommendation. I think if we offer one briefing, there will be flood of requests and it could be spending. I'm sure other groups would be happy to offer their interpretation.

I like the idea of sending the recording. Thanks

From: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Sent: Thursday, July 14, 2022 3:25 PM
To: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Subject: RE: Northwest RiverPartners' campaign on "The Story" tonight

Hi Summer-

I don't think we would want BPA staff to present E3 study results to customers because we are really trying to keep the E3 analysis as independent as possible. I suggest sending a link to the recording of the Council meeting where E3 briefed their report (scroll through about 2 to 3 hours; it was the last agenda item of the meeting). Once they have viewed the presentation we could be available to answer or facilitate answers to specific questions.

<https://nwcouncil.box.com/shared/static/zhw1qh20u3s4tgd2jk6s9ozruo9lg967.mp4>

We could potentially facilitate E3 to present their results but we are prioritizing Congressional staff briefings and I'm not sure if the current contract \$'s will support additional meetings (depends on how many DC briefings get scheduled). I can check with E3 on budget once Sonya finishes scheduling. Birgit and I could probably swing a briefing if others feel strongly that we should.

Thanks,
Eve

From: Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Sent: Thursday, July 14, 2022 12:05 PM
To: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Subject: FW: Northwest RiverPartners' campaign on "The Story" tonight

Request from a customer for an Replacement Cost Study briefing.

I expect we will get more of these.

From: Perry, Marcus I (BPA) - PSW-6 <miperry@bpa.gov>
Sent: Thursday, July 14, 2022 11:51 AM
To: Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: RE: Northwest RiverPartners' campaign on "The Story" tonight

Hey Summer. I received a request from a customer to have someone provide a briefing on the E3 Dam Replacement study for their Utility Advisory Committee. I see Eve James and Birgit Koehler listed on the Talking Pints as people to contact for questions...but would they be the right people to connect with for discussing the study results externally too? I wasn't sure if we were planning a larger debrief from E3 for customers outside of the councils presentation the other day?

-Marcus

From: Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Sent: Thursday, July 14, 2022 11:23 AM
To: Thompson, Kim T (BPA) - PS-6 <ktthompson@bpa.gov>; ADL_PSE_ONLY <ADL_PSE_ONLY@BPASite1.bpa.gov>; ADL_PSW_ALL <ADL_PSW_ALL@BPASite1.bpa.gov>; Hilliard Creecy, Jamae (BPA) - PE-6 <jlhilliard@bpa.gov>; Leady Jr, William J (BPA) - PG-5 <wjleady@bpa.gov>; Dibble, Rachel L (BPA) - PT-5 <rldibble@bpa.gov>; Spraggins, Melanie (BPA) - P-6 <mspraggins@bpa.gov>; Cooper, Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>
Subject: FW: Northwest RiverPartners' campaign on "The Story" tonight

KGW is channel 8 in Portland, not sure about elsewhere in the region. This might be something to watch.

From: Scruggs, Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Sent: Thursday, July 14, 2022 10:30 AM
To: Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Goodwin, Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: FW: Northwest RiverPartners' campaign on "The Story"

FYI, sounds like Kurt Miller will be appearing in a KGW segment by Pat Dooris this evening, responding to viewer questions about the NRPs' pro-LSRD campaign.

Joel Scruggs (He/Him)
Director of Communications | Communications (DK)
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-5511 | C (b)(6)



From: Cook,Joel D (BPA) - K-7
Sent: Wednesday, July 13, 2022 3:57 PM
To: Koehler,Birgit G (BPA) - PG-5; Baskerville,Sonya L (BPA) - AIN-WASH; Hairston,John L (BPA) - A-7; Zelinsky,Benjamin D (BPA) - E-4; James,Eve A L (BPA) - PG-5; Godwin,Mary E (BPA) - LN-7; Armentrout,Scott G (BPA) - E-4; Habibi,Maryam A (BPA) - DKP-7; Scruggs,Joel L (BPA) - DK-7; James,Daniel M (BPA) - D-7
Cc: Johnson,G Douglas (BPA) - DK-7
Subject: RE: Potential response to PPC letter (DRAFT)

I too like referring back to the EIS work in addition to the proposed comments

Joel Cook - From Workspace ONE Boxer

On Jul 13, 2022 2:36 PM, "Habibi,Maryam A (BPA) - DKP-7" <maasgharian@bpa.gov> wrote:
I'll see if I can find the latest version before he returns tomorrow.

Maryam Habibi

Manager | Media Relations, Policy Communications and Writing

BONNEVILLE POWER ADMINISTRATION

P 503-230-4413 | C (b)(6)

From: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>

Sent: Wednesday, July 13, 2022 2:34 PM

To: Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; James,Daniel M (BPA) - D-7 <dmjames@bpa.gov>

Cc: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>

Subject: RE: Potential response to PPC letter (DRAFT)

Good point.

Doug, can you please send those out again.

Thanks

John

From: Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>

Sent: Wednesday, July 13, 2022 2:28 PM

To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; James,Daniel M (BPA) - D-7 <dmjames@bpa.gov>

Cc: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>

Subject: RE: Potential response to PPC letter (DRAFT)

I believe Doug and folks had created some if asked talking points that already had been cleared with DOE and should suffice on the E3 study.

On the so-called science study, I think we could say that isn't Administration policy and we continue to work toward understanding the best available science and adaptive management for the various species.

Thanks.

Sonya Baskerville

BPA National Relations

202.253.7352 m

On Jul 13, 2022 5:19 PM, "Hairston,John L (BPA) - A-7" <jlhairston@bpa.gov> wrote:

My thinking would be to create a combination of the 3 plus my CRSO context.

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>

Sent: Wednesday, July 13, 2022 2:17 PM

To: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Daniel M (BPA) - D-7 <dmjames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Cc: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>

Subject: RE: Potential response to PPC letter (DRAFT)

I believe the second statement would be good as a response if we receive questions about our position on the other paper.

I like the context you provide around the E3 report building on the CRSO analysis.

Maryam Habibi

Manager | Media Relations, Policy Communications and Writing

BONNEVILLE POWER ADMINISTRATION

P 503-230-4413 | C(b)(6)

From: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>

Sent: Wednesday, July 13, 2022 2:14 PM

To: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Daniel M (BPA) - D-7 <dmjames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Cc: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>

Subject: RE: Potential response to PPC letter (DRAFT)

Thanks Joel,

Well let's see. I think the statement is good, but a little provocative given the policy confusion taking place in D.C. right now regarding the LSRDs. Couple of thoughts, 1) If we were to make a statement, I think it should come from me. 2) I think a statement should also include reference to the EIS ROD and that the E3 study provide greater focus on the alternative that was covered in the ROD. Otherwise I like the content that has been drafted.

Any thoughts from others on this?

From: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>

Sent: Wednesday, July 13, 2022 11:57 AM

To: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Daniel M (BPA) - D-7 <dmjames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Cc: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>

Subject: Potential response to PPC letter (DRAFT)

PPC's claims of interference by CEQ will draw some interest and we will likely get calls from Clearing Up and potentially others. While I don't think we should address those claims head on, it's an opportunity to emphasize key takeaways from the E3 study since those findings are being overshadowed. We can also put some focus on the clean energy aspect. Here are some draft statements to consider. If we're comfortable providing a response, it might be safer to have it attributed to me or Maryam.

Please review these draft statements and provide your feedback.

"E3's study elevates our understanding of the complexities and costs involved in exploring replacement resources to the Lower Snake River dams. Given that Bonneville's utility customers and Northwest electric ratepayers would bear these

costs through significantly higher rates, it's critical that the latest analysis of power supply options, projected costs and impacts are available and fairly presented alongside other information."

"We respect and appreciate the commitment of so many groups and leaders in this regional dialogue about long-term strategies that prioritize the protection and enhancement of salmon and steelhead. Ultimately, the region as a whole must continue to advance collaborative solutions while also preserving critical and essential services and purposes that the Northwest public, economy and society rely on."

"The demand for low-cost, dependable, clean energy is only increasing. From a practical standpoint, there simply aren't any realistic replacement options available today or in the foreseeable future that wouldn't increase carbon dioxide emissions, raise electricity bills for millions of Northwest residents and make our power grid less reliable. These are compelling impacts that federal officials and the entire should not ignore."

Joel Scruggs (He/Him)

Director of Communications | Communications (DK)

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-5511 | C(b)(6)



From: Habibi, Maryam A (BPA) - DKP-7
Sent: Wednesday, July 13, 2022 4:19 PM
To: Hairston, John L (BPA) - A-7; Baskerville, Sonya L (BPA) - AIN-WASH; Koehler, Birgit G (BPA) - PG-5; Cook, Joel D (BPA) - K-7; Zelinsky, Benjamin D (BPA) - E-4; James, Eve A L (BPA) - PG-5; Godwin, Mary E (BPA) - LN-7; Armentrout, Scott G (BPA) - E-4; Scruggs, Joel L (BPA) - DK-7; James, Daniel M (BPA) - D-7
Cc: Johnson, G Douglas (BPA) - DK-7
Subject: RE: Potential response to PPC letter (DRAFT)

Sonya confirmed she meant the draft talking points. Yesterday, we updated and posted them internally. Here is the link.

<https://connection.bud.bpa.gov/news/current-messages/talkingpoints/E3%20analyzes%20potential%20replacement%20resources%20and%20costs%20of%20lower%20Snake%20River%20dams.docx>

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C (b)(6)

From: Hairston, John L (BPA) - A-7 <jlhairston@bpa.gov>
Sent: Wednesday, July 13, 2022 2:34 PM
To: Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Cook, Joel D (BPA) - K-7 <jdcook@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs, Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; James, Daniel M (BPA) - D-7 <dmjames@bpa.gov>
Cc: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: Potential response to PPC letter (DRAFT)

Good point.

Doug, can you please send those out again.

Thanks
John

From: Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Sent: Wednesday, July 13, 2022 2:28 PM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Cook, Joel D (BPA) - K-7 <jdcook@bpa.gov>; Hairston, John L (BPA) - A-7 <jlhairston@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Habibi, Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Scruggs, Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; James, Daniel M (BPA) - D-7 <dmjames@bpa.gov>
Cc: Johnson, G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Subject: RE: Potential response to PPC letter (DRAFT)

I believe Doug and folks had created some if asked talking points that already had been cleared with DOE and should suffice on the E3 study.

On the so-called science study, I think we could say that isn't Administration policy and we continue to work toward understanding the best available science and adaptive management for the various species.

Thanks.

Sonya Baskerville
BPA National Relations
(b)(6) m

On Jul 13, 2022 5:19 PM, "Hairston,John L (BPA) - A-7" <jlhairston@bpa.gov> wrote:
My thinking would be to create a combination of the 3 plus my CRSO context.

From: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Sent: Wednesday, July 13, 2022 2:17 PM
To: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Daniel M (BPA) - D-7 <dmjames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Subject: RE: Potential response to PPC letter (DRAFT)

I believe the second statement would be good as a response if we receive questions about our position on the other paper.

I like the context you provide around the E3 report building on the CRSO analysis.

Maryam Habibi
Manager | Media Relations, Policy Communications and Writing
BONNEVILLE POWER ADMINISTRATION
P 503-230-4413 | C (b)(6)

From: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>
Sent: Wednesday, July 13, 2022 2:14 PM
To: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Daniel M (BPA) - D-7 <dmjames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Subject: RE: Potential response to PPC letter (DRAFT)

Thanks Joel,

Well let's see. I think the statement is good, but a little provocative given the policy confusion taking place in D.C. right now regarding the LSRDs. Couple of thoughts, 1) If we were to make a statement, I think it should come from me. 2) I think a statement should also include reference to the EIS ROD and that the E3 study provide greater focus on the alternative that was covered in the ROD. Otherwise I like the content that has been drafted.

Any thoughts from others on this?

From: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>

Sent: Wednesday, July 13, 2022 11:57 AM

To: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James,Daniel M (BPA) - D-7 <dmjames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Cc: Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdijohnson@bpa.gov>

Subject: Potential response to PPC letter (DRAFT)

PPC's claims of interference by CEQ will draw some interest and we will likely get calls from Clearing Up and potentially others. While I don't think we should address those claims head on, it's an opportunity to emphasize key takeaways from the E3 study since those findings are being overshadowed. We can also put some focus on the clean energy aspect. Here are some draft statements to consider. If we're comfortable providing a response, it might be safer to have it attributed to me or Maryam.

Please review these draft statements and provide your feedback.

"E3's study elevates our understanding of the complexities and costs involved in exploring replacement resources to the Lower Snake River dams. Given that Bonneville's utility customers and Northwest electric ratepayers would bear these costs through significantly higher rates, it's critical that the latest analysis of power supply options, projected costs and impacts are available and fairly presented alongside other information."

"We respect and appreciate the commitment of so many groups and leaders in this regional dialogue about long-term strategies that prioritize the protection and enhancement of salmon and steelhead. Ultimately, the region as a whole must continue to advance collaborative solutions while also preserving critical and essential services and purposes that the Northwest public, economy and society rely on."

"The demand for low-cost, dependable, clean energy is only increasing. From a practical standpoint, there simply aren't any realistic replacement options available today or in the foreseeable future that wouldn't increase carbon dioxide emissions, raise electricity bills for millions of Northwest residents and make our power grid less reliable. These are compelling impacts that federal officials and the entire should not ignore."

Joel Scruggs (He/Him)

Director of Communications | Communications (DK)

BONNEVILLE POWER ADMINISTRATION

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From: Leary, Jill C (BPA) - LN-7
Sent: Thursday, June 9, 2022 10:11 AM
To: Armentrout, Scott G (BPA) - E-4; Godwin, Mary E (BPA) - LN-7; Baskerville, Sonya L (BPA) - AIN-WASH
Cc: Zelinsky, Benjamin D (BPA) - E-4; James, Eve A L (BPA) - PG-5; Koehler, Birgit G (BPA) - PG-5; Hairston, John L (BPA) - A-7; Cook, Joel D (BPA) - K-7; Sweet, Jason C (BPA) - EW-4; Scruggs, Joel L (BPA) - DK-7; Leady Jr, William J (BPA) - PG-5; Cooper, Suzanne B (BPA) - P-6
Subject: RE: Proposed Public roll out of E3

Hi Scott,
Mary and I discussed, and this sounds like a good plan. We also mentioned it to Emily Hammond, and they thought it made sense, thanks.

Jill

From: Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Thursday, June 9, 2022 9:08 AM
To: Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <sibaskerville@bpa.gov>
Cc: Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Hairston, John L (BPA) - A-7 <jlhairston@bpa.gov>; Cook, Joel D (BPA) - K-7 <jdcook@bpa.gov>; Sweet, Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Scruggs, Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Leady Jr, William J (BPA) - PG-5 <wjleady@bpa.gov>; Cooper, Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>
Subject: Proposed Public roll out of E3

All – discussion this morning – we are proposing to offer a presentation of the E3 study to the Northwest Power and Conservation Council - Power Committee. This would be our public release plan. The next scheduled meeting is July (2nd week) – though we could offer a special meeting if they want it earlier. This closes the loop on release to the public in a specific forum plus honors our commitment to the council to share this study. We could inform CEQ that this is the release plan and they can offer that info to those wishing for the results. This is just a proposal and we welcome feedback. Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C (b)(6)



From: Cook,Joel D (BPA) - K-7
Sent: Tuesday, June 28, 2022 2:12 PM
To: Johnson,G Douglas (BPA) - DK-7; Baskerville,Sonya L (BPA) - AIN-WASH;
Zelinsky,Benjamin D (BPA) - E-4; Cooper,Suzanne B (BPA) - P-6; Chong Tim,Marcus H
(BPA) - L-7
Cc: Scruggs,Joel L (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7; James,Eve A L (BPA) -
PG-5; Koehler,Birgit G (BPA) - PG-5; Goodwin,Summer G (BPA) - DKS-7
Subject: RE: REVIEW REQUESTED: Draft talking points E3 LSRD replacement analysis

Looks good
Thanks

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Tuesday, June 28, 2022 10:27 AM
To: Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>;
Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>; Chong
Tim,Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>
Cc: Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>;
James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Goodwin,Summer
G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: REVIEW REQUESTED: Draft talking points E3 LSRD replacement analysis

I have attached the current version of our draft talking points we intend to provide to AEs and other BPA external communicators next week ahead of our briefing for the Northwest Power and Conservation Council. These have been reviewed by Communications and Eve James and Birgit Koehler. I am also attached our proposed outreach plan so you are familiar with the sequence of events we propose for release.

Please provide edits and comments by noon, Thursday, June 30. Ideally, we will have these finalized by COB, Friday, July 1 and can provide the talking points and the presentation E3 will use to brief the Council to our external communicators via Communications email the day before the Council briefing. We are meeting today with Eve and Birgit to discuss the outreach plan. If anyone would like to participate, please let me know and I'll forward you the invite.

Please let me know if you have questions or need more information about the talking points or outreach plan. Thanks!

From: James,Eve A L (BPA) - PG-5
Sent: Monday, June 27, 2022 7:49 AM
To: Koehler,Birgit G (BPA) - PG-5; Scruggs,Joel L (BPA) - DK-7; Warner,Joshua P (BPA) - AIR-7; Pruder Scruggs,Kathryn M (BPA) - E-4; Johnson,G Douglas (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement cost analysis talking points
Attachments: E3 LSRD replacement cost analysis TPs v1 kps suggestions_jpw_jlsbgk_eaj.docx

This version replies to a few comments and I replaced the table that had some weird font discrepancies.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Monday, June 27, 2022 7:26 AM
To: Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Warner,Joshua P (BPA) - AIR-7 <jpwarner@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement cost analysis talking points

I replied to a couple prior comments, and of course added edits and comments of my own.

From: Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>
Sent: Sunday, June 26, 2022 10:51 PM
To: Warner,Joshua P (BPA) - AIR-7 <jpwarner@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement cost analysis talking points

Hey, all. I added some initial suggestions and a few comments.

Joel Scruggs (He/Him)
Director of Communications | Communications (DK)
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-5511 | C (b)(6)



From: Warner,Joshua P (BPA) - AIR-7 <jpwarner@bpa.gov>
Sent: Friday, June 24, 2022 3:54 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement cost analysis talking points

One more edit.

From: Warner,Joshua P (BPA) - AIR-7
Sent: Friday, June 24, 2022 3:39 PM

To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement cost analysis talking points

Thanks for the chance to take a look. I have not seen any other documents on the study, so just working from the messages in the doc. I put my comments on top of Katie's comments. I then pulled Eve's comments into this document because I was mid-stream when I saw them.

Josh

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Friday, June 24, 2022 2:58 PM
To: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Warner,Joshua P (BPA) - AIR-7 <jpwarner@bpa.gov>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement cost analysis talking points

Added a few edits to Katie's version but will revisit early next week to make sure I didn't miss anything on a sunny Friday afternoon.

From: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Friday, June 24, 2022 2:25 PM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Warner,Joshua P (BPA) - AIR-7 <jpwarner@bpa.gov>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement cost analysis talking points

Thanks for the opportunity to review. A few suggestions for the key messages. I'm out all next week.

Have a great weekend!

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Friday, June 24, 2022 2:13 PM
To: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Warner,Joshua P (BPA) - AIR-7 <jpwarner@bpa.gov>
Subject: REVIEW REQUESTED: E3 LSRD replacement cost analysis talking points

Please take a look and provide any edits or comments you have by noon, Tuesday, June 28. Once I have your comments and edits, I'll circulate a revised version to managers and executives. We need to have these done by next Friday if we still intend to present the results to the Council Wednesday or Thursday the week of the 4th of July.

The first few sections are new – the Q&A was lifted almost verbatim from the E3 powerpoint presentation. I hope this is close to the mark. Thanks for your help. Have a great weekend.

From: Johnson,G Douglas (BPA) - DK-7
Sent: Tuesday, June 28, 2022 8:49 AM
To: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement study

Let's get that and the proposed rollout plan to them. I am OK with the current version. Were you and Birgit able to resolve those remaining comments?

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, June 28, 2022 8:47 AM
To: Johnson,G Douglas (BPA) - DK-7 <gjohnson@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement study

Hi Doug-

There was a lot of interest at the Executive Advisory Group meeting this morning about the E3 study rollout. The basic concern during the discussion was that the study is independent and we don't want to be viewed as putting a spin on it or interfering with others viewing the study as independent but also don't want to be flat footed when asked our viewpoint. Joel and Sonya would like to review the talking points when you think you have a good version for internal review -I think this version looks good but will defer to your expertise and let you circulate around to a minimum of Joel Cook, Sonya Baskerville, Ben Zelinsky (acting for Scott Armentrout), Suzanne Cooper.

Thanks,
Eve

From: James,Eve A L (BPA) - PG-5
Sent: Monday, June 27, 2022 5:02 PM
To: Johnson,G Douglas (BPA) - DK-7 <gjohnson@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement study

Attached is a cleaned up version.

From: Johnson,G Douglas (BPA) - DK-7 <gjohnson@bpa.gov>
Sent: Monday, June 27, 2022 9:32 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: REVIEW REQUESTED: E3 LSRD replacement study

OK. I cleaned this up and deleted comments that were addressed. There are a few that I don't know how to handle. Please take a look and provide language or deletions that address your comments. Thanks.

FOR INTERNAL USE ONLY

BPA talking points

E3 lower Snake River dam replacement costs analysis

June 2022

What this is

Earlier this year, BPA ~~contracted with~~~~engaged~~ electric industry research firm Energy and Environmental Economics, also known as E3, ~~to conduct an independent analysis of the electricity system value of the four lower Snake River (LSR) dams. This new analysis~~ builds on the analysis performed in the Columbia River System Operations Environmental Impact Statement regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future. ~~BPA anticipates E3's study to contribute to the regional dialogue about the future of these publicly-owned assets and help elevate regional understanding of the complexities and expenses involved in exploring replacement resources for the LSR dams.~~

Comment [SL(-D1)]: Pulled from E3 slide deck

Key messages and storyline

- ~~Breaching the dams would require resource builds just to get the system back to where it is now rather than replacing fossil-fuel generation.~~
- ~~As states move forward with clean energy policies, fossil-fuel generated power is being removed from the grid. Reducing hydropower would require the resource region to build new generation just to get the system back to where it is now. Until all fossil-fuel power plants are retired, reducing hydropower means more CO2 emissions in the region, which is a step backward from the region's carbon reduction goals.~~
- ~~Also, some of the lower-cost options for replacing lost hydro-power rely on emerging technologies that are not yet developed or available at large-scale. reliance on emerging technologies not yet deployed is assumed for some of the lower-cost options.~~
- Replacing the dams' hydropower energy and capacity services with existing renewable technology would be prohibitively expensive.
- This ~~The~~ E3 study evaluates what is required to maintain ~~the~~ current reliability standards. Assuming different risk levels for reliability, as is done in other studies of LSN dam power replacement, is a policy decision outside the scope of this analysis. That is something BPA, its customers and constituents will have to consider as discussions about the future of the lower Snake River dams continue.
- Replacement ~~New~~ resources to replace the existing lower Snake River dams energy and capacity would cost \$xxx per year. If this is not paid for by an outside source, it would result in higher electric bills for millions of Northwest residents.

Comment [SL(-D2)]: I got hung up on this term. Should we say "region"

Comment [KG(-P3)]: Yes, "resources" doesn't make sense here

Comment [SL(-D4)]: Could we say "current state" instead?

Comment [PSM(-E5)]: This is vetted language from Alissa Kaseweter.

Comment [KG(-P6)]: "Prohibitively expensive" is in the eye of the beholder. If this is referring to Scenario 2c, then this is not only existing technology but also deep decarbonization of other sectors of the economy

Comment [SL(-D7)]: Decarbonization increases volatility, especially if more dependent on intermittent resources that lack ramping/load following capabilities.

Comment [KG(-P8)]: E3 did not study other reliability risks, so this doesn't make sense unless directed to other studies

Comment [KG(-P9)]: I doubt we would consider not keeping the lights on as in the amount of replacement in the NWECC study, but we might consider slightly higher risk

- The replacement of the dams' hydropower ~~It would~~ also take up to approximately 20 years to complete after Congressional approval if Transmission builds were needed and there was not litigation on siting.

Background

With multiple reviews of the future of the lower Snake River dams being conducted by the Council on Environmental Quality, the Columbia Basin Collaborative and Senator Patty Murray (D-WA) and Washington Governor Jay Inslee, BPA felt it necessary to update the potential costs of replacing the energy services from these facilities.

The CRSO EIS analysis examined a series of resource replacement portfolios using the Northwest Power and Conservation Council's latest resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. E3 ~~will include~~ used a resource portfolio optimizer model using with their data sets and their criteria and objectives to create least cost replacement portfolios.

E3's independent analysis includes several scenarios for replacement resources, including some with emerging technologies, such as offshore wind, small modular nuclear and gas plants with carbon capture or hydrogen burning capability that are not deployed yet. It also includes use of traditional renewable resources, such as wind, solar, and storage and demand response. All of the scenarios present moderate to significant upward rate pressure for BPA's customers if not paid for by an outside source.

For more information, contact: Eve James, 503-230-5558 or Birgit Koehler, 503-230-4249

Questions and answers

1. What was the scope of the study and what questions did it address?

BPA contracted with E3 to answer what resources (one or more portfolios of resources) would be needed to maintain reliability, which is close to replacing the full energy and other grid services provided by the lower Snake River dams?-. This includes modeling regional grid scenarios with and without these dams. The model is designed to identify one or more replacement resource portfolio(s) and provide a comparison of the forecasted costs associated with each scenario. The analysis also discusses the timeline under which a build-out of replacement resources could occur.

E3's key study questions are:

- What additional resources would be needed to replace the power services provided by the LSR Dams through 2045?
- What is the net cost to BPA ratepayers?
- How do costs and resource needs change under different types of clean energy futures?'

Comment [WP(-D10): EVE'S COMMENT:
Because location and types of replacement resources needed putting a timeline in needs some caveats.

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Comment [KG(-P11): This may be true, but I don't remember that they used the Council's cost estimates

Comment [EAJ12]: They used Council's latest load forecasts but updated prices from Energy Commodities data. The CRSO EIS used the Council forecasts and price forecasts from the time but E3 uses the most recent power plan

Comment [WP(-D13): EVE'S COMMENT:
The model has offshore wind but never selected it due to the high cost

Comment [KG(-P14): This is what we asked them to do, per request from the COO. But E3's approach was to see what it would take to maintain grid reliability, which was pretty much a full replacement study. Given the narrative I saw in the Inslee/Murray report, it might be worth stating this differently. (in the I/M paper, the EIS is described as "full replacement" which comes across as replacing more than is needed.

- How much does replacing the dams rely on emerging, not-yet commercialized technologies?

Comment [SL(-D15)]: Per E3's presentation.

2. What power benefits do the four LSRDs currently provide?

These facilities first and foremost provide reliable electricity to help the western interconnection and the Pacific Northwest avoid blackouts. They also provide carbon-free energy to help fight climate changes. More specifically, they are capable of providing a short-term peaking capacity of more than 3,000 MWs. They can provide more than 2,000 MW of longer term peaking capacity during cold snaps when Pacific Northwest electricity use is at its highest. ~~The also- as well as~~ provide important reserves and provide essential grid reliability services, including voltage support, reactive power and black start ability.

3. What resources does the study recommend to replace the output of the lower Snake River dams?

The study recommends a combination of renewable generation (wind and solar) and "clean firm" resources (such as dual fuel natural gas + hydrogen plants, advanced small modular nuclear, or gas with carbon capture and storage), and energy efficiency.

Comment [KG(-P16)]: At least one scenario picks solar. One scenario picks neither wind nor solar.

4. What are the replacement resource scenarios E3 evaluated?

Scenario	Replacement Resources Selected, Cumulative by 2045 (GW*)
Scenario 1: 100% Clean Retail Sales	+ 2.1 GW dual fuel NG/H2 CCGT + 0.5 GW wind
Scenario 2a: Deep Decarb. (Baseline Technologies)	+ 2.0 GW dual fuel NG/H2 CCGT + 0.3 GW li-ion battery + 0.4 GW wind + 0.05 GW advanced energy efficiency + additional H2 generation**

Scenario 2b: Deep Decarb. (Emerging Technologies)	+ 1.5 GW dual fuel NG/H2 CCGT + 0.7 GW nuclear SMR
Scenario 2c: Deep Decarb. (No New Combustion)	+ 10.6 GW wind + 1.4 GW solar

Scenario	Replacement Resources Selected, Cumulative by 2045 (GW*)
Scenario 1: 100% Clean Retail Sales	+ 2.1 GW dual fuel NG/H2 CCGT + 0.5 GW wind
Scenario 2a: Deep Decarb. (Baseline Technologies)	+ 2.0 GW dual fuel NG/H2 CCGT + 0.3 GW li-ion battery + 0.4 GW wind + 0.05 GW advanced energy efficiency + additional H2 generation**
Scenario 2b: Deep Decarb. (Emerging Technologies)	+ 1.5 GW dual fuel NG/H2 CCGT + 0.7 GW nuclear SMR
Scenario 2c: Deep Decarb. (No New Combustion)	+ 10.6 GW wind + 1.4 GW solar

Comment [WP(-D17)]: I assume this table will be cleaned up – font, size, etc.

Comment [EAJ18]: I re-inserted the table keeping the source formatting so it should be cleaned up now.

- In scenarios that assume new combustion generation may be permitted in the Northwest, firm capacity is mostly replaced with ~2 GW of dual fuel natural gas + hydrogen turbines. These turbines may initially burn natural gas when needed during reliability challenged periods, but would transition to hydrogen by 2045 to reach zero-emissions.
- If advanced nuclear is available, it replaces is selected in lieu of renewables and some of the gas plants.

Comment [KG(-P19)]: “replacement” is a bit confusing since we are replacing the existing LSN dams, not existing renewables

- The “no new combustion” scenario with decarbonization of the broader economy (e.g. electric vehicles and electric heating) requires an impractically large (12 GW) buildout of renewable energy to replace the dams firm capacity contributions and GHG-free energy. This is required because the wind and solar power are not as reliable for serving load as would be firm combustion generation, and thus large quantities are needed to ensure that some generation may be available during the critical periods like winter cold spells.

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5. What does each option cost?

	Total Costs (real 2022 \$)	Annual Cost Increase (real 2022 \$)			Incremental Public Power Costs [% increase vs. ~8.5 cents/kWh NW average retail rates]
	Net Present Value in year of breaching	2025	2035	2045	2045
Scenario 1: 100% Clean Retail Sales	\$7.5 billion		\$434 million	\$478 million	0.8 cents/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$11 billion	\$495 million	\$466 million	\$509 million	0.8 cents/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$11.5 billion		\$496 million	\$860 million	1.5 cents/kWh [+18%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$7 billion		\$415 million	\$428 million	0.7 cents/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$46 billion	n/a	\$1,953 million	\$3,199 million	5.5 cents/kWh [+65%]

Comment [WP(-D20)]: Why do we have the year 2024 at the breaching year? Much of what I have seen from advocates recently says all replacement resources need to be in place before breaching.

Comment [KG(-P21)]: Josh, we wanted to be in line with the CRSO EIS which assumed breaching 2 years out and 10 years out. (It will take even longer than that, but we didn't want to pick an arbitrary date.)

*-Cost increases account for replacement energy, capacity, and reserves as well as avoided LSR capital + expense, but do not include any costs for breaching the dams, which would be an additional cost.

*NPV and annual cost increase are shown for the Northwest Region as a whole, but the incremental costs are calculated relative to the BPA Tier I annual sales for public power customers.

*% increase versus average retail rates assumes ~8.5 cents/kWh retail rates (estimated from OR and WA average retail rates). This does not include additional account for any other rate increases that will be driven by higher loads or clean energy needs that increase regional rates as shown in the earlier 2045 incremental cost chart.

*Annual residential customer cost impact assumes 1,280 kWh/month for average residential customers in Oregon and Washington (current ~1,000 kWh/month average + 28% from electrification load growth).

*New federal tax credits for hydrogen plants/fuels or ITC/PTC extension for renewables would provide a cost reduction to public power customers from taxpayers

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Comment [KG(-P22)]: This is in the ppt, but not in the TPs.

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Comment [WP(-D23)]: Does this at all undercut the previous point that the rate increase is solely for replacing the LSRDs?

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6. How do the replacement costs compare to the current costs of the lower Snake River dams?

The lower Snake River dams cost between \$13 and \$17/MWh to operate and maintain. Replacement resources, depending on those chosen, are projected to cost between \$77 and \$139/MWh. Replacement costs rise to more than \$500/MWh in the deep [economy-wide](#) decarbonization scenario that includes only existing [resources-technologies](#) (wind, solar, etc.) and no emerging technology, such as hydrogen and small modular nuclear.

7. What is the projected rate impact to BPA customers?

In scenarios 1, 2a and 2b, the rate impact would be between 8% and 18% or ~\$100 to \$230 per year. In a deep [economy-wide](#) decarbonization scenario (2c) with no emerging technologies, the cost would be approximately a 65% increase or \$850 per year.

Note: These costs do not include potential transmission [and integration](#) costs associated with interconnection and grid reinforcement that could be necessary to add the new resources.

8. What is the timeline necessary to add the resources that would be required?

E3 estimates that adding additional renewable energy and firm capacity additions would take approximately five to seven years after Congressional approval to breach the dams and possibly up to 10 to 20 years if additional new large-scale transmission was required [and there was not litigation on siting.](#)

Comment [WP(-D24): EVE'S COMMENT: Adding this phrase since it was causing confusion during DOE peer review. The Baseline has the decarbonization policy of OR/WA/CA that basically forces coal off-line but does not assume the load growth that occurs under the economy-wide decarbonization where transportation and building HVACs get electrified.

Comment [KG(-P25): Is this true for the LSN replacement resources or for the resources that are needed for keeping the grid reliable even without breaching the LSN?

Comment [EAJ26]: I think this note is true for 1,2a, and 2b but not for 2c. That is the reason 2c costs so much is the needed transmission to build out MT and WY wind to replace LSN without new emerging technology to provide the firm capacity during cold events and low solar angles.

From: Johnson,G Douglas (BPA) - DK-7
Sent: Tuesday, June 28, 2022 10:20 AM
To: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement study

Just did. I'll send it to the folks we discussed and copy the two of you. Thanks so much for all the edits/clarifications!!

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, June 28, 2022 9:34 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement study

This looks good to me. Doug did you want to accept changes, delete comments and then send?

Thanks!
Eve

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, June 28, 2022 9:32 AM
To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement study

Well, I cleaned up one sentence that bugged me (appears twice) and found a few things. Eve could do a quick check of my edits, but then I think it is ready to go

From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Sent: Tuesday, June 28, 2022 9:07 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement study

Perfect. Send me that version, I'll clean it up and send it to the group we talked about and cc you two.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, June 28, 2022 9:05 AM
To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement study

Birgit is looking over the revised/cleaned up version I sent last night.

From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Sent: Tuesday, June 28, 2022 8:50 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement study

Let's also add Marcus Chong-Tim. I can clean the documents up if need be.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, June 28, 2022 8:47 AM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement study

Hi Doug-

There was a lot of interest at the Executive Advisory Group meeting this morning about the E3 study rollout. The basic concern during the discussion was that the study is independent and we don't want to be viewed as putting a spin on it or interfering with others viewing the study as independent but also don't want to be flat footed when asked our viewpoint. Joel and Sonya would like to review the talking points when you think you have a good version for internal review -I think this version looks good but will defer to your expertise and let you circulate around to a minimum of Joel Cook, Sonya Baskerville, Ben Zelinsky (acting for Scott Armentrout), Suzanne Cooper.

Thanks,
Eve

From: James,Eve A L (BPA) - PG-5
Sent: Monday, June 27, 2022 5:02 PM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: REVIEW REQUESTED: E3 LSRD replacement study

Attached is a cleaned up version.

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Monday, June 27, 2022 9:32 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: REVIEW REQUESTED: E3 LSRD replacement study

OK. I cleaned this up and deleted comments that were addressed. There are a few that I don't know how to handle. Please take a look and provide language or deletions that address your comments. Thanks.

From: Koehler,Birgit G (BPA) - PG-5
Sent: Friday, July 22, 2022 10:41 AM
To: Johnson,G Douglas (BPA) - DK-7; James,Eve A L (BPA) - PG-5
Subject: RE: REVISED: LSRD E3 customer message
Attachments: Customer Communications - E3 - LSRD breaching analysis v2.docx

I've added a couple of suggestions and comments. See what you think.

From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Sent: Friday, July 22, 2022 10:14 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: FW: REVISED: LSRD E3 customer message

See attached. We have proposed the following for the next 6 weeks. Let me know what you think. Thanks.

From: Johnson,G Douglas (BPA) - DK-7
Sent: Friday, July 22, 2022 10:09 AM
To: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>
Subject: FW: REVISED: LSRD E3 customer message

Have we advanced this at all? AEs are asking about briefing opportunities. Specifically, Port Angeles, which has requested a briefing. More briefing requests are likely on the way. Can we get this moving if we have not yet? Especially the idea of the August John H/DOE official customer meeting.

From: Johnson,G Douglas (BPA) - DK-7
Sent: Friday, July 15, 2022 2:27 PM
To: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <sibaskerville@bpa.gov>
Subject: REVISED: LSRD E3 customer message

I just had a conversation with Josh Warner who listened in on the Power AE call. See the red message. John needs to remind customers of this point. Subtly, but it still needs to be part of the conversation.

From: Goodwin,Summer G (BPA) - DKS-7
Sent: Monday, June 27, 2022 4:06 PM
To: Johnson,G Douglas (BPA) - DK-7; Scruggs,Joel L (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7
Cc: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5
Subject: RE: REVISED proposed E3 LSRD replacement study outreach plan

Nice plan Doug. I set up some time tomorrow afternoon to discuss. If that's too soon, let me know.

I think the press availability that Doug is referring to is usually like a simplified press conference but no dog and pony show. Just answering their questions. Someone from E3 and Doug and perhaps Eve and Birgit would likely be on the phone for it and would take turns answering the reporters' questions. Usually these are done as soon as possible after something is announced because you want to be part of the message and not wait so long that the story gets told without you. Doug may have other ideas but he's logged off and wanted to be sure you had some idea of what we were thinking. He'll confirm or correct me tomorrow.

Best

Summer

From: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Sent: Monday, June 27, 2022 3:23 PM
To: Scruggs,Joel L (BPA) - DK-7 <jlsruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: REVISED proposed E3 LSRD replacement study outreach plan

Please see the attached. Summer, should we get a meeting scheduled tomorrow or Wednesday to discuss?

From: Johnson,G Douglas (BPA) - DK-7
Sent: Tuesday, June 28, 2022 6:52 AM
To: James,Eve A L (BPA) - PG-5; Scruggs,Joel L (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7; Goodwin,Summer G (BPA) - DKS-7
Cc: Koehler,Birgit G (BPA) - PG-5
Subject: RE: REVISED proposed E3 LSRD replacement study outreach plan

I was thinking a joint hour-long press availability. Any press outlet could call in to a conference line and ask questions about the report and potential future consequences on the FCRPS and our customers, etc.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Monday, June 27, 2022 3:46 PM
To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>; Scruggs,Joel L (BPA) - DK-7 <jscruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: REVISED proposed E3 LSRD replacement study outreach plan

I can loop in Arne at E3 since he will be presenting at the council meeting. When you say part of press availability do you just mean contact information to refer press to or will we be coordinating with them on responses? Just want to make sure I set the appropriate time commitment expectations. I know that after the council meeting he has conflicts until later in the afternoon and then has the next day available for a Congressional Delegation meeting but I can give him a heads up if there is press needs as well.

From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Sent: Monday, June 27, 2022 3:43 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Scruggs,Joel L (BPA) - DK-7 <jscruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: REVISED proposed E3 LSRD replacement study outreach plan

We can plug that info in. Thanks Eve! Who should we contact at E3 to see if they would be willing to be part of a press availability?

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Monday, June 27, 2022 3:38 PM
To: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>; Scruggs,Joel L (BPA) - DK-7 <jscruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: REVISED proposed E3 LSRD replacement study outreach plan

This looks good to me Doug. Just so you are aware the council agenda time is currently set for 7/7 8:30 – 10 AM. Sonya is trying to put together a meeting for Congressional Delegation staff either later that day or 7/8.

From: Johnson,G Douglas (BPA) - DK-7 <[gdjohnson@bpa.gov](mailto:gjohnson@bpa.gov)>
Sent: Monday, June 27, 2022 3:23 PM
To: Scruggs,Joel L (BPA) - DK-7 <jscruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>

Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Subject: REVISED proposed E3 LSRD replacement study outreach plan

Please see the attached. Summer, should we get a meeting scheduled tomorrow or Wednesday to discuss?

E3 Study and the Value of the lower Snake River dams

Issue: Elements of public power are becoming increasingly frustrated with Bonneville's "arms-length" approach to the E3 report results. Bonneville has used the study as the foundation of its comments to the effort Washington Governor Inslee and Senator Murray are leading regarding the future of the LSRDs. We need to reassure public power we understand the value of the facilities and reaffirm our commitment to keep power rates low.

Recommendation: Use John Hairston's Friday, July 15 message to employees to clearly articulate BPA's position on LSRD breaching customers and build on it in August.

Phase 1: Encourage Power Account Executives to share John's Friday, July 15 message to all employees with GMs and other customer representatives.

Phase 2: Leverage John's appearance at the August 4 PPC Executive Committee meeting to expand on the info in the message. Key theme: *BPA is both federal and a business.*

- Bonneville asked E3 to do an independent analysis, therefore Bonneville has asked E3 to share the results without Bonneville augmenting the presentations
- I am committed to looking at the issue through the lens of "sound business practices."
- Part of that is remembering that Bonneville has many responsibilities. One of those is public purpose, which means we must listen to constituencies that the FCRPS benefits and those the FCRPS impacts. We have to acknowledge that and appropriately manage those responsibilities.
- At this time As the head of an agency responsible for keeping the lights on, my instincts tell me ~~reliance onto~~ be cautious about relying on "emerging technologies," is too much of a wild-card to rely on. While technologies will undoubtedly advance, we simply don't know what technologies will mature to commercial scale and how quickly.
- The region should monitor and let some of those things mature and emerge further before we make any big, potentially costly decisions.

We will have to adjust messages and content when we find out what ultimately will happen with the litigation stay.

Phase 3: Mid/Late August - Customer briefing/Q&A with John, a DOE representative (preferably the Deputy Secretary) and, possibly, a US Army Corps of Engineers executive. This would demonstrate alignment between BPA and DOE and cover the electrical attributes of the current system and all breaching analysis currently being performed.

Comment [KG(-P1): Adding this in response to the very first line of the issue statement.

But, maybe BPA is too hesitant to quote E3's results. I haven't been in external forums. And we've let E3 talk directly to the key DC folks, so not much need for us to restate the results.

Comment [KG(-P2): This is a bit of a strong statement. Yes, it is how we would like to feel, but we lose credibility with DOE. And over the coming 10-30 years, something will develop, we just don't know what.

From: Egerdahl,Ryan J (BPA) - PGPR-5
Sent: Thursday, June 16, 2022 3:24 PM
To: Koehler,Birgit G (BPA) - PG-5
Subject: RE: Scheduling E3 at council meeting

Totally agree with you on all below.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 16, 2022 3:22 PM
To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Marker,Douglas R (BPA) - AIR-7 <drmarker@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>
Cc: Sweet,Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Subject: RE: Scheduling E3 at council meeting

1.5 hours seems like a good time. We could make it longer, but I don't know that we want to invite that much discussion. With a power-savvy audience, I hope E3 can get through it OK

... just noticed this email still sitting in my in-box. I thought I had sent it a while ago.

Scott and I, also Eve and I were skyping on the side. We think that letter the E3 study stand on its own with the Council is wiser than us putting too much of our mark on it. Maybe we'll pull out an important but non-advocating talking point from our slides that we can mention verbally.

Birgit

From: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Thursday, June 16, 2022 2:19 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Marker,Douglas R (BPA) - AIR-7 <drmarker@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>
Cc: Sweet,Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Subject: RE: Scheduling E3 at council meeting

Thanks for working to lock this down. I agree with Eve – just E3 is a 1.5 hour session. We went that long and the main audience was not primarily power savvy but launched many good questions that took time to answer effectively. Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C (b)(6)



From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Thursday, June 16, 2022 12:50 PM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Marker,Douglas R (BPA) - AIR-7 <drmarker@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>
Cc: Sweet,Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Subject: RE: Scheduling E3 at council meeting

Thanks Ryan- E3 is available July 6 any time or July 7 except for a conflict from 10 – 1 PM. The CEQ presentation today was 1 ½ hours and had lots of questions throughout the presentation. Not sure how much agenda time would be needed but I would say a minimum of 1 hour to get through the slides and more to leave time for Q&A.

From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Thursday, June 16, 2022 12:44 PM

To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Marker,Douglas R (BPA) - AIR-7 <drmarker@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>
Cc: Sweet,Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Subject: RE: Scheduling E3 at council meeting

Hi all. Jennifer Light said either July 6 or 7 could work for a public meeting with Council members. I can confirm that we will make one of those days work.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Thursday, June 16, 2022 7:19 AM

To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Marker,Douglas R (BPA) - AIR-7 <drmarker@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Cc: Sweet,Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Subject: RE: Scheduling E3 at council meeting

Ryan- for your information as you try to schedule with the Council- we expect the E3 report to be done by July 1. The first week of July is the holiday and I will be out of the office and one of the key SME's at E3 will be out as well (though others could potentially cover if needed).

From: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>

Sent: Thursday, June 16, 2022 7:16 AM

To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Marker,Douglas R (BPA) - AIR-7 <drmarker@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Cc: Sweet,Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Subject: RE: Scheduling E3 at council meeting

Thanks – can you confirm when we get it locked in? Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

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From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Sent: Thursday, June 16, 2022 7:14 AM

To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Marker,Douglas R (BPA) - AIR-7 <drmarker@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Cc: Sweet,Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Subject: RE: Scheduling E3 at council meeting

Adding Ryan Egerdahl who works closely with the Power Committee

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Sent: Thursday, June 16, 2022 7:12 AM

To: Marker,Douglas R (BPA) - AIR-7 <drmarker@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>
Cc: Sweet,Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>

Subject: Scheduling E3 at council meeting

Who is the lead (BPA) for the Council power committee meeting? Suggest we reach out today with the plan to get the E3 roll out on the agenda..... Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

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From: Egerdahl,Ryan J (BPA) - PGPR-5
Sent: Tuesday, July 26, 2022 9:29 AM
To: Klumpp,Elizabeth C (BPA) - AIR-WSGL; Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5
Subject: RE: RN - addresses E3 report in Clearing Up

I would like an E3 response for sure. Never ending work.

From: Klumpp,Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>
Sent: Tuesday, July 26, 2022 8:56 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: RE: RN - addresses E3 report in Clearing Up

I think a brief, understandable response from Arne would provide useful education and it'd help the LSR conversation as well as the whole decarb conversation.

(b)(6)

(b)(6) It's essential, but hard work.
Replacing the LSRDs (in the near decades) is an extremely hard lift ON TOP of decarbonization.

And until the coal is all removed from the West, we know this story doesn't go well for climate change emissions.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 26, 2022 7:13 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Klumpp,Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: RE: RN - addresses E3 report in Clearing Up

In a separate email thread, Arne suggested writing a brief technical response. Scott and I both think that's a good idea.

From Arne:

FYI, see the critique from Renewables Northwest. Would BPA be interested in sponsoring us to write a brief, technical response? Each of these points is easy to rebut. They are mostly based on misunderstandings and mischaracterizations. Very annoying. We would keep it short and technical.

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, July 26, 2022 7:03 AM
To: Klumpp,Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: RN - addresses E3 report in Clearing Up

I think he is missing that it is incremental. There is a huge buildout just to meet the carbon-free futures especially when you start electrifying other sectors of the economy which this guy doesn't mention. With the large renewable build-outs

for those cases the summer isn't as limiting as the winter deficits when the low sun angle in the NW and multi-day events can't be met by 4 hour storage solutions.

From: Klumpp,Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>
Sent: Monday, July 25, 2022 5:21 PM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RN - addresses E3 report in Clearing Up

Do you think this person is making a point or are they missing that the E3 LSR study was incremental – above and beyond how the region meets the two state's Clean Energy goals?

Regardless, I don't think the region is going to use demand response to solve the carbon-free standard challenges.

I think to actually decarbonize the economy, like Washington is pursuing, will require investing in nearly every measure possible, including those that don't yet exist (like multi-day storage).

Opinion & Perspectives



Bearing Down

[9]Renewable NW Responds to LSRD Power Replacement Study

SUMMARY: Sashwat Roy, technology and policy manager at Renewable Northwest, argues that the recent Energy and Environmental Economics study commissioned by BPA on replacing generation from lower Snake River dams relied on a modeling tool that didn't fully capture the value of existing renewables and battery storage, nor did it account for the impact of climate change on hydro generation and load.

BPA's [study](#) of optimal capacity expansion scenarios with and without the lower Snake River dams indicates a disregard for existing renewable and storage capacity resources vital to ensuring resource adequacy in the region, according to Renewable Northwest's analysis.

The Energy and Environmental Economics study portrays an alternate reality where only "firm or

dispatchable" resources like natural gas-fired power and small modular nuclear reactors are able to replace capacity provided by the LSRD. Hybrid and stand-alone storage projects (including long-duration storage) in conjunction with distributed energy resources and response mechanisms will be important complementary resources to BPA's hydro fleet in providing the needed capacity and flexibility to the Pacific Northwest electric system.

The modeling tool used, RESOLVE, does not account for the full value of hybrid and stand-alone storage resources. Rather than make decisions based on a single model, the RESOLVE model simulates the operation of WECC's system for 41 independent days sampled from historical meteorological record from 2007-2009.

It is risky to assume that this abbreviated time series accurately captures the full intrayear variability of renewable resources and storage as well as that of the hydro system. Studies comparing different generation types typically rely on production-cost models that are run sequentially for 8,760 hours and can fully dispatch

Continued on page 5

Continued from page 3

resources across hours, days and weeks to understand the system and resource interactions, and dispatch. Instead, RESOLVE selects resources based primarily on their capital costs and capacity accreditation value to fill the need.

RESOLVE replaces the energy from the dams with additional wind power and “firm capacity” with natural gas and hydrogen combustion plants. Small amounts of energy efficiency and battery storage are also selected in some scenarios. The report mentions that “storage resources such as battery storage and pumped hydro support renewable integration but show limited capacity value given the large shares of hydro in the Northwest region.”

This highlights the limitations of relying on a capacity expansion model without a full-year production-cost model because storage resources can provide both flexibility and capacity benefits and act as a complement to hydro resources.

The report does not mention hybrid solar/wind plus battery storage resources at all. Although battery storage resources can be selected individually by the RESOLVE or RECAP model, the model cannot co-optimize its dispatch with solar or wind generation. The cost-effectiveness of hybrid resources in the region is shown in recent integrated resource plans from PacifiCorp, Portland General Electric and Idaho Power, where hybrid resources—especially solar paired with four-hour battery storage—have over 80 percent effective load carrying capability (ELCC) value.

Idaho Power’s recent portfolio modeling in its 2021 IRP shows that ELCC values of hybrids and four-hour stand-alone storage exceed 85 percent with eight-hour battery storage assigned a 97 percent ELCC value. It is implausible that a capacity expansion model would not select solar plus storage or even long-duration stand-alone storage resources like pumped hydro in the region unless the model does not fully realize their value. If the model cannot endogenously co-optimize, it leads to overbuilding and over-curtailment in the resource portfolio.

E3’s modeling does not account for the impact of climate change-adjusted hydro and load in the changing demand pattern of the region. According to the recent 2021 Secure Water Act Study by the Bureau of Reclamation, increasing temperatures, earlier runoff and lower summer flows may reduce hydropower flexibility in the Pacific Northwest.

This is particularly impactful for the summer peak hours. E3 states that “[t]he biggest cost drivers for replacement resources are the need to replace the lost firm capacity for regional resource adequacy” especially during multiday events in the winter. The climate data suggests that the Pacific Northwest is increasingly moving toward more high-demand hours in the summer than winter due to lesser hydro availability in summer primarily due to higher temperatures. This was also the conclusion of the Northwest Power and Conservation Council’s 2021 regional plan. It is surprising that E3 does not consider downscaled climate data that BPA has

worked on to undertake this regional analysis and instead relies on outdated historical data for future projections.

The region is moving toward clean, non-emitting capacity resources to meet capacity needs and state-policy targets. Investor-owned utilities like PacifiCorp, PGE, and Idaho Power will procure more than 3 GW of solar, wind, hybrid and energy storage resources over the next few years because of their zero variable costs, increasingly lower capital expenditures, and operational characteristics that include flexibility and dispatchability.

The E3 study selects extremely speculative near-term resources, dual-fuel natural gas and small modular reactors, to replace the LSRD. The Oregon PUC recently acknowledged PacifiCorp's 2021 IRP only to the extent that nuclear is not included in the preferred portfolio, which indicates the financial risk in such investments ([CU No. 2049 \[10\]](#)).

While hydrogen-fired combustion turbines may be cost-effective in the future, there is not enough supply or infrastructure in the region to satisfy that need in the near term.

Additionally, the study does not consider the electrolyzer load that would be added to the system and how it would interact with the generation portfolio in the Pacific Northwest. Investing in natural gas-fired generation plants in the present with a hope that eventually they would be converted to burn hydrogen is a risky investment strategy.

The effect of the Western Resource Adequacy Program is not captured in the E3 study. E3 states that "resource adequacy needs are captured in RESOLVE by ensuring that all resource portfolios have enough capacity to meet the peak Core Northwest median peak demand plus a 15 percent planning reserve margin."

Once WRAP is up and running, the load and resource diversity in the region will lead to a more efficient resource buildout and allocation going forward, lowering

planning reserve margins for it is unclear why E3 uses data that WRAP's assumptions for reduc

To meet regional decarboni irrespective of whether the low breached or not, load-serving e clean and non-emitting capacity wind, paired with battery stora batteries and pumped-hydro res

Investor-owned utilities in th started on this energy transition. region to continue to rely on spe outdated modeling assumptions capacity resources. The tools an mine how to move forward on r generator replacements need to are commercially available and procurement mandates and deca

Steve Wright wrote in last v that the region is taking a risk l "mystery resource" to rescue u adequacy issues.

In fact, there is also an argu mystery resource at all but a pe having their own values, that w challenges.

Perhaps the mystery resourc face and we just need to look d we currently have at our dispos

Editor's Note: The second part of Steve Wright's column on resource adequacy, originally published in [CU No. 2064](#), is postponed and will be published in [CU No. 2064](#).

From: Koehler,Birgit G (BPA) - PG-5
Sent: Thursday, June 16, 2022 7:23 AM
To: James,Eve A L (BPA) - PG-5
Cc: Egerdahl,Ryan J (BPA) - PGPR-5
Subject: RE: Scheduling E3 at council meeting

I'm not sure if Ryan is in charge of scheduling, but thought he should be included in the thread since he had checked with the Council. Ryan, if that is a roll you can fill, then great. Otherwise I presume we work with Sonya?

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Thursday, June 16, 2022 7:19 AM
To: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Marker,Douglas R (BPA) - AIR-7 <drmarker@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
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Ryan- for your information as you try to schedule with the Council- we expect the E3 report to be done by July 1. The first week of July is the holiday and I will be out of the office and one of the key SME's at E3 will be out as well (though others could potentially cover if needed).

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Subject: RE: Scheduling E3 at council meeting

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SCOTT G ARMENTROUT
Executive Vice President, Environment, Fish & Wildlife, SES | E-4

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SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife. SES | E-4

BONNEVILLE POWER ADMINISTRATION

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From: Egerdahl,Ryan J (BPA) - PGPR-5
Sent: Friday, June 24, 2022 8:08 AM
To: Jennifer Light; Chad Madron; Donahue,Scott L (BPA) - EWP-4; Walker,Danielle N (BPA) - EW-4; Moody,David F (BPA) - PEH-6
Cc: Annika Roberts; Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5; Baskerville,Sonya L (BPA) - AIN-WASH
Subject: RE: Scheduling E3 at council meeting

Hi all. Thanks for getting this set up. I am out of the office next week AND the week of July 4th. ☺ I am asking Scott D., Danielle, and Dave to stay connected with Chad and Jenn on the Power Committee agenda / webinar information that Chad normally posts X days before each meeting. Then, that BPA crew can get make sure Sonya, Birgit, Scott Armentrout, and probably many others get the right information when available.

Chad or Jenn, sending the virtual meeting info to Arne directly is still a good idea. Thanks again.

Ryan

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Thursday, June 23, 2022 3:52 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Chad Madron <CMadron@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Cc: Annika Roberts <aroberts@nwcouncil.org>
Subject: [EXTERNAL] RE: Scheduling E3 at council meeting

Yes, we will do that.

Thanks!

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Thursday, June 23, 2022 3:11 PM
To: Jennifer Light <JLight@NWCouncil.org>; Chad Madron <CMadron@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Cc: Annika Roberts <aroberts@nwcouncil.org>
Subject: RE: Scheduling E3 at council meeting

Great- I will be out of the office that week so could you make sure that the virtual meeting information gets sent to Arne Olson email arne@ethree.com? He will be giving the E3 results presentation.

Thanks,
Eve James

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Wednesday, June 22, 2022 12:32 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Chad Madron <CMadron@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Cc: Annika Roberts <aroberts@nwcouncil.org>
Subject: [EXTERNAL] RE: Scheduling E3 at council meeting

Hello Eve,

We have heard back from all our members, and the proposed time on July 7th from 8:30-10:00 Pacific works. Let's consider that final. We have blocked this time off on the calendars on our end.

Thank you.
Jennifer

From: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Sent: Wednesday, June 22, 2022 9:03 AM
To: Chad Madron <CMadron@NWCouncil.org>; Jennifer Light <JLight@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Cc: Annika Roberts <aroberts@nwcouncil.org>
Subject: RE: Scheduling E3 at council meeting

Good Morning-

Has this agenda timeslot moved from the tentative space to actual agenda time? Let me know so I can let E3 know- I don't want to hold 2 days on their calendars if we can narrow it down.

Thanks,
Eve

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Friday, June 17, 2022 1:13 PM
To: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Jennifer Light <JLight@NWCouncil.org>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Cc: Annika Roberts <aroberts@nwcouncil.org>
Subject: [EXTERNAL] RE: Scheduling E3 at council meeting

These will be virtual

Sent via the Samsung Galaxy S21 Ultra 5G, an AT&T 5G smartphone

----- Original message -----

From: "James,Eve A L (BPA) - PG-5" <ejames@bpa.gov>
Date: 6/17/22 1:08 PM (GMT-08:00)
To: Chad Madron <CMadron@NWCouncil.org>, Jennifer Light <JLight@NWCouncil.org>, "Egerdahl,Ryan J (BPA) - PGPR-5" <rjegerdahl@bpa.gov>
Cc: Annika Roberts <aroberts@nwcouncil.org>
Subject: RE: Scheduling E3 at council meeting

Are the meetings still virtual? Or will it be in person?

On Jun 17, 2022 12:51 PM, "Egerdahl,Ryan J (BPA) - PGPR-5" <rjegerdahl@bpa.gov> wrote:
I hope that's not a spoiler for the new series I have yet to watch. Thx Chad

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Friday, June 17, 2022 12:48 PM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Jennifer Light <JLight@NWCouncil.org>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Annika Roberts <aroberts@nwcouncil.org>
Subject: [EXTERNAL] RE: Scheduling E3 at council meeting



From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Friday, June 17, 2022 12:45 PM
To: Chad Madron <CMadron@NWCouncil.org>; Jennifer Light <JLight@NWCouncil.org>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Annika Roberts <aroberts@nwcouncil.org>
Subject: RE: Scheduling E3 at council meeting

One question, Chad? Is this tentative?

From: Chad Madron <CMadron@NWCouncil.org>
Sent: Friday, June 17, 2022 12:40 PM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Jennifer Light <JLight@NWCouncil.org>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Chad Madron <CMadron@NWCouncil.org>; Annika Roberts <aroberts@nwcouncil.org>
Subject: [EXTERNAL] RE: Scheduling E3 at council meeting

TENTATIVELY (also this is tentative)... I'm feeling like this will likely land 8:30-10am on the 7th.

But as I mentioned, that is tentative. More info to come. But I wanted to mention it so you could keep an eye on keeping that spot open (tentatively)

From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Thursday, June 16, 2022 3:26 PM
To: Jennifer Light <JLight@NWCouncil.org>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Chad Madron <CMadron@NWCouncil.org>
Subject: RE: Scheduling E3 at council meeting

Thank you.

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Thursday, June 16, 2022 2:26 PM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Chad Madron <CMadron@NWCouncil.org>
Subject: [EXTERNAL] RE: Scheduling E3 at council meeting

Thanks Ryan and Eve.

Chad will do some calendaring to find a 90 minute window those dates that work for the full Council. We will get back to you soon.

From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Thursday, June 16, 2022 12:58 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Jennifer Light <JLight@NWCouncil.org>
Cc: Chad Madron <CMadron@NWCouncil.org>
Subject: RE: Scheduling E3 at council meeting

Hi Eve and Jenn. We are connecting via email. Jenn, see below on dates and times that work for us. What do you think?
Thx

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Thursday, June 16, 2022 12:50 PM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>;
Subject: RE: Scheduling E3 at council meeting

Thanks Ryan- E3 is available July 6 any time or July 7 except for a conflict from 10 – 1 PM. The CEQ presentation today was 1 ½ hours and had lots of questions throughout the presentation. Not sure how much agenda time would be needed but I would say a minimum of 1 hour to get through the slides and more to leave time for Q&A.

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Wednesday, May 25, 2022 9:57 AM
To: Koehler, Birgit G (BPA) - PG-5; James, Eve A L (BPA) - PG-5
Subject: RE: Skype from Scott RE non-tech E3 slide deck

I think we literally need to make the first slide this:

What it would take to replace the output of removing the four lower Snake Riv

- What are we replacing?
 - 3,483 MW of nameplate capacity
- How much would it cost to replace 3,483 of nameplate capacity?
 - Total cost per year: \$XXX
 - Upfront costs after that: \$XXX
- How long would it take to replace the 3,483 of lost capacity from removing
 - XXX years

Plant	Nameplate Capacity (MW)*
Lower Granite	930
Little Goose	930
Lower Monumental	930
Ice Harbor	693
Total = 3,483	

What are the services we need to replace, and what is the cost of each?

- Energy: XXX MW for \$XXX
- Instantaneous and sustained capacity : XXX MW for \$XXX
- Reserve carrying capacity: XXX MW for \$XXX
- Fast ramping: XXX MW for \$XXX
- Voltage and reactive power: XXX MW for \$XXX
- Frequency and Inertial response: XXX MW for \$XXX
- Blackstart capability: XXX MW for \$XXX
- Short-Circuit and Grounding Contribution: XXX MW for \$XXX
- Voltage and Frequency Excursion Ride-Through : XXX MW for \$XXX
- Participation in Remedial Action Schemes: XXX MW for \$XXX

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From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, May 25, 2022 9:49 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; James, Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Subject: RE: Skype from Scott RE non-tech E3 slide deck

And more from Scott:

[5/25/2022 9:24 AM] Armentrout, Scott G (BPA) - E-4:

- Costs range between over \$400 million to nearly \$2 billion per year depending on available technologies and carbon reduction policies
- Could **increase public power costs** by 8% (best case scenario with emerging tech) to 65%
- Could **raise residential electricity costs** by ~\$100 –850 per year

This section is particularly challenging to deal with

I know it means something - but what?

It doesn't get at how much it would cost to replace the dams

Because it doesn't translate

[5/25/2022 9:25 AM] Armentrout,Scott G (BPA) - E-4:

I think of it as stated before - what is the upfront cost and then the recurring cost for how long. Bounding

Something with this wide of range and avg is reduced to a random number when someone wants to know the cost

[5/25/2022 9:26 AM] Armentrout,Scott G (BPA) - E-4:

Also the qualifier words like "depending on"

I know this is a tough project - but maybe not as tough as doing CRSO over again - ugh

[5/25/2022 9:28 AM] Koehler,Birgit G (BPA) - PG-5:

I understand what you are saying. The challenge I have in framing it is that we just don't know what carbon policy will be in 10-25 years. And we don't know if batteries will be abundant, or if there will be lithium shortage. And we don't know if SMRs will break through to commercial viability,...

Not trying to make excuses, but struggling how to frame this range properly. We may be able to frame it at the lower end (still very high) but also caveat the risk that it could be a lot, a lot higher.

[5/25/2022 9:30 AM] Koehler,Birgit G (BPA) - PG-5:

Katie, Eve, and I are meeting at 10 to work through this. We'll include the up-front build cost into the opening slides

[5/25/2022 9:30 AM] Armentrout,Scott G (BPA) - E-4:

I say we go on the knowns

the unknowns can be mentioned but we have to go with what is, not what will be

[5/25/2022 9:32 AM] Armentrout,Scott G (BPA) - E-4:

So here is the cost today. The unknowns introduce a range of \$x-x.

[5/25/2022 9:33 AM] Armentrout,Scott G (BPA) - E-4:

I used to ask the question about what triggers are out there that would move us differently? - i.e. the advent of some new technology, cost of power or competitiveness numbers of a certain amount, etc.

So I heard power say that power generation at the Willamette's was no longer beneficial at a certain number

[5/25/2022 9:35 AM] Armentrout,Scott G (BPA) - E-4:

While not relevant with this E3 study, it is a concept I still think leadership could use - what are we watching for as triggers to make a conclusion that a cost is worth it or not worth it

From: Pruder Scroggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>

Sent: Wednesday, May 25, 2022 8:41 AM

To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Subject: RE: Skype from Scott RE non-tech E3 slide deck

10-4. I'll send the email so you can start looking at it, then I'll book some time.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, May 25, 2022 8:40 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: Skype from Scott RE non-tech E3 slide deck

FYI, Katie, here's a Skype I just had with Scott.

I do have a lot of free time today, and this is a high priority

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, May 25, 2022 8:27 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: Skype from Scott RE non-tech E3 slide deck

[5/25/2022 8:11 AM] Armentrout,Scott G (BPA) - E-4:

Hey Birgit - I sent these ideas in an email but wanted you to have it direct. I think putting it in some of these stats will be helpful:\$\$ XXX Billion would be needed up front\$\$ XX Billion more per year for so many years
Years to construct replacement transmission
ETC

[5/25/2022 8:13 AM] Armentrout,Scott G (BPA) - E-4:

Anyway - we need more conclusions on the main question vs regional background etc.

[5/25/2022 8:14 AM] Koehler,Birgit G (BPA) - PG-5:

I saw your email, and was wondering if the NPV would be an easy way to show that. But E3 might be able to pull out the specific construction numbers too.

and yes, I was concerned that the construction challenges would not get sufficient emphasis. I think E3 is more in the mode of conveying dry facts and less on these other messages. I'll take some notes for the next iteration.

[5/25/2022 8:14 AM] Armentrout,Scott G (BPA) - E-4:

I think if we screen from our main question - What does it cost to replace all the services of the LSRDs - then all these other bullets we can ask ourselves: What does that have to do with the cost.

NPV dives us into another dimension too

Just hard to reconcile.

The Simpson proposal put a number on replacement of power

[5/25/2022 8:15 AM] Koehler,Birgit G (BPA) - PG-5:

As I was going through the slides with Eve, it was clear that we had a lot of good info in there, but thinking about it last night, it still felt too dense to me.

[5/25/2022 8:15 AM] Armentrout,Scott G (BPA) - E-4:

This policy issue is looking for numbers

How much?

How long?

simpler

Yes there are details

But put those after

So if you are looking for how much - its buried

[5/25/2022 8:16 AM] Armentrout,Scott G (BPA) - E-4:

or too complex

And how long is not in there specifically

[5/25/2022 8:17 AM] Koehler,Birgit G (BPA) - PG-5:

Scott, your input is really good. As I work through these, I keep playing back in my head what you have been saying. We'll take another round of review when it comes back, and make sure we put the key costs and time in the front.

[5/25/2022 8:17 AM] Armentrout,Scott G (BPA) - E-4:

So get back to the how much and how long test. Stay away from it depends or insider calcs and numbers that mean nothing to the questions

We'll need to do another iteration. And Scott is correct, we don't really have that issue about how long it takes to do this. I believe we tried to prompt them for that information, but their style is just "here are the model facts" and less comfortable with ancillary information.

From: James,Eve A L (BPA) - PG-5
Sent: Wednesday, June 1, 2022 1:40 PM
To: Koehler,Birgit G (BPA) - PG-5; Diffely,Robert J (BPA) - PGPL-5
Subject: RE: Slide for E3 study results responding to NWECC study

That is a great point Rob – I will incorporate that and the study only replaced 80% of the ramping capability assuming the region is flush with resources to meet the other 20%. I suspect you are correct Birgit about why they haven't updated.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, June 1, 2022 1:39 PM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: Slide for E3 study results responding to NWECC study

Rob, are you thinking that this is why they chose to anchor their study on the 2018 analysis, maybe they didn't want to recalculate the need for replacement (since coal retirements could have raised that requirement)?

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Sent: Wednesday, June 1, 2022 1:33 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Slide for E3 study results responding to NWECC study

Wouldn't it be important up front to state NWECC is looking at replacing some (not all of the attributes) of the project but is not a reliability study that maintains adequacy as the CRSO EIS and E3?

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, June 1, 2022 11:27 AM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Slide for E3 study results responding to NWECC study

Send edits/comments to the slide and then we can add another if it is missing and crucial points for the DC folks who may have already seen the NWECC study.

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Sent: Wednesday, June 1, 2022 11:24 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Slide for E3 study results responding to NWECC study

Sure,
More than 1 page?

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, June 1, 2022 11:01 AM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: Slide for E3 study results responding to NWEK study

Hi Rob-

Birgit, Katie, and I are working on some BPA perspective on the E3 study slides. We'll share those to get your feedback when they are a little further along. Would you be able to help me craft a slide responding to the NWEK study that just came out? Birgit sent screen shots along at one point to get some initial thoughts. We want to have some high level comments for non-technical folks- I've attached a slide to start from and the NWEK study deck. Please let me know if you have comments/edits or if there are other crucial points we should be making (we can add another slide if needed).

Thanks,
Eve

From: James,Eve A L (BPA) - PG-5
Sent: Wednesday, June 1, 2022 11:08 AM
To: Diffely,Robert J (BPA) - PGPL-5
Cc: Koehler,Birgit G (BPA) - PG-5
Subject: RE: Slide for E3 study results responding to NWECC study

Oops- I also meant to ask for feedback on this slide as well:

- **Not fast**

- Up to XXX years total

- Perhaps 1 to 5 years for Congressional approval
 - Roughly 5 years to replace the capacity resources [confirm with Diffely, meant to include siting and construction]
 - XXX to build transmission, which includes providing compliance with the National Environmental Policy Act, siting, permits, etc.

From: James,Eve A L (BPA) - PG-5
Sent: Wednesday, June 1, 2022 11:01 AM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 (bgkoehler@bpa.gov) <bgkoehler@bpa.gov>
Subject: Slide for E3 study results responding to NWECC study

Hi Rob-

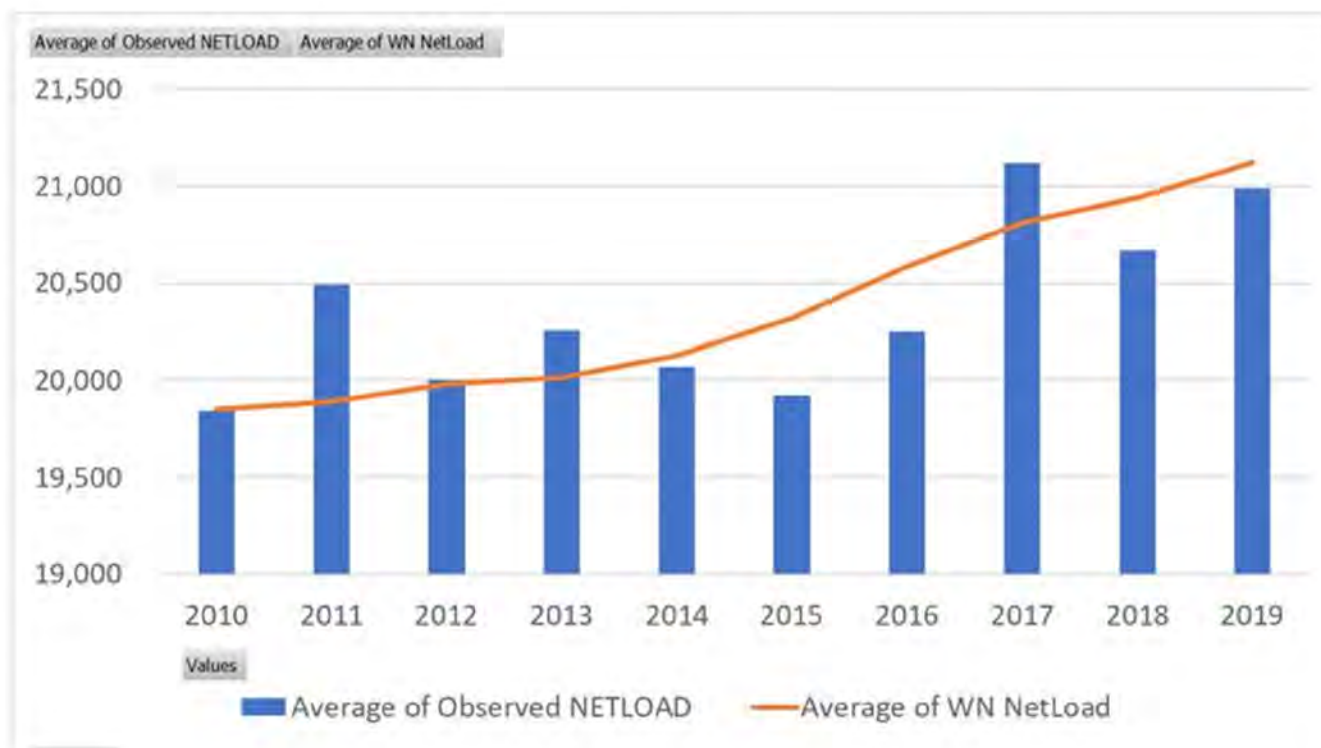
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Thanks,
Eve

From: Diffely,Robert J (BPA) - PGPL-5
Sent: Wednesday, June 1, 2022 2:06 PM
To: Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5
Subject: RE: Slide for E3 study results responding to NWECC study

Yes – they need to do a reliability analysis around further coal removal, electrification, CETA, and the 2021 clean energy for all. And the 2015 7th Power Plan load forecast (off by miles) what they used in the 2018 analysis for 2026 (19,143 aMW): The 2019 weather adjusted load actual was approximately 21,000 aMW.

Regional Loads net of DSI (aMW) with and without variations in weather



California officials CPUC, Energy Commission, CAISO warning about risks of blackouts - [California officials warn of likely summer power shortages, blackouts - CBS San Francisco \(cbsnews.com\)](https://www.cbsnews.com/news/california-officials-warn-of-likely-summer-power-shortages-blackouts/)

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Sent: Wednesday, June 1, 2022 1:39 PM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: Slide for E3 study results responding to NWECC study

Rob, are you thinking that this is why they chose to anchor their study on the 2018 analysis, maybe they didn't want to recalculate the need for replacement (since coal retirements could have raised that requirement)?

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To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
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Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Slide for E3 study results responding to NWECC study

Send edits/comments to the slide and then we can add another if it is missing and crucial points for the DC folks who may have already seen the NWECC study.

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
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Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Slide for E3 study results responding to NWECC study

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More than 1 page?

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Sent: Wednesday, June 1, 2022 11:01 AM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: Slide for E3 study results responding to NWECC study

Hi Rob-
Birgit, Katie, and I are working on some BPA perspective on the E3 study slides. We'll share those to get your feedback when they are a little further along. Would you be able to help me craft a slide responding to the NWECC study that just came out? Birgit sent screen shots along at one point to get some initial thoughts. We want to have some high level comments for non-technical folks- I've attached a slide to start from and the NWECC study deck. Please let me know if you have comments/edits or if there are other crucial points we should be making (we can add another slide if needed).

Thanks,
Eve

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Wednesday, May 25, 2022 8:39 AM
To: Koehler, Birgit G (BPA) - PG-5; James, Eve A L (BPA) - PG-5
Subject: RE: Stop the presses on E3 -- we have more work to do

Sounds good. I'm writing up a summary of what Scott said and I'll send it to you shortly. He is VERY frustrated. After I send the email, I can try to book some time to talk if that is helpful.

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, May 25, 2022 8:37 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: Stop the presses on E3 -- we have more work to do

Can we let E3 work on the middle section of the slide deck while we work on the front and conclusion? We may need to have this complete by Friday, so want to keep it moving as fast as possible.

From: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Wednesday, May 25, 2022 8:35 AM
To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: Stop the presses on E3 -- we have more work to do
Importance: High

Hi Eve and Birgit,
Please let E3 know that we are going to send them another version. I just got off the phone with Scott and I'll write something up ASAP, and follow up with you guys on the phone. We still don't have the messages right.

Katie Pruder Scruggs
Environmental Communication Specialist
Bonneville Power Administration
503-230-3111

(b)(6)

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Thursday, May 26, 2022 10:49 AM
To: Koehler, Birgit G (BPA) - PG-5; James, Eve A L (BPA) - PG-5
Cc: Armentrout, Scott G (BPA) - E-4; Zelinsky, Benjamin D (BPA) - E-4
Subject: RE: TP Idea for the Nameplate issue

Importance: High

Another note from Scott in this:

“The main thing I wanted to convey is that a lesser amount is a policy decision not a study of LSRD capacity”

From: Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Thursday, May 26, 2022 10:25 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>;
Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>
Subject: TP Idea for the Nameplate issue
Importance: High

Here is something we could work on for the nameplate issue – for consideration:

This study specifically deals with replacing the installed and operating Lower Snake River Dam capacity to generate power. The Nameplate capacity is 3483 MW. The max production is XXXX MW as operating. The avg MW production as operating is XXXX MW. The avg peaking MW production as operating is XXXX MW. Studies that suggest replacement of only the average MW are not answering the same question as this study – actual replacement of all the services of the LSRDs. Replacing a different number is a policy decision.

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

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From: Anasis,John G (TFE)(BPA) - TOOP-DITT-2
Sent: Wednesday, June 1, 2022 2:36 PM
To: James,Eve A L (BPA) - PG-5
Cc: Koehler,Birgit G (BPA) - PG-5; Pruder Scruggs,Kathryn M (BPA) - E-4; McManus,Bart (BPA) - TOOC-DITT-2; Bustamante,Richard (BPA) - PTK-5
Subject: RE: Transmission considerations for LSN replacement study

DELIBERATIVE FOIA EXEMPT

Eve,

Thank you for this clarification. If you are looking for the costs and timing to add new transmission you need to contact Ricky Bustamante and his team in Transmission Planning. I added Ricky to the cc list of this e-mail so that you can begin the dialog with him.

Thanks again!

John

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, June 1, 2022 2:32 PM
To: Anasis,John G (TFE)(BPA) - TOOP-DITT-2 <jganasis@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; McManus,Bart (BPA) - TOOC-DITT-2 <bamcmanus@bpa.gov>
Subject: RE: Transmission considerations for LSN replacement study

DELIBERATIVE FOIA EXEMPT

Thanks John- for Slide 4, I was looking for this type of info under timing:

- XXX to build transmission, which includes providing compliance with the National Environmental Policy Act, siting, permits, etc.

I think maybe Joel had gone to a Tx presentation of some sort discussing challenges around transmission building and wanted to make sure we captured transmission considerations. Is there someone in Tx who would have some good estimates on how long to build transmission?

From: Anasis,John G (TFE)(BPA) - TOOP-DITT-2 <jganasis@bpa.gov>
Sent: Wednesday, June 1, 2022 2:23 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; McManus,Bart (BPA) - TOOC-DITT-2 <bamcmanus@bpa.gov>
Subject: RE: Transmission considerations for LSN replacement study

DELIBERATIVE FOIA EXEMPT

Eve,

Thank you for your note. I added a sentence to slide 6 in the attached version of the PowerPoint to flag voltage support and inertia as a couple other important things we get from the Lower Snake projects. That is shown in red. Slide 6 was the only place where I saw any transmission related references, so please let me know if I missed something. I did not see any transmission items on slide 4.

As far as what additional information may be needed, that depends on who the intended audience is for this PowerPoint presentation. If it is for the general public, policy-makers, or the fisheries community, then I think this is about the right level of detail. If the target audience is more technically oriented, such as regional utility folks, then they may want some additional detail. Please let me know if we need to look at this further based on who will be seeing the final version.

I have copied Bart on this e-mail so that he can comment on the statements on reserves if he sees fit.

Let me know if this meets your needs or if I can be of any other help. Thank you again!

John

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Wednesday, June 1, 2022 8:25 AM

To: Anasis,John G (TFE)(BPA) - TOOP-DITT-2 <jganasis@bpa.gov>

Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>

Subject: Transmission considerations for LSN replacement study

DELIBERATIVE FOIA EXEMPT

Hi John-

We are putting together a few slides together with BPA's perspective on the LSN replacement study work. Execs would like a transmission considerations slide. We want to make sure to keep the information in the presentation consistent with the EIS as much as we can. Birgit, Katie, and I are working on some messaging and were hoping for some feedback from TX on slide 4 and we can add an additional slide or Tx info on other slides if needed. If we should be bugging someone else over in Transmission for this information please let us know. The PDF is a rough draft version of the E3 study results that we will be putting our slides with.

Thanks,
Eve

From: James,Eve A L (BPA) - PG-5
Sent: Thursday, June 30, 2022 7:56 AM
To: Johnson,G Douglas (BPA) - DK-7
Cc: Koehler,Birgit G (BPA) - PG-5
Subject: RE: Updated talking points
Attachments: E3 LSRD replacement cost analysis TPs v4.docx

Deliberative, FOIA exempt

Attached is an updated version including the graphic Liz suggested and a note with her proposed language to what the graphic means and the source.

From: James,Eve A L (BPA) - PG-5
Sent: Thursday, June 30, 2022 7:32 AM
To: Johnson,G Douglas (BPA) - DK-7 <gdjohnson@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 (<bgkoehler@bpa.gov> <bgkoehler@bpa.gov>
Subject: Updated talking points

Deliberative, FOIA exempt

Good Morning-

Attached is an updated version of the talking points. E3 updated the NPV numbers in the report using a calculation assumption closer in line with the Inslee/Murray report and the numbers BPA uses for financing projects. We are reviewing the final report and will wait to send the updated PPT until after all changes are incorporated. I wasn't sure if you wanted to add or adjust talking points per Liz Klumpp's suggestions so I just updated the NPV amounts in the current draft that I had.

Thanks,
Eve

FOR INTERNAL USE ONLY

BPA talking points

E3 lower Snake River dam replacement costs analysis

June 2022

What this is

Earlier this year, BPA contracted with electric industry research firm Energy and Environmental Economics, also known as E3, to conduct an independent analysis of the electricity system value of the four lower Snake River (LSR) dams. This new analysis builds on the analysis performed in the Columbia River System Operations Environmental Impact Statement regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future. BPA anticipates E3's study to contribute to the regional dialogue about the future of these publicly-owned assets and help elevate regional understanding of the complexities and expenses involved in exploring replacement resources for the LSR dams.

Key messages and storyline

- As states move forward with clean energy policies, fossil-fuel generated power is being removed from the grid. Reducing hydropower would require the region to build new generation just to get the system back to its current state. Until all fossil-fuel power plants are retired, reducing hydropower means more CO2 emissions in the region, which is a step backward from the region's carbon reduction goals. Some of the lower-cost options for replacing lost hydropower rely on emerging technologies that are not yet developed or available at large-scale.
- Replacing the dams' hydropower energy and capacity services with existing renewable technology and no technological breakthroughs is projected to create 65% upward rate pressure. This is much higher than the other scenarios evaluated- prohibitively expensive.
- The E3 study evaluates what is required to maintain current reliability standards. Assuming different risk levels for reliability, as is done in other studies of LSN dam power replacement, is a policy decision outside the scope of this analysis.
- New resources to replace the existing lower Snake River dams' energy and capacity would cost between \$8.7 to 15.1 billion with at least one emerging technology and up to \$61 billion absent breakthroughs in not-yet-commercialized emerging technologies. If these costs are not paid for by an outside source, it would result in higher electric bills for millions of Northwest residents.
- The replacement of the dams' hydropower could take up to approximately 20 years to complete after Congressional approval assuming Transmission builds were needed but there was not litigation or other major delay on siting.

Background

With multiple reviews of the future of the lower Snake River dams being conducted by the Council on Environmental Quality, the Columbia Basin Collaborative and Senator Patty Murray (D-WA) and Washington Governor Jay Inslee, BPA felt it necessary to update the potential costs of replacing the energy services from these facilities.

The CRSO EIS analysis examined a series of resource replacement portfolios using the Northwest Power and Conservation Council's latest forecasts and updated Energy Commodities resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. E3 used a resource portfolio optimizer model with their data sets and their criteria and objectives to create least-cost replacement portfolios.

E3's independent analysis includes several scenarios for replacement resources, including some with emerging technologies such as small modular nuclear reactors (SMRs) and gas plants with carbon capture or hydrogen burning capability that are not available yet. It also includes use of traditional renewable resources, such as wind, solar, storage and demand response. All of the scenarios present moderate to significant upward rate pressure for BPA's customers if not paid for by an outside source.

For more information, contact: Eve James, 503-230-5558 or Birgit Koehler, 503-230-4249

Questions and answers

1. What was the scope of the study and what questions did it address?

BPA contracted with E3 to answer what resources (one or more portfolios of resources) would be needed to maintain reliability, which is close to replacing the energy and other grid services provided by the lower Snake River dams. This includes modeling regional grid scenarios with and without the dams. The model is designed to identify one or more replacement resource portfolio(s) and provide a comparison of the forecasted costs associated with each scenario. The analysis also discusses the timeline under which a build-out of replacement resources could occur.

E3's key study questions are:

- What additional resources would be needed to replace the power services provided by the LSR Dams through 2045?
- What is the net cost to BPA ratepayers?
- How do costs and resource needs change under different types of clean energy futures?
- How much does replacing the dams rely on emerging, not-yet commercialized technologies?

2. What power benefits do the four LSRDs currently provide?

These facilities first and foremost provide reliable electricity to help the western interconnection and the Pacific Northwest avoid blackouts. They also provide carbon-free energy. More specifically, they are capable of providing a short-term peaking capacity of more than 3,000 MWs. They can provide more than 2,000 MW of longer term peaking capacity during cold snaps when Pacific Northwest electricity use is at its highest as well as provide important reserves and essential grid reliability services, including voltage support, reactive power and black start ability.

3. What resources does the study recommend to replace the output of the lower Snake River dams?

The study recommends a combination of renewable generation (wind and solar) and “clean firm” resources (such as dual fuel natural gas + hydrogen plants, advanced small modular nuclear reactors (SMR), or gas with carbon capture and storage), and energy efficiency.

4. What are the replacement resource scenarios E3 evaluated?

Scenario	Replacement Resources Selected, Cumulative by 2045 (GW*)
<p>Scenario 1: 100% Clean Retail Sales</p>	<p>+ 2.1 GW dual fuel NG/H2 CCGT + 0.5 GW wind</p>
<p>Scenario 2a: Deep Decarb. (Baseline Technologies)</p>	<p>+ 2.0 GW dual fuel NG/H2 CCGT + 0.3 GW li-ion battery + 0.4 GW wind + 0.05 GW advanced energy efficiency + additional H2 generation**</p>
<p>Scenario 2b: Deep Decarb. (Emerging Technologies)</p>	<p>+ 1.5 GW dual fuel NG/H2 CCGT + 0.7 GW nuclear SMR</p>

Scenario 2c: Deep Decarb.
(No New Combustion)

+ 10.6 GW wind
+ 1.4 GW solar

- In scenarios that assume new combustion generation may be permitted in the Northwest, firm capacity is mostly replaced with ~2 GW of dual fuel natural gas + hydrogen turbines. These turbines may initially burn natural gas when needed during reliability challenged periods, but would transition to green hydrogen by 2045 to reach zero-emissions.
- If advanced nuclear is available, it is selected in lieu of renewables and some of the gas plants.
- The “no new combustion” scenario with decarbonization of the broader economy (e.g. electric vehicles and electric heating) requires an impractically large (12 GW) buildout of renewable energy to replace the dams’ firm capacity contributions and GHG-free energy. This is required because the wind and solar power are not as reliable for serving load as would be firm combustion generation, and thus large quantities are needed to ensure that some generation may be available during the critical periods like winter cold spells.

5. What does each option cost?

	Total Costs (real 2022 \$)	Annual Cost Increase (real 2022 \$)			Incremental Public Power Costs [% increase vs. ~8.5 cents/kWh NW average retail rates]
	Net Present Value in year of breaching	2023	2025	2045	2045
Scenario 1: 100% Clean Retail Sales	\$9.7 billion		\$434 million	\$478 million	0.8 cents/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$11.7 billion	\$495 million	\$466 million	\$509 million	0.8 cents/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$15.1 billion		\$496 million	\$860 million	1.5 cents/kWh [+18%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$8.7 billion		\$415 million	\$428 million	0.7 cents/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$61 billion	n/a	\$1,953 million	\$3,199 million	5.5 cents/kWh [+65%]

•Cost increases account for replacement energy, capacity, and reserves as well as avoided LSR capital + expense, but do not include any costs for breaching the dams, which would be an additional cost.

•NPV and annual cost increase are shown for the Northwest Region as a whole, but the incremental costs are calculated relative to the BPA Tier I annual sales for public power customers.

•% increase versus average retail rates assumes ~8.5 cents/kWh retail rates (estimated from OR and WA average retail rates). This does not account for any other rate increases that will be driven by higher loads or clean energy needs that increase regional rates.

•Annual residential customer cost impact assumes 1,280 kWh/month for average residential customers in Oregon and Washington (current ~1,000 kWh/month average + 28% from electrification load growth).

•New federal tax credits for hydrogen plants/fuels or ITC/PTC extension for renewables would provide a cost reduction to public power customers from taxpayers



E3 2022 study results: these are not the total costs to the Northwest of decarbonizing the electricity grid or its economy; these costs reflect the incremental costs of removing the four lower Snake River dams in each of those scenarios.

6. How do the replacement costs compare to the current costs of the lower Snake River dams?

The lower Snake River dams cost between \$13 and \$17/MWh to operate and maintain. Replacement resources, depending on those chosen, are projected to cost between \$77 and \$139/MWh. Replacement costs rise to more than \$500 MWh in the deep economy-wide decarbonization scenario that includes only existing technologies (wind, solar, etc.) and no emerging technology, such as hydrogen and small modular nuclear.

7. What is the projected rate impact to BPA customers?

In scenarios 1, 2a and 2b, the rate impact would be between 8% and 18% or ~\$100 to \$230 per year. In a deep economy-wide decarbonization scenario (2c) with no emerging technologies, the cost would be approximately a 65% increase or \$850 per year per household.

Note: Scenario 2c required increases in the supply of wind on new transmission (Northwest, Montana, Wyoming, and off-shore wind) to enable a feasible solution which drives the costs impractically high.

8. What is the timeline necessary to add the resources that would be required?

E3 estimates that adding additional renewable energy and firm capacity additions would take approximately five to seven years after Congressional approval to breach the dams and possibly up to 10 to 20 years assuming additional new large-scale transmission was required but there was not litigation or other major delay on siting.

From: Koehler,Birgit G (BPA) - PG-5
Sent: Thursday, June 2, 2022 7:25 AM
To: Diffely,Robert J (BPA) - PGPL-5
Cc: James,Eve A L (BPA) - PG-5
Subject: RE: can we make a map like this?

Thanks for verifying. It's so easy to get crosswise with so many numbers

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Sent: Thursday, June 2, 2022 7:23 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Subject: RE: can we make a map like this?

Good morning,
Looks like I goofed. Thank you for correcting.

Rob

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, June 1, 2022 7:30 PM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Subject: RE: can we make a map like this?

Deliberative Process Privilege; FOIA-exempt.

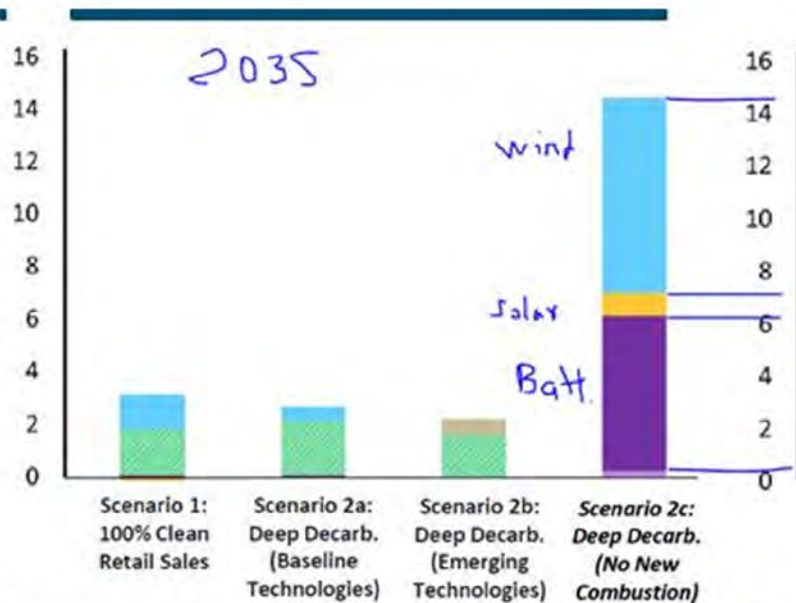
Rob,

Turns out we are trying to map Scenario 2c, which isn't on the table from you because we didn't have those results until recently. So, I started to do the math myself. And I went to look at your data versus the source you so helpfully provided. Could it be that you used the Std dev not the actual size? If I reverse your math, it looks like you used 1.7 acres/MW for solar. (e.g. 1600 MW on 4.3 square miles converted to acres/MW using 0.0015625 square miles/acre). For wind at 600 MW, 23.4 acres I get 25 acres/MW from your table, but 44.7 acres/MW from the NREL table. I'm also attaching my excel file in case you want to verify anything.

Land Use

Technology Type	Size (acres / MW)	Size Std. Dev. (acres / MW)
Photovoltaics <10 kW	3.2	2.2
Photovoltaics 10 100 kW	5.5	0.7
Photovoltaics 100 1,000 kW	5.5	0.7
Photovoltaics 1 10 MW	6.1	1.7
Wind <10 kW	30	n/a
Wind 10 100 kW	30	n/a
Wind 100- 1000 kW	30	n/a
Wind 1 10 MW	44.7	25.0

Here's what I'm coming up with,



Literally using a ruler on a screen to get the best read of MW since I couldn't find it in any of their tables
 On-shore wind 7145 MW * 44.7 acres/MW from NREL * 0.001563 sq miles/acre = 500 sq miles

Solar 855 MW * 6.1 acres/MW from NREL * 0.001563 sq miles/acre = 8 sq miles

Didn't find conversion factors for batteries in those references or a quick search, but from the graph it looks like it is about 5750 MW battery (didn't see what duration and that affects the land area too, maybe it is 6 hours.)

I asked my husband if he'd like to give it a try. He came up with 65 acres. So that doesn't register next to the wind and solar.

Using Megapack, Tesla can deploy an emissions-free 250 MW, 1 GWh power plant in less than three months on a **three-acre** footprint – four times faster than a traditional fossil fuel power plant of that size.

That is 83.3 MW/Acre,

So $5700\text{MW}/83.3\text{MW/Acre} = 65\text{Acres}$

That is 22.8GWH of storage in a 4 hour format.

Using 4,385 Tesla Megabucks.

1000 megapacks cost \$1,654,927,950 installed, so 4384 megapacks would be \$7.3B

This is a big project. Tesla has only deployed 5GWH of storage so far.

Info from: <https://www.tesla.com/megapack/design> for cost and number of packs and <https://www.tesla.com/blog/introducing-megapack-utility-scale-energy-storage#:~:text=Using%20Megapack%2C%20Tesla%20can%20deploy,creating%20seamless%20renewable%20energy%20plants.>

for acreage.

Mark

Here's what I came up with for rough map ideas if the 500 square miles are correct

Map idea, showing wind is way bigger than area for two reservoirs. Could redo with 4 reservoirs and skinnier boxes



Deliberate: FOIA Exempt

Map idea, Seattle



CalBrestis, FOIA Exempt 8

From: Diffely, Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Sent: Monday, May 23, 2022 9:00 AM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: can we make a map like this?

Here is a high level estimate based on NREL. [Land Use by System Technology | Energy Analysis | NREL](#)
 E3 studies rely mostly on gas/H2 and wind. For offshore, the NREL report [Offshore Wind Market Report: 2021 Edition \(energy.gov\)](#) – I used the estimated acres from 5 projects in the New York Bight

	E3						
	S0 No Policy	S1 100% Clean Retail Sales	S1a 100% Clean Retail Sales (no carbon price)	S2 - Deep Decarb	S2a1 - Deep Decarb on combustion	S2a2 - Deep Decarb no gas	S2a3 - Deep Decarb emerging tech
Year	2035	2035	2035	2035	2035	2035	2035
Reliability Metric	PRM	PRM	PRM	PRM	PRM	PRM	PRM
Gas (MW)	2300	1800	2200	2000			1500 (H2)
DR (MW)							
Solar (MW)		-500			1500	1600	
Batteries (MW)		100	100	200	6000	300	
Wind (MW)	200	1300		600	9400		600
Offshore Wind (MW)						13000	
Pumped Storage (MW)					300		
Conservation (MW)					10	10	
SMR (MW)							600
Wind (Sq Miles)	7.8	50.8	0.0	23.4	367.2	0.0	23.4
Offshore Wind (Sq Miles)						1204.4	
Solar (Sq Miles)		-1.3	0.0	0.0	4.0	4.3	0.0

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Monday, May 23, 2022 8:29 AM
To: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
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E3 provided the amount of solar already. Not sure when we will get the land area from them. We could ask this afternoon.

For Rob's FYI: Katie is working to improve the E3 non-technical version of the ppt. We're hoping to get that done very quickly because it is urgent that we get back to CEQ and DOE as quickly as possible.

In fact, we should discuss with E3 (and amongst ourselves) if we are far enough along that we can schedule that meeting. Many people would be happy if we could do it next week.

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Great! Thanks for your quick response.

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Sure

E3 is planning to provide the land use (number of acres) across their scenarios, so we should have these numbers soon.

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Hi Rob,

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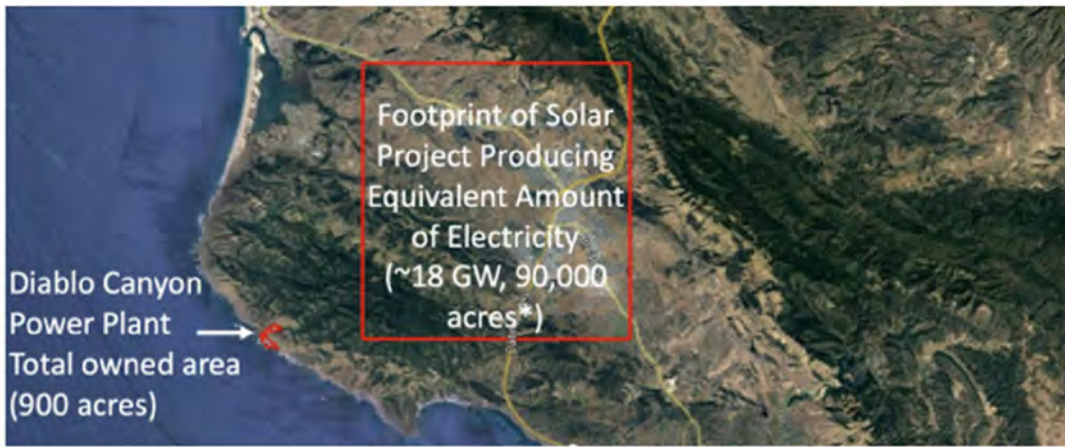


Figure 1-7: Hypothetical spatial footprint of 18 GW of PV compared to the San Francisco metro area (Credit: Lucid Catalyst LLC)



4. Impact of differing operating patterns on capacity value of Diablo Canyon

Katie Pruder Scruggs
Environmental Communication Specialist
Bonneville Power Administration
503-230-3111

(b)(6)

From: Pruder Scruggs,Kathryn M (BPA) - E-4
Sent: Monday, May 23, 2022 10:27 AM
To: Koehler,Birgit G (BPA) - PG-5
Subject: RE: can we make a map like this?

Got it.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Monday, May 23, 2022 10:26 AM
To: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: can we make a map like this?

Katie,

I'm not sure if Rob is working on a map or not, but we can always put a placeholder in your ppt (maybe a copy of the Diablo Canyon map) and ask them to try to create something similar. (Maybe not overlay on the LSN reservoirs, because they are a large area themselves).

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Subject: RE: can we make a map like this?

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Sent: Monday, May 23, 2022 7:53 AM

To: Diffely, Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>

Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Subject: can we make a map like this?

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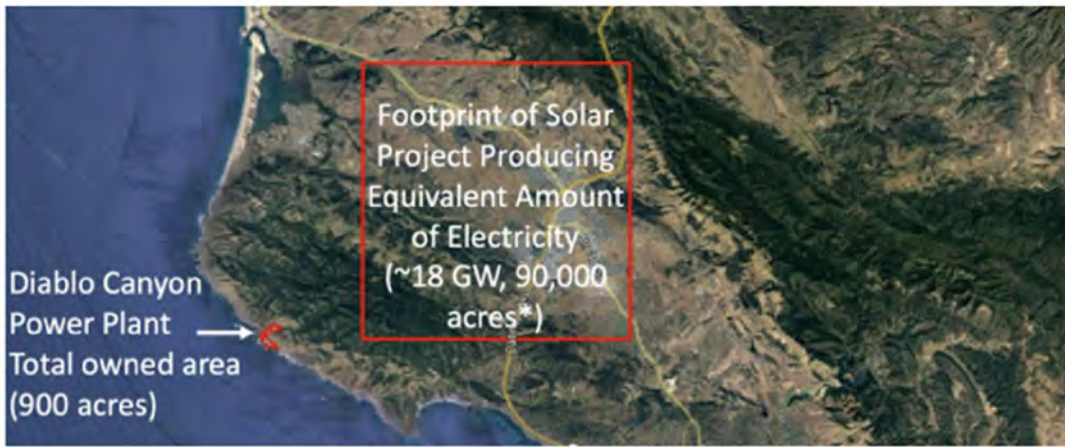


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4. Impact of differing operating patterns on capacity value of Diablo Canyon

Katie Pruder Scruggs
Environmental Communication Specialist
Bonneville Power Administration
503-230-3111

(b)(6)

From: Koehler,Birgit G (BPA) - PG-5
Sent: Wednesday, June 1, 2022 5:38 PM
To: Marker,Douglas R (BPA) - AIR-7
Subject: RE: could use your input on one bullet

I like it!

Many thanks 😊

From: Marker,Douglas R (BPA) - AIR-7 <drmarker@bpa.gov>
Sent: Wednesday, June 1, 2022 5:22 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: could use your input on one bullet

We have same instinct to not exaggerate the length of time it will take but to be realistic. So I offered a suggestion to convey that.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, June 1, 2022 4:57 PM
To: Marker,Douglas R (BPA) - AIR-7 <drmarker@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: could use your input on one bullet

Thanks. That does help. If NEPA has to happen in-between those two steps, then that could add 2-4 years too, but there might be overlap so it might not fully extend the timeline. I am concerned about appearing to exaggerate, so what do you think about this? We want to keep it super simple, but it is difficult to put something complicated into simple wording and still be accurate

- Up to XXX years total
 - ~~Perhaps~~ Practically, likely **5 to 10 years** for Congressional approval for breaching, USACE NEPA analysis, and Congressional budget appropriations
 - Roughly 5 years to replace the capacity resources [awaiting confirmation from Rob Diffely]
 - XXX to build transmission, which includes providing compliance with the National Environmental Policy Act, siting, permits, etc.

From: Marker,Douglas R (BPA) - AIR-7 <drmarker@bpa.gov>
Sent: Wednesday, June 1, 2022 4:40 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: could use your input on one bullet

I'll try to give you a reasonable hypothetical – given that your audience should be familiar with the legislative process.

I base this on breaching requiring Congressional authorization – but it seems reasonable to me that Congressional action would take at least two sequenced actions.

Congress would have to authorize dam breaching, presumably in a Water Resource Development Act cycle – so at least two years.

Then you should assume how long it will take Corps to do planning and design and the necessary NEPA process.

Then it will matter of getting appropriations. The Administration would presumably propose in the President’s budget – that’s a two year lead time, and then a year at minimum for initial appropriations.

That gives me five years in a reasonable sequence of congressional action – but not including Corps planning and design and NEPA.

Does that help?

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, June 1, 2022 4:04 PM
To: Marker, Douglas R (BPA) - AIR-7 <drmarker@bpa.gov>
Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: could use your input on one bullet

Deliberative, FOIA Exempt

Hey Doug,

Eve, Katie Pruder Scruggs, and I are preparing a few slides for DOE/CEQ that includes a timeline for how long it might take if we had to replace the generation of the LSN dams. Do you have a good idea what we should put into that first red text under bullet 2 for how long it might take Congress to approve breaching? The “Perhaps 1 to 5 year” is my un-informed guess absent input from someone like you with DC experience.

B O N N E V I L L E P O W E R A D M I N I S T R A T I O N

While it is *feasible* to replace power benefits of the lower Snake River dams, it is not *cheap, fast, or easy.*

- **Not cheap**
 - XXX for public power total, assuming paid for with debt spread over 50 years.
 - XXX for each public power household per year
 - XXX households affected
 - Social justice issue – lower income households would be disproportionately harmed by increased costs because a larger proportion of their income goes to the electric bill
- **Not fast**
 - Up to XXX years total
 - Perhaps 1 to 5 years for Congressional approval
 - Roughly 5 years to replace the capacity resources (confirm with Diffely, meant to include siting and construction)
 - XXX to build transmission, which includes providing compliance with the National Environmental Policy Act, siting, permits, etc.
- **Not easy**
 - Policy requirements to reduce emissions are removing fossil fuel resources from the grid. Breaching the four lower Snake River dams significantly **adds to the deficit of resources** in the region.

Acquiring replacement resources could require building new renewable resources at an unprecedented rate.

Deliberative, FOIA Exempt 4

From: Diffely,Robert J (BPA) - PGPL-5
Sent: Thursday, June 2, 2022 7:35 AM
To: Koehler,Birgit G (BPA) - PG-5
Cc: James,Eve A L (BPA) - PG-5
Subject: RE: how about this slide?

Yes and it is in the same report – bottom of slide 18

- Given the weather-dependent nature of the replacement portfolios, any final or “binding” assessment of the optimal mix of replacement resources should take a multi-year stochastic approach to weather modeling, versus the more deterministic analysis featured in this study

- ❖ However, given the intent and purpose of this study, the scope of weather-years and data used were reasonable an inline with industry standards

• Unlike prior efforts, this study determined the degree to which that demand will impact regional



From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, June 1, 2022 6:42 PM
To: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: how about this slide?

Rob, that quote from Energy Strategies at the bottom of the slide is confusing me. Are they saying that wind should be treated stochastically in the same report where they *don't* treat it stochastically?

Is that from their 2018 study but then not applied to their 2022 study? If that's the case, we can use it, but would want to say “NWECC 2022” study in the title and attribute the quote something like this “Energy Strategies (NWECC) 2018, p. 18.

From: James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Sent: Wednesday, June 1, 2022 2:44 PM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: how about this slide?

Rob sent me the slide- I'll add that

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Sent: Wednesday, June 1, 2022 2:43 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: how about this slide?

The capacity was 2,750 MW in Jan 2020 and 3,000 MW in Dec 2021

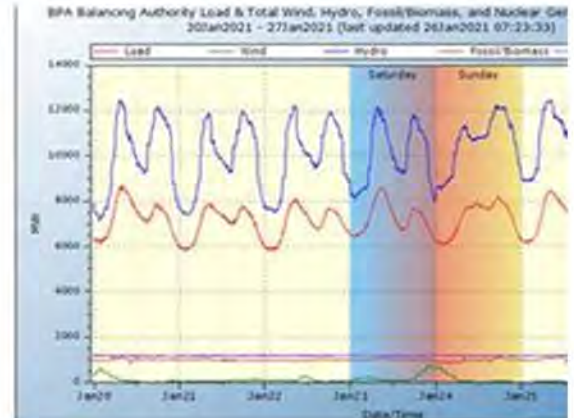
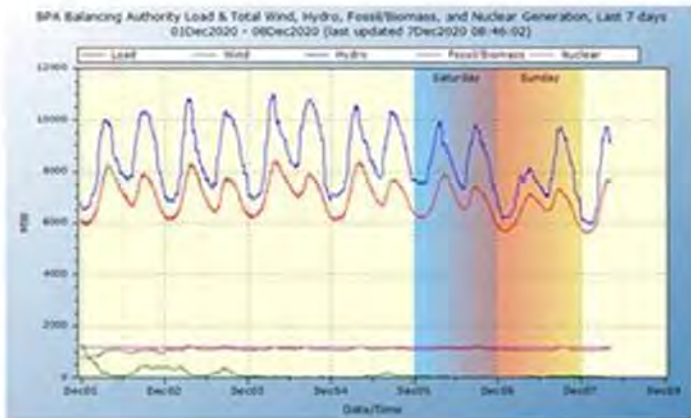
From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Wednesday, June 1, 2022 2:41 PM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: how about this slide?

I do like this. Cool that you have these two examples saved, Rob.
I don't know that we can squeeze it into the NWECC slide, but it would be a fast slide to present, so OK if we needed to insert an extra slide to include this. A picture is worth 1000 words. (I'd add a dashed line at the installed capacity and a fat, green arrow pointing to the green wind line.

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Sent: Wednesday, June 1, 2022 2:32 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: how about this slide?

Lacking stochastic approach to m

- Wind does not consistently provide generation around the clock as reported in examples from Jan 2020 and Dec 2021 with extremely low wind (Green Line) f of installed capacity in the BPA BA



- “Any final or binding assessment of optimal mix of replacement resources should use a stochastic approach to weather modeling vs the more deterministic analysis fe

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Sent: Wednesday, June 1, 2022 1:40 PM

To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>

Subject: RE: Slide for E3 study results responding to NWECC study

That is a great point Rob – I will incorporate that and the study only replaced 80% of the ramping capability assuming the region is flush with resources to meet the other 20%. I suspect you are correct Birgit about why they haven't updated.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Sent: Wednesday, June 1, 2022 1:39 PM

To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>

Subject: RE: Slide for E3 study results responding to NWECC study

Rob, are you thinking that this is why they chose to anchor their study on the 2018 analysis, maybe they didn't want to recalculate the need for replacement (since coal retirements could have raised that requirement)?

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Sent: Wednesday, June 1, 2022 1:33 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Slide for E3 study results responding to NWECC study

Wouldn't it be important up front to state NWECC is looking at replacing some (not all of the attributes) of the project but is not a reliability study that maintains adequacy as the CRSO EIS and E3?

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, June 1, 2022 11:27 AM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Slide for E3 study results responding to NWECC study

Send edits/comments to the slide and then we can add another if it is missing and crucial points for the DC folks who may have already seen the NWECC study.

From: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Sent: Wednesday, June 1, 2022 11:24 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Slide for E3 study results responding to NWECC study

Sure,
More than 1 page?

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, June 1, 2022 11:01 AM
To: Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: Slide for E3 study results responding to NWECC study

Hi Rob-
Birgit, Katie, and I are working on some BPA perspective on the E3 study slides. We'll share those to get your feedback when they are a little further along. Would you be able to help me craft a slide responding to the NWECC study that just came out? Birgit sent screen shots along at one point to get some initial thoughts. We want to have some high level comments for non-technical folks- I've attached a slide to start from and the NWECC study deck. Please let me know if you have comments/edits or if there are other crucial points we should be making (we can add another slide if needed).

Thanks,
Eve

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Thursday, May 26, 2022 7:10 AM
To: Koehler, Birgit G (BPA) - PG-5; James, Eve A L (BPA) - PG-5
Subject: RE: more input from Scott

Yes, I've sent everything Scott has said to me, to you both in email.

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, May 26, 2022 7:09 AM
To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: more input from Scott

Scott is just skyping me. But we've passed on the relevant info in email.

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Thursday, May 26, 2022 7:08 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: more input from Scott

OK- I don't think Scott is including me on his input so I'll trust you guys to capture in notes and then forward to me when it is time to edit.

From: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Thursday, May 26, 2022 7:06 AM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: more input from Scott

Sounds good!

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, May 26, 2022 7:05 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: more input from Scott

Scott also said that we can get this presentation right before presenting, meaning not rush it for tomorrow's deputy briefing (if that is even relevant tomorrow).

"Waste of time to do it before [it is right]"

I've made a new copy labeled Thursday morning where I'm keeping these notes from Scott in new green text boxes. I don't want to edit this version further until we get a copy back from E3.

And when Jill or Mary gets in, we will ask them what the latest expectation is for Friday's deputy briefing (DOE pre-brief) and Tuesday's potential Deputy meeting

From: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>

Sent: Thursday, May 26, 2022 6:59 AM

To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>

Subject: more input from Scott

Importance: High

We should say: My thought is to say 9% or \$100 for each of the XXXX million power customers in the region that 9 % or \$100 lacks scope and scale and known metric

Katie Pruder Scruggs

Environmental Communication Specialist

Bonneville Power Administration

503-230-3111

(b)(6)

From: Egerdahl,Ryan J (BPA) - PGPR-5
Sent: Friday, June 10, 2022 9:37 AM
To: Koehler,Birgit G (BPA) - PG-5
Subject: RE: present E3 results at Power meeting of Council?

thx

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 9, 2022 3:39 PM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Subject: RE: present E3 results at Power meeting of Council?

I think it is fine to get the options. Scott may have reached out more internally. (I haven't gone back to reread that email)

From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Thursday, June 9, 2022 3:24 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Subject: RE: present E3 results at Power meeting of Council?

Roger that. I sent our Council power contacts an email to see what's possible for forums. Was that ok, or is EFW already checking? Or, is two routes of checking ok? 😊

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 9, 2022 3:20 PM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Subject: RE: present E3 results at Power meeting of Council?

Be aware that Scott also started setting something in motion. I think I forwarded to you for awareness.

From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Thursday, June 9, 2022 3:09 PM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>
Subject: RE: present E3 results at Power meeting of Council?

Hi. Let me check with Chad at Council. Thanks Birgit

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 9, 2022 9:04 AM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>

Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Diffely,Robert J (BPA) - PGPL-5 <rjdiffely@bpa.gov>

Subject: present E3 results at Power meeting of Council?

Deliberative Process Privilege; FOIA-exempt.

Ryan,

We are looking for a forum to present the E3 results. We won't be ready for next week's Council meeting. The July meeting is possible, but we'd prefer a bit sooner. Is there a RAAC meeting or whatever it is called or any other relevant meeting coming up in the near future where we could offer to brief the Council (and public)? Maybe we have to offer the Council a special meeting.

Birgit

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Thursday, June 2, 2022 7:17 AM
To: James, Eve A L (BPA) - PG-5; Koehler, Birgit G (BPA) - PG-5
Subject: RE: some quick additional text before sending to Scott

You'll want to fix that on the deck I just sent.

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Thursday, June 2, 2022 7:10 AM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Subject: RE: some quick additional text before sending to Scott

That is better- sorry I captured that wrong!

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Thursday, June 2, 2022 7:10 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: some quick additional text before sending to Scott

How about instead of "mature emerging technologies" we say "maturation of emerging technologies"? I like the emphasis on the verb that the technologies need to mature.

From: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Thursday, June 2, 2022 6:59 AM
To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: some quick additional text before sending to Scott

Got it

From: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Thursday, June 2, 2022 6:58 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: some quick additional text before sending to Scott

Good Morning Katie-

Instead of sending the whole PPT again I'll just send screenshots of some language Birgit and I talked through to add (in green below so you can easily see it):

Slide 4:

- **Not cheap**

- Up to \$2,000 M/year to \$3,200 M/year for public debt spread over 50 years, or 434 million/year decarbonization and assuming mature emerging technology
- Up to \$850/year for each public power house decarbonization and assuming mature emerging technology

Slide 5:

- Replacing the lost power with new resources would require 500 sq miles or 50 sq miles without decarbonization with assuming mature emerging technology (X-acre square miles) of land.

From: Pruder Scruggs,Kathryn M (BPA) - E-4
Sent: Tuesday, May 24, 2022 1:47 PM
To: Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5; Armentrout,Scott G (BPA) - E-4
Subject: RE: suggestions to make E3 study less technical for lay audience 5 24.pptx

Got it. Power owns the document for now so I'll let Eve and Birgit noodle on it, then see if they need more help from me.

On May 24, 2022 11:32 AM, "Armentrout,Scott G (BPA) - E-4" <sgarmentrout@bpa.gov> wrote:
The way I am thinking about it is what question did we try to answer here. How much does it cost to fully replace all the services provided by the LSRDs? That should be up front. Then – here are the services we are talking about. Then – here is what they would cost to replace. The rest of the info is how we got to that number. Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C (b)(6)



From: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Tuesday, May 24, 2022 11:29 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: RE: suggestions to make E3 study less technical for lay audience 5 24.pptx

Should we keep the very high level summary and call it "key takaways" and have a separate "executive summary" slide with more details?

On May 24, 2022 11:12 AM, "Armentrout,Scott G (BPA) - E-4" <sgarmentrout@bpa.gov> wrote:
There is an awful lot of background info in here. The executive summary stuff is way too general. A couple thoughts – highlight the services we are talking about – power generation, reserves, ancillary services, black start capability, reg up, reg down etc. How much do these dams have and how much is it going to cost to replace them? Bottom line upfront. We don't want the viewer to have to extract anything – straight up. Anyway, I know this is difficult – however we need to work on it more. Scott

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C (b)(6)



From: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Sent: Tuesday, May 24, 2022 9:59 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: suggestions to make E3 study less technical for lay audience 5 24.pptx

Importance: High

Scott – this is FYI only. Eve and Birgit will likely have edits so this is still draft. However, I do welcome your comments at any point in the process.

Eve and Birgit – Here's my first take on this. I'm available to continue working with you, but I need to be offline for a few hours over lunchtime for a personal errand. I will, however, have my BPA phone and will take calls and I'll be back at my post this afternoon.

Katie Pruder Scruggs
Environmental Communication Specialist
Bonneville Power Administration
503-230-3111
(b)(6)

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Monday, May 23, 2022 7:54 AM
To: Koehler, Birgit G (BPA) - PG-5
Cc: James, Eve A L (BPA) - PG-5
Subject: RE: technical version of results, and some Birgit notes

Thanks Birgit! Great talking with you. Even and I are meeting at 3 today.

From: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Monday, May 23, 2022 7:53 AM
To: Pruder Scruggs, Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Cc: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: technical version of results, and some Birgit notes

Deliberative, FOIA Exempt

Hey Katie,

I'm not sure you need their technical version after all, but here you have it just in case. Includes technical version of results, e.g.

And I'm attaching the scatter-shot ideas that I was starting to assemble that might help you build this up.

Eve,

I'm not quite sure what to make of the E3 slides that show that replacement resources are less MW than the 3,500 MW of the LSN. Maybe it's OK, because we can still say that it seems odd to get rid of perfectly good generation.

Katie and I just spent an hour talking through the E3 ppt. I was more alarmed on Friday than I am this morning having taken a closer look. But I just walked through it once, and didn't know what to make of some of it on the first pass. I suggested that Katie talk with you too to get your impressions.

Katie will probably make a new PPT (without fancy background or font), using screen shots of E3's graphics unless they send us a ppt. But then E3 can use Katie's to go back and modify their own, giving it the E3 look.

Will we use this for CEQ&DOE as well as for the public? The former is the high priority, so that's all I've focused on. Katie rightly pointed out that it would be an idea to have it suitable for both, so I'd try to make that appropriate. The public audience probably would have more technical folks than CEQ, but we may not want to give them more details than what we give CEQ.

Birgit

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Tuesday, May 24, 2022 10:01 AM
To: James, Eve A L (BPA) - PG-5; Koehler, Birgit G (BPA) - PG-5
Cc: Armentrout, Scott G (BPA) - E-4
Subject: RE: suggestions to make E3 study less technical for lay audience 5 24.pptx

Also note, per Birgit's request, the presentation is not formatted. It's just sort of "notes" for E3 to consider in their presentation.

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Tuesday, May 24, 2022 9:59 AM
To: James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Cc: Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Subject: suggestions to make E3 study less technical for lay audience 5 24.pptx
Importance: High

Scott – this is FYI only. Eve and Birgit will likely have edits so this is still draft. However, I do welcome your comments at any point in the process.

Eve and Birgit – Here's my first take on this. I'm available to continue working with you, but I need to be offline for a few hours over lunchtime for a personal errand. I will, however, have my BPA phone and will take calls and I'll be back at my post this afternoon.

Katie Pruder Scruggs
Environmental Communication Specialist
Bonneville Power Administration
503-230-3111

(b)(6)

From: James,Eve A L (BPA) - PG-5
Sent: Monday, May 23, 2022 8:00 AM
To: Koehler,Birgit G (BPA) - PG-5; Pruder Scruggs,Kathryn M (BPA) - E-4
Subject: RE: technical version of results, and some Birgit notes

Deliberative, FOIA Exempt

Thanks Birgit- I think having the public slide deck the same for CEQ and public is a good idea. The full technical report will be posted at some point for those wanting more detail. Katie and I have a meeting later today after the E3 meeting. Also, Doug Johnson said he is available to help with messaging and help with planning the public rollout so once Katie and I get a first pass put together we can loop him in as well.

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Monday, May 23, 2022 7:53 AM
To: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>
Cc: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: technical version of results, and some Birgit notes

Deliberative, FOIA Exempt

Hey Katie,

I'm not sure you need their technical version after all, but here you have it just in case. Includes technical version of results, e.g.

And I'm attaching the scatter-shot ideas that I was starting to assemble that might help you build this up.

Eve,

I'm not quite sure what to make of the E3 slides that show that replacement resources are less MW than the 3,500 MW of the LSN. Maybe it's OK, because we can still say that it seems odd to get rid of perfectly good generation.

Katie and I just spent an hour talking through the E3 ppt. I was more alarmed on Friday than I am this morning having taking a closer look. But I just walked through it once, and didn't know what to make of some of it on the first pass. I suggested that Katie talk with you too to get your impressions.

Katie will probably make a new PPT (without fancy background or font), using screen shots of E3's graphics unless they send us a ppt. But then E3 can use Katie's to go back and modify their own, giving it the E3 look.

Will we use this for CEQ&DOE as well as for the public? The former is the high priority, so that's all I've focused on. Katie rightly pointed out that it would be idea to have it suitable for both, so I'd try to make that appropriate. The public audience probably would have more technical folks than CEQ, but we may not want to give them more details than what we give CEQ.

Birgit

From: Johnson,G Douglas (BPA) - DK-7
Sent: Friday, June 24, 2022 2:13 PM
To: Scruggs,Joel L (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7; James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5; Pruder Scruggs,Kathryn M (BPA) - E-4; Warner,Joshua P (BPA) - AIR-7
Subject: REVIEW REQUESTED: E3 LSRD replacement cost analysis talking points
Attachments: E3 LSRD replacement cost analysis TPs v1.docx

Please take a look and provide any edits or comments you have by noon, Tuesday, June 28. Once I have your comments and edits, I'll circulate a revised version to managers and executives. We need to have these done by next Friday if we still intend to present the results to the Council Wednesday or Thursday the week of the 4th of July.

The first few sections are new – the Q&A was lifted almost verbatim from the E3 powerpoint presentation. I hope this is close to the mark. Thanks for your help. Have a great weekend.

FOR INTERNAL USE ONLY

BPA talking points

E3 lower Snake River dam replacement costs analysis

June 2022

What this is

Earlier this year, BPA engaged electric industry research firm Energy and Environmental Economics also known as E3 to build on the analysis performed in the Columbia River System Operations Environmental Impact Statement regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future.

Key messages and storyline

- Breaching the dams would require resource builds just to get the system back to where it is now rather than replacing fossil-fuel generation. Also, reliance on emerging technologies not-yet deployed is assumed for some of the lower-cost options. Replacing the dams with existing renewable technology would be prohibitively expensive.
- This study evaluates what is required to maintain the current reliability standards. Assuming different risk levels for reliability is a policy decision outside the scope of this analysis. That is something BPA, its customers and constituents will have to consider as discussion about the future of the lower Snake River dams continue.
- Replacement resources would result in higher electric bills for millions of NW residents. It would also take up to 20 years to complete.

Background

With multiple reviews of the future of the lower Snake River dams being conducted by the Council on Environmental Quality, the Columbia Basin Collaborative and Senator Patty Murray (D-WA) and Washington Governor Inslee, BPA felt it necessary to update the potential costs of replacing these facilities.

The CRSO EIS analysis examined a series of resource replacement portfolios using the Northwest Power and Conservation Council's latest resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. E3 will include a resource portfolio optimizer model using their data sets and their criteria and objectives to create least cost replacement portfolios.

E3's analysis includes several scenarios for replacement resources, including some emerging technologies, such as offshore wind and gas plants with carbon capture that are not deployed yet. It also includes use of traditional renewable resources, such as wind, solar and storage. All of the scenarios present moderate to significant upward rate pressure for BPA's customers.

For more information, contact: Eve James, 503-230-5558 or Birgit Koehler, 503-230-4249

Questions and answers

1. What was the scope of the study and what questions did it address?

BPA contracted with E3 to answer what resources (one or more portfolios of resources) would be needed to replace the full energy and other grid services provided by the lower Snake River dams? This includes modeling regional grid scenarios with or without those dams. The model is designed to identify one or more replacement resource portfolio(s) and provide a comparison of the forecasted costs associated with each scenario. The analysis also discusses the timeline under which a build-out of replacement resources could occur.

2. What power benefits do the four LSRDs currently provide?

These facilities first and foremost provide reliable electricity to help the western interconnection and the Pacific Northwest avoid blackouts. They also provide carbon-free energy to help fight climate changes. More specifically, they are capable of providing a short-term peaking capacity of more than 3,000 MWs. They can provide more than 2,000 MW of longer term peaking capacity during cold snaps when Pacific Northwest electricity use is at its highest. They also provide important reserves and provide essential grid reliability services, including voltage support, reactive power and black start ability.

3. What resources does the study recommend to replace the output of the lower Snake River dams?

The study recommends a combination of renewable generation (wind) and "clean firm" resources (such as dual fuel natural gas + hydrogen plants, advanced small modular nuclear, or gas with carbon capture and storage), and energy efficiency.

4. What are the replacement resource scenarios E3 evaluated?

Scenario	Replacement Resources Selected, Cumulative by 2045 (GW*)
Scenario 1: 100% Clean Retail Sales	+ 2.1 GW dual fuel NG/H2 CCGT + 0.5 GW wind
Scenario 2a: Deep Decarb. (Baseline Technologies)	+ 2.0 GW dual fuel NG/H2 CCGT + 0.3 GW li-ion battery + 0.4 GW wind + 0.05 GW advanced energy efficiency + additional H2 generation**
Scenario 2b: Deep Decarb. (Emerging Technologies)	+ 1.5 GW dual fuel NG/H2 CCGT + 0.7 GW nuclear SMR
<i>Scenario 2c: Deep Decarb. (No New Combustion)</i>	+ 10.6 GW wind + 1.4 GW solar

- Firm capacity is mostly replaced with ~2 GW of dual fuel natural gas + hydrogen turbines. These turbines may initially burn natural gas when needed during reliability challenged periods, but would transition to hydrogen by 2045 to reach zero-emissions.
- If advanced nuclear is available, it replaces renewables and some of the gas plants.
- The “no new combustion” scenario requires an impractically large (12 GW) buildout of renewable energy to replace the dams firm capacity contributions and GHG-free energy.

5. What does each option cost?

	Total Costs (real 2022 \$)	Annual Cost Increase (real 2022 \$)			Incremental Public Power Costs [% increase vs. ~8.5 cents/kWh NW average retail rates]
	Net Present Value in year of breaching	2025	2035	2045	2045
Scenario 1: 100% Clean Retail Sales	\$7.5 billion		\$434 million	\$478 million	0.8 cents/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$11 billion	\$495 million	\$466 million	\$509 million	0.8 cents/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$11.5 billion		\$496 million	\$860 million	1.5 cents/kWh [+18%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$7 billion		\$415 million	\$428 million	0.7 cents/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$46 billion	n/a	\$1,953 million	\$3,199 million	5.5 cents/kWh [+65%]

*Cost increases account for replacement energy, capacity, and reserves as well as avoided LSR capital + expense, but do not include any costs for breaching the dams, which would be an additional cost.

•NPV and annual cost increase are shown for the Northwest Region as a whole, but the incremental costs are calculated relative to the BPA Tier I annual sales for public power customers.

•% increase versus average retail rates assumes ~8.5 cents/kWh retail rates (estimated from OR and WA average retail rates). This does not include additional rate increases driven by higher loads or clean energy needs that increase regional rates as shown in the earlier 2045 incremental cost chart.

•Annual residential customer cost impact assumes 1,280 kWh/month for average residential customers in Oregon and Washington (current ~1,000 kWh/month average + 28% from electrification load growth).

•New federal tax credits for hydrogen plants/fuels or ITC/PTC extension for renewables would provide a cost reduction to public power customers from taxpayers

6. How do the replacement costs compare to the current costs of the lower Snake River dams?

The lower Snake River dams cost between \$13 and \$17/MWh to operate and maintain. Replacement resources, depending on those chosen, are projected to cost between \$77 and \$139/MWh. Replacement costs rise to more than \$500 MWh in the deep decarbonization scenario that includes only existing resources (wind, solar, etc.) and no emerging technology, such as hydrogen and small modular nuclear.

7. What is the projected rate impact to BPA customers?

In scenarios 1, 2a and 2b, the rate impact would be between 8% and 18% or ~\$100 to \$230 per year. In a deep decarbonization scenario (2c) with no emerging technologies, the cost would be approximately a 65% increase or \$850 per year.

These costs do not include potential transmission costs associated with interconnection and grid reinforcement that could be necessary to add the new resources.

8. What is the timeline necessary to add the resources that would be required?

E3 estimates that adding additional renewable energy and firm capacity additions would take approximately five to seven years after Congressional approval to breach the dams and possibly up to 10 to 20 years if additional new large-scale transmission was required.

From: Johnson,G Douglas (BPA) - DK-7
Sent: Wednesday, July 20, 2022 1:55 PM
To: Goodwin,Summer G (BPA) - DKS-7; Habibi,Maryam A (BPA) - DKP-7; Baskerville,Sonya L (BPA) - AIN-WASH; Scruggs,Joel L (BPA) - DK-7; Godwin,Mary E (BPA) - LN-7; Leary,Jill C (BPA) - LN-7
Cc: James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5
Subject: REVIEW REQUESTED: E3 presentation, study and Council meeting recording Comms email
Attachments: E3 Study materials v1.docx

Here is what I propose we send via Comms email regarding the E3 presentation, etc.

From: Marker,Douglas R (BPA) - AIR-7
Sent: Wednesday, June 29, 2022 10:22 AM
To: Zelinsky,Benjamin D (BPA) - E-4; Armentrout,Scott G (BPA) - E-4; Cooper,Suzanne B (BPA) - P-6; Senters,Anne E (BPA) - LN-7; Chong Tim,Marcus H (BPA) - L-7; McDonald,Thomas A (BPA) - C-7; Scruggs,Joel L (BPA) - DK-7; Leary,Jill C (BPA) - LN-7; Godwin,Mary E (BPA) - LN-7; Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5; Klumpp,Elizabeth C (BPA) - AIR-WSGL; Peacock,Julie (BPA) - AIR-7; Williams,John J (BPA) - AIR-BOISE; Reller,Mark D (BPA) - AIR-MSGL; Dondy-Kaplan,Hannah A (BPA) - AIR-7; Ledy Jr,William J (BPA) - PG-5
Cc: Johnson,G Douglas (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7; Warner,Joshua P (BPA) - AIR-7; Manchester,Kathleen L (CONTR) - AIT-7; Jones,Sheron M (BPA) - AIN-WASH; Baskerville,Sonya L (BPA) - AIN-WASH
Subject: Responses to Northwest Congressional delegation members concerning CEQ process have been signed and sent
Attachments: 2022-0624 E3 PNW Congressional CEQ letters.pdf

These letters were held during CEQ's development of its responses. John Hairston has signed them and they have been sent to the delegation members. Thanks for everyone's help with our responses.

Best,

Doug

Doug Marker
Intergovernmental Affairs
Bonneville Power Administration
drmarker@bpa.gov

(b)(6)

Title: E3 Study, presentation and NWPCC video

Internal Outreach Guidance

Power AEs: Share BPA's comments with your customers

Transmission AEs: Outreach to your transmission only customers is optional

D.C., EERs, CAEs and BPA Managers: FYI only

Internal Information

Last week, Energy and Environmental Economics (E3) delivered the results of its analysis of the costs related to replacing the lower Snake River dams to the Northwest Power and Conservation Council. We are proving you with links to those materials to share with your customers.

Background

Earlier this year, BPA engaged electric industry research firm Energy and Environmental Economics (E3) to build on the analysis performed in the Columbia River System Operations (CRSO) Environmental Impact Statement (EIS) regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future.

The CRSO EIS analysis examined a series of resource replacement portfolios using the Northwest Power and Conservation Council's latest resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. E3 will include a resource portfolio optimizer model using their data sets and their criteria and objectives to create least cost replacement portfolios.

The objective of the current analysis is to provide BPA with an independent study of lower Snake River dam breaching and potential replacement resources from a realistic analytic, operational, and resource characteristic perspective, so that BPA can enhance its understanding of the complexity and expense involved in replacing those assets

External Information

On Wednesday, July 13, E3 representatives briefed the Northwest Power and Conservation Council on the study findings. You can share the video with your customers at this [link](#). **Please note this link is a recording of the entire Council meeting. The E3 presentation starts at 1:57:22 and runs to the end.**

You can share the report and the presentation with your customers. Both are at this [link](#).

John Hairston addressed the E3 study and other analyses regarding the future of the lower Snake River dams in his Friday email to BPA employees. In that message, he said:

"While BPA does not support breaching these dams, we respect and appreciate the commitment of so many groups and leaders in the regional dialogue about long-term strategies that prioritize the protection and enhancement of salmon and steelhead. Ultimately, the region as a whole must continue to advance collaborative solutions in balance with the other critical and essential services the system provides."



Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

June 24, 2022

In reply refer to: AI-7

The Honorable Dan Newhouse
United States House of Representatives
Washington, D.C. 20515

Dear Representative Newhouse:

I am responding to the inquiry from you and your colleagues in the Northwest Congressional Delegation concerning the Bonneville Power Administration's role in the discussions by the Council on Environmental Quality (CEQ) on salmon and steelhead restoration in the Columbia River Basin. You and your colleagues also asked Bonneville to provide more information about analysis Bonneville is sponsoring concerning the four Federal lower Snake River dams.

I will address the questions in your letter in turn:

- 1. Has BPA engaged in a study or contracted with a consultant to study any aspect of the four dams on the lower Snake River? If so:**
 - a. What is being studied and what is the purpose of the study?**

Bonneville has engaged Energy + Environmental Economics (E3) to examine certain questions related to the effects to power and transmission from breaching the four lower Snake River dams. Bonneville will use this information to help inform its participation with the Administration as it continues engaging with regional entities related to the Columbia River System.

Bonneville will use the analysis to compare against the hydropower modeling completed as part of the Columbia River System Environmental Impact Statement (CRSO EIS) and take into account E3's experience with replacement resource portfolio optimizers. The analysis will entail examining what replacement resources would be needed to replace all of the power attributes of the four lower Snake River dams if they were breached. The analysis does not include an assessment of the costs associated with transmission infrastructure or transmission access that would be necessary to accommodate replacement resources.

- b. Where is the funding authorized for this study?**

Funding for this analysis is within Bonneville's statutory authorities for electric power resource and transmission planning.

- c. A recent study conducted by the Pacific Northwest National Laboratory and others outlined the necessity for hydropower on the Columbia-Snake Rivers for grid resilience throughout the western United States. BPA also put out a press release in July 2021 crediting the lower Snake River dams with keeping eastern Washington powered during the 2021 record heatwave. How is grid reliability and resilience being included in the analysis?**

Grid reliability and resilience is an expertise of E3. That is a main focus of the study. The study will evaluate the value of hydropower for power reliability for the Northwest and the western region.

- d. How is BPA valuing the carbon-free energy generated by the lower Snake River dams within this study, in light of President Biden's climate agenda and Executive Order 13990?**

The CRSO EIS described the carbon-free value of generation from the Federal Columbia and Snake River dams. Although the analysis of the impact of alternatives predates Executive Order 13990, it remains the best available information.

- e. What information is this study expected to uncover that was not made available from the BiOp or ROD?**

Since the completion of those documents in 2020, there is additional information about coal generation retirements in the West. States, including Washington and Oregon, have passed additional mandates and established goals that affect electric power resource planning.

- 2. How has BPA weighed the importance of the baseload power generation hydropower on the lower Snake River provides in its engagement with CEQ on a solution for threatened and endangered species in the Columbia River Basin?**

As referenced by CEQ in their June 9, 2022 letter to you and your colleagues, CEQ has reached out to agencies and departments to exchange information, including Bonneville. Bonneville has briefed CEQ on the value of power generation from the lower Snake River dams consistent with how that was described in the CRSO EIS.

- 3. Has BPA conducted a study on the impacts to regional grid reliability and ratepayers, in the case of potential loss of renewable hydropower capacity on the lower Snake River? If so, please provide that study to us.**

The CRSO EIS contains the most recent and extensive assessment of the impacts to power system and transmission reliability from alternative operations of the Columbia River System, including the alternative that analyzed breach of the lower Snake River dams. The EIS also included an analysis of the impact on ratepayers.

4. How has BPA focused on Executive Order 13990 and President Biden's 2030 greenhouse gas goals during its involvement with the CEQ stakeholder engagement process?

Bonneville has briefed CEQ on the Columbia River System's carbon-free attributes, consistent with the analysis of carbon emission impacts in the CRSO EIS, which remains the best available information. While the CRSO EIS was completed prior to the Executive Order and the President's statement of climate goals, the analysis is responsive to the Administration's directives.

5. Does removing 3,000 megawatts of hydropower capacity on the lower Snake River support President Biden's 2030 greenhouse gas reduction targets?

Bonneville cannot offer a statement of Administration policy to respond to this question. The CRSO EIS evaluated an alternative that included breaching the lower Snake River dams. The analysis found that GHG emissions would increase even if the lost hydropower were replaced with carbon-free renewables because the region would likely rely more on fossil fuel-based resources, such as coal and natural gas, to balance renewable generation. Further, any new carbon-free renewable resources that replace the power contributions of the lower Snake River Dams would need to be in addition to new carbon-free generation built to replace existing fossil-fuel generation and for increasing electrification.

Thank you for the opportunity to respond to your questions. If I can provide additional information, please contact me directly or Sonya Baskerville, Bonneville's Manager for National Relations, at 202-596-5640.

(b)(6)

John Hairston
Administrator and Chief Executive Officer

cc: The Honorable James E. Risch, U.S. Senator
The Honorable Mike Crapo, U.S. Senator
The Honorable Steve Daines, U.S. Senator
The Honorable Cathy McMorris Rodgers, U.S. Representative
The Honorable Russ Fulcher, U.S. Representative
The Honorable Jaime Herrera Beutler, U.S. Representative
The Honorable Cliff Bentz, U.S. Representative



Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

June 24, 2022

In reply refer to: AI-7

The Honorable Cathy McMorris Rodgers
United States House of Representatives
Washington, D.C. 20515

Dear Representative McMorris Rodgers:

I am responding to the inquiry from you and your colleagues in the Northwest Congressional Delegation concerning the Bonneville Power Administration's role in the discussions by the Council on Environmental Quality (CEQ) on salmon and steelhead restoration in the Columbia River Basin. You and your colleagues also asked Bonneville to provide more information about analysis Bonneville is sponsoring concerning the four Federal lower Snake River dams.

I will address the questions in your letter in turn:

- 1. Has BPA engaged in a study or contracted with a consultant to study any aspect of the four dams on the lower Snake River? If so:**
 - a. What is being studied and what is the purpose of the study?**

Bonneville has engaged Energy + Environmental Economics (E3) to examine certain questions related to the effects to power and transmission from breaching the four lower Snake River dams. Bonneville will use this information to help inform its participation with the Administration as it continues engaging with regional entities related to the Columbia River System.

Bonneville will use the analysis to compare against the hydropower modeling completed as part of the Columbia River System Environmental Impact Statement (CRSO EIS) and take into account E3's experience with replacement resource portfolio optimizers. The analysis will entail examining what replacement resources would be needed to replace all of the power attributes of the four lower Snake River dams if they were breached. The analysis does not include an assessment of the costs associated with transmission infrastructure or transmission access that would be necessary to accommodate replacement resources.

- b. Where is the funding authorized for this study?**

Funding for this analysis is within Bonneville's statutory authorities for electric power resource and transmission planning.

- c. A recent study conducted by the Pacific Northwest National Laboratory and others outlined the necessity for hydropower on the Columbia-Snake Rivers for grid resilience throughout the western United States. BPA also put out a press release in July 2021 crediting the lower Snake River dams with keeping eastern Washington powered during the 2021 record heatwave. How is grid reliability and resilience being included in the analysis?**

Grid reliability and resilience is an expertise of E3. That is a main focus of the study. The study will evaluate the value of hydropower for power reliability for the Northwest and the western region.

- d. How is BPA valuing the carbon-free energy generated by the lower Snake River dams within this study, in light of President Biden's climate agenda and Executive Order 13990?**

The CRSO EIS described the carbon-free value of generation from the Federal Columbia and Snake River dams. Although the analysis of the impact of alternatives predates Executive Order 13990, it remains the best available information.

- e. What information is this study expected to uncover that was not made available from the BiOp or ROD?**

Since the completion of those documents in 2020, there is additional information about coal generation retirements in the West. States, including Washington and Oregon, have passed additional mandates and established goals that affect electric power resource planning.

- 2. How has BPA weighed the importance of the baseload power generation hydropower on the lower Snake River provides in its engagement with CEQ on a solution for threatened and endangered species in the Columbia River Basin?**

As referenced by CEQ in their June 9, 2022 letter to you and your colleagues, CEQ has reached out to agencies and departments to exchange information, including Bonneville. Bonneville has briefed CEQ on the value of power generation from the lower Snake River dams consistent with how that was described in the CRSO EIS.

- 3. Has BPA conducted a study on the impacts to regional grid reliability and ratepayers, in the case of potential loss of renewable hydropower capacity on the lower Snake River? If so, please provide that study to us.**

The CRSO EIS contains the most recent and extensive assessment of the impacts to power system and transmission reliability from alternative operations of the Columbia River System, including the alternative that analyzed breach of the lower Snake River dams. The EIS also included an analysis of the impact on ratepayers.

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Thank you for the opportunity to respond to your questions. If I can provide additional information, please contact me directly or Sonya Baskerville, Bonneville's Manager for National Relations, at 202-596-5640.

Sincerely,

(b)(6)

John Hairston
Administrator and Chief Executive Officer

cc: The Honorable James E. Risch, U.S. Senator
The Honorable Mike Crapo, U.S. Senator
The Honorable Steve Daines, U.S. Senator
The Honorable Dan Newhouse, U.S. Representative
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Department of Energy

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P.O. Box 3621
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Administrator and Chief Executive Officer

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Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

June 24, 2022

In reply refer to: AI-7

The Honorable Russ Fulcher
United States House of Representatives
Washington, D.C. 20515

Dear Representative Fulcher:

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Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

June 24, 2022

In reply refer to: AI-7

The Honorable James E. Risch
United States Senate
Washington, D.C. 20510

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Department of Energy

Bonneville Power Administration
P.O. Box 3621
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June 24, 2022

In reply refer to: AI-7

The Honorable Steve Daines
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Department of Energy

Bonneville Power Administration
P.O. Box 3621
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June 24, 2022

In reply refer to: AI-7

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June 24, 2022

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From: James,Eve A L (BPA) - PG-5
Sent: Wednesday, June 1, 2022 11:01 AM
To: Diffely,Robert J (BPA) - PGPL-5
Cc: Koehler,Birgit G (BPA) - PG-5
Subject: Slide for E3 study results responding to NWECC study
Attachments: Comparison to NWECC study.pptx; 2022-05-LSR-Dam-Replacement-Study-Full-Deck-Final-to-Client-220518.pdf

Hi Rob-

Birgit, Katie, and I are working on some BPA perspective on the E3 study slides. We'll share those to get your feedback when they are a little further along. Would you be able to help me craft a slide responding to the NWECC study that just came out? Birgit sent screen shots along at one point to get some initial thoughts. We want to have some high level comments for non-technical folks- I've attached a slide to start from and the NWECC study deck. Please let me know if you have comments/edits or if there are other crucial points we should be making (we can add another slide if needed).

Thanks,
Eve

Comparison to NWECC study

- The Northwest Energy Coalition study incorrectly describes the capacity of the four lower Snake River dams as 1,000 MW, when in fact, the nameplate capacity is 3,483MW and sustained capacity is over 2,000 MW.
 - The region regularly calls upon more than 2,000 MW of sustained peaking capabilities, to **avoid power shortages** during the winter and has provided peak generation between 2,500 and 3,000 MW during late-winter/early-spring in the majority of the last 20 years
- Baseline for the NWECC study assumes that 300 MW of market purchases to provide firm power.
 - While BPA sometimes purchases power to serve its customers, during times of high demand (winter cold snaps or summer heat events) there often is not enough power on the market, and other utilities may be declaring energy shortage emergencies.
- The NWECC study understates the benefits that the four lower Snake River dams provide in terms of grid stability – ancillary services such as generation reserves required to keep the lights on.
 - In addition to providing sustained peaking capacity the lower Snake River dams provide generation reserves that can provide additional generation on short notice for grid stability and to integrate other intermittent resources such as wind and solar.

Deliberative: FOIA Exempt

From: James,Eve A L (BPA) - PG-5
Sent: Wednesday, June 1, 2022 1:27 PM
To: Leary,Jill C (BPA) - LN-7
Cc: Koehler,Birgit G (BPA) - PG-5; Pruder Scruggs,Kathryn M (BPA) - E-4
Subject: UNTITLED.pptx
Attachments: UNTITLED.pptx

Deliberative, FOIA exempt

Hi Jill-

Attached is a draft slide we were putting together for BPA perspective on the E3 study. The first slide is to make the point that this information does not change what we would have selected in the CRSO EIS. Please let us know if there is any troublesome wording we need to fix.

Thanks,
Eve

Would conclusions in the E3 study change the decision for the Columbia River System Environmental Impact Statement ?

- **No.** In fact, the E3 study **confirms** the decision.
- The E3 study provides an updated picture of the energy landscape:
 - **Policy decisions** and legislation in the region are having a real effect on the amount of resources available to provide firm capacity to avoid power shortages. Specifically, fossil-fuel based resources, such as coal plants, are being removed now.
 - Compounding the situation from removing fossil fuel resources, decarbonizing the region will result in **increased electricity use** in other sectors such as transportation (electric vehicles) and heating/cooling buildings (changing from gas to electric).
 - The E3 study also considers the **availability of emerging technology** in future scenarios. Even considering emerging technology such as small modular nuclear reactors, the region would face power shortages if the four lower Snake River dams are breached, given the path towards deep carbonization of the energy sector.

From: Johnson,G Douglas (BPA) - DK-7
Sent: Thursday, June 30, 2022 8:11 AM
To: Cook,Joel D (BPA) - K-7; Baskerville,Sonya L (BPA) - AIN-WASH; Zelinsky,Benjamin D (BPA) - E-4; Cooper,Suzanne B (BPA) - P-6; Chong Tim,Marcus H (BPA) - L-7
Cc: Scruggs,Joel L (BPA) - DK-7; Habibi,Maryam A (BPA) - DKP-7; James,Eve A L (BPA) - PG-5; Koehler,Birgit G (BPA) - PG-5; Goodwin,Summer G (BPA) - DKS-7
Subject: UPDATE: Draft talking points E3 LSRD replacement analysis
Attachments: E3 LSRD replacement cost analysis TPs v4 revised discount rate.docx

There is an additional Q&A in this version and a modification to the charts showing the costs of replacement, etc. The changes address the discount used. E3 originally used a 5% discount rate, which is more commonly associated with IOU estimates. E3 is now using 3%, which is more in line with the Murray/Inslee analysis and BPA's own 2.81% Weighted Average Capital Costs. Please let me know if you have edits/comments. Thanks.

From: Johnson,G Douglas (BPA) - DK-7
Sent: Tuesday, June 28, 2022 10:27 AM
To: Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>; Chong Tim,Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>
Cc: Scruggs,Joel L (BPA) - DK-7 <jlscruggs@bpa.gov>; Habibi,Maryam A (BPA) - DKP-7 <maasgharian@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Goodwin,Summer G (BPA) - DKS-7 <sggoodwin@bpa.gov>
Subject: REVIEW REQUESTED: Draft talking points E3 LSRD replacement analysis

I have attached the current version of our draft talking points we intend to provide to AEs and other BPA external communicators next week ahead of our briefing for the Northwest Power and Conservation Council. These have been reviewed by Communications and Eve James and Birgit Koehler. I am also attached our proposed outreach plan so you are familiar with the sequence of events we propose for release.

Please provide edits and comments by noon, Thursday, June 30. Ideally, we will have these finalized by COB, Friday, July 1 and can provide the talking points and the presentation E3 will use to brief the Council to our external communicators via Communications email the day before the Council briefing. We are meeting today with Eve and Birgit to discuss the outreach plan. If anyone would like to participate, please let me know and I'll forward you the invite.

Please let me know if you have questions or need more information about the talking points or outreach plan. Thanks!

FOR INTERNAL USE ONLY

BPA talking points

E3 lower Snake River dam replacement costs analysis

June 2022

What this is

Earlier this year, BPA contracted with electric industry research firm Energy and Environmental Economics, also known as E3, to conduct an independent analysis of the electricity system value of the four lower Snake River (LSR) dams. This new analysis builds on the analysis performed in the Columbia River System Operations Environmental Impact Statement regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future. BPA anticipates E3's study to contribute to the regional dialogue about the future of these publicly-owned assets and help elevate regional understanding of the complexities and expenses involved in exploring replacement resources for the LSR dams.

Key messages and storyline

- As states move forward with clean energy policies, fossil-fuel generated power is being removed from the grid. Reducing hydropower would require the region to build new generation just to get the system back to its current state. Until all fossil-fuel power plants are retired, reducing hydropower means more CO2 emissions in the region, which is a step backward from the region's carbon reduction goals. Some of the lower-cost options for replacing lost hydropower rely on emerging technologies that are not yet developed or available at large-scale.
- Replacing the dams' hydropower energy and capacity services with existing renewable technology and no technological breakthroughs is projected to create 65% upward rate pressure. This is much higher than the other scenarios evaluated- prohibitively expensive.
- The E3 study evaluates what is required to maintain current reliability standards. Assuming different risk levels for reliability, as is done in other studies of LSN dam power replacement, is a policy decision outside the scope of this analysis.
- New resources to replace the existing lower Snake River dams' energy and capacity would cost between \$8.7 to 15.1 billion with at least one emerging technology and up to \$61 billion absent breakthroughs in not-yet-commercialized emerging technologies. If these costs are not paid for by an outside source, it would result in higher electric bills for millions of Northwest residents.
- The replacement of the dams' hydropower could take up to approximately 20 years to complete after Congressional approval assuming Transmission builds were needed but there was not litigation or other major delay on siting.

Background

With multiple reviews of the future of the lower Snake River dams being conducted by the Council on Environmental Quality, the Columbia Basin Collaborative and Senator Patty Murray (D-WA) and Washington Governor Jay Inslee, BPA felt it necessary to update the potential costs of replacing the energy services from these facilities.

The CRSO EIS analysis examined a series of resource replacement portfolios using the Northwest Power and Conservation Council's latest forecasts and updated Energy Commodities resource cost estimates to reflect reasonable replacement resource alternatives and associated costs. E3 used a resource portfolio optimizer model with their data sets and their criteria and objectives to create least-cost replacement portfolios.

E3's independent analysis includes several scenarios for replacement resources, including some with emerging technologies such as small modular nuclear reactors (SMRs) and gas plants with carbon capture or hydrogen burning capability that are not available yet. It also includes use of traditional renewable resources, such as wind, solar, storage and demand response. All of the scenarios present moderate to significant upward rate pressure for BPA's customers if not paid for by an outside source.

For more information, contact: Eve James, 503-230-5558 or Birgit Koehler, 503-230-4249

Questions and answers

1. What was the scope of the study and what questions did it address?

BPA contracted with E3 to answer what resources (one or more portfolios of resources) would be needed to maintain reliability, which is close to replacing the energy and other grid services provided by the lower Snake River dams. This includes modeling regional grid scenarios with and without the dams. The model is designed to identify one or more replacement resource portfolio(s) and provide a comparison of the forecasted costs associated with each scenario. The analysis also discusses the timeline under which a build-out of replacement resources could occur.

E3's key study questions are:

- What additional resources would be needed to replace the power services provided by the LSR Dams through 2045?
- What is the net cost to BPA ratepayers?
- How do costs and resource needs change under different types of clean energy futures?
- How much does replacing the dams rely on emerging, not-yet commercialized technologies?

2. What power benefits do the four LSRDs currently provide?

These facilities first and foremost provide reliable electricity to help the western interconnection and the Pacific Northwest avoid blackouts. They also provide carbon-free energy. More specifically, they are capable of providing a short-term peaking capacity of more than 3,000 MWs. They can provide more than 2,000 MW of longer term peaking capacity during cold snaps when Pacific Northwest electricity use is at its highest as well as provide important reserves and essential grid reliability services, including voltage support, reactive power and black start ability.

3. What resources does the study recommend to replace the output of the lower Snake River dams?

The study recommends a combination of renewable generation (wind and solar) and “clean firm” resources (such as dual fuel natural gas + hydrogen plants, advanced small modular nuclear reactors (SMR), or gas with carbon capture and storage), and energy efficiency.

4. What are the replacement resource scenarios E3 evaluated?

Scenario	Replacement Resources Selected, Cumulative by 2045 (GW*)
<p>Scenario 1: 100% Clean Retail Sales</p>	<p>+ 2.1 GW dual fuel NG/H2 CCGT + 0.5 GW wind</p>
<p>Scenario 2a: Deep Decarb. (Baseline Technologies)</p>	<p>+ 2.0 GW dual fuel NG/H2 CCGT + 0.3 GW li-ion battery + 0.4 GW wind + 0.05 GW advanced energy efficiency + additional H2 generation**</p>
<p>Scenario 2b: Deep Decarb. (Emerging Technologies)</p>	<p>+ 1.5 GW dual fuel NG/H2 CCGT + 0.7 GW nuclear SMR</p>

Scenario 2c: Deep Decarb.
(No New Combustion)

+ 10.6 GW wind
+ 1.4 GW solar

- In scenarios that assume new combustion generation may be permitted in the Northwest, firm capacity is mostly replaced with ~2 GW of dual fuel natural gas + hydrogen turbines. These turbines may initially burn natural gas when needed during reliability challenged periods, but would transition to green hydrogen by 2045 to reach zero-emissions.
- If advanced nuclear is available, it is selected in lieu of renewables and some of the gas plants.
- The “no new combustion” scenario with decarbonization of the broader economy (e.g. electric vehicles and electric heating) requires an impractically large (12 GW) buildout of renewable energy to replace the dams’ firm capacity contributions and GHG-free energy. This is required because the wind and solar power are not as reliable for serving load as would be firm combustion generation, and thus large quantities are needed to ensure that some generation may be available during the critical periods like winter cold spells.

5. What does each option cost?

	Total Costs (real 2022 \$)	Annual Cost Increase (real 2022 \$)			Incremental Public Power Costs [% increase vs. ~8.5 cents/kWh NW average retail rates]
	Net Present Value in year of breaching	2023	2025	2045	2045
Scenario 1: 100% Clean Retail Sales	\$9.7 billion		\$434 million	\$478 million	0.8 cents/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$11.7 billion	\$495 million	\$466 million	\$509 million	0.8 cents/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$15.1 billion		\$496 million	\$860 million	1.5 cents/kWh [+18%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$8.7 billion		\$415 million	\$428 million	0.7 cents/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$61 billion	n/a	\$1,953 million	\$3,199 million	5.5 cents/kWh [+65%]

•Cost increases account for replacement energy, capacity, and reserves as well as avoided LSR capital + expense, but do not include any costs for breaching the dams, which would be an additional cost.

•NPV and annual cost increase are shown for the Northwest Region as a whole, but the incremental costs are calculated relative to the BPA Tier I annual sales for public power customers.

•% increase versus average retail rates assumes ~8.5 cents/kWh retail rates (estimated from OR and WA average retail rates). This does not account for any other rate increases that will be driven by higher loads or clean energy needs that increase regional rates.

•Annual residential customer cost impact assumes 1,280 kWh/month for average residential customers in Oregon and Washington (current ~1,000 kWh/month average + 28% from electrification load growth).

•New federal tax credits for hydrogen plants/fuels or ITC/PTC extension for renewables would provide a cost reduction to public power customers from taxpayers



E3 2022 study results: these are not the total costs to the Northwest of decarbonizing the electricity grid or its economy; these costs reflect the incremental costs of removing the four lower Snake River dams in each of those scenarios.

6. How do the replacement costs compare to the current costs of the lower Snake River dams?

The lower Snake River dams cost between \$13 and \$17/MWh to operate and maintain. Replacement resources, depending on those chosen, are projected to cost between \$77 and \$139/MWh. Replacement costs rise to more than \$500 MWh in the deep economy-wide decarbonization scenario that includes only existing technologies (wind, solar, etc.) and no emerging technology, such as hydrogen and small modular nuclear.

7. What is the projected rate impact to BPA customers?

In scenarios 1, 2a and 2b, the rate impact would be between 8% and 18% or ~\$100 to \$230 per year. In a deep economy-wide decarbonization scenario (2c) with no emerging technologies, the cost would be approximately a 65% increase or \$850 per year per household.

Note: Scenario 2c required increases in the supply of wind on new transmission (Northwest, Montana, Wyoming, and off-shore wind) to enable a feasible solution which drives the costs impractically high.

8. What is the timeline necessary to add the resources that would be required?

E3 estimates that adding additional renewable energy and firm capacity additions would take approximately five to seven years after Congressional approval to breach the dams and possibly up to 10 to 20 years assuming additional new large-scale transmission was required but there was not litigation or other major delay on siting.

From: Koehler,Birgit G (BPA) - PG-5
Sent: Wednesday, May 25, 2022 4:14 PM
To: James,Eve A L (BPA) - PG-5; Pruder Scruggs,Kathryn M (BPA) - E-4
Subject: lay-person ppt
Attachments: LayPersonPPT 5 25 mid-afternoon.pptx

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Wednesday, May 25, 2022 12:02 PM
To: Pruder Scruggs,Kathryn M (BPA) - E-4 <kpruder@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: LayPersonPPT 5 25noon.pptx

From: Koehler,Birgit G (BPA) - PG-5
Sent: Wednesday, July 6, 2022 2:08 PM
To: Arne Olson
Cc: James,Eve A L (BPA) - PG-5; Aaron Burdick
Subject: questions about what studies could be done

Deliberative, FOIA exempt

Hello Arne,

I'm getting some interesting questions, including one to pass on to you.

Could RESOLVE model only one LSN dam breached? I have a guess as to what you might say, but better to get the answer from you.

And a follow-up question, could you model the four dams coming offline in a staggered fashion?

Thanks,
Birgit

Title slide

What it would take to replace the output of breachi

are exaggerating by only putting out the nameplate. Others are saying 1,000 -- we need to put our sustained capacity number up front to counter that narrative accurately.

ams

- What are we losing?
 - 3,483 MW of nameplate capacity, including more than 2,000 MW of peaking capability to avoid power shortages during cold weather events
- How much would it cost to replace benefits of the four lower Snake River dams?
 - Upfront costs: \$XXX (with today's carbon policy)
 - Total cost per year after that: \$XXX
 - These costs could quadruple with aggressive carbon reduction policies and absent breakthroughs in commercial-scale technology
- What are the rate impacts to public power customers?
 - Public power costs increase by 9% or \$100 per year (with today's carbon policy)
 - Public power costs increase by 65% or \$850 per year (with aggressive carbon reduction policies and absent breakthroughs in commercial-scale technology)
- How long would it take to replace the services from breaching the four lower Snake River dams?
 - It would take up to a decade or more to bring new resources on-line once a decision to breach the dams has been reached.

Plant	Nameplate Capacity (MW)*
Lower Granite	930
Little Goose	930
Lower Monumental	930
	693
	Total = 3,483

E3 please fill in these numbers, first number is construction, second is O&M and fuel? Use S1

E3, are these numbers right? The second set is about 7 times the % but 8.5 times the \$. Is it a rounding issue? We copied from your slide deck

Does E3 have anything more definitive on timeline, including transmission?

What services need to be replaced if the four lower Snake River dams are breached?

- What are the services we need to replace, *and* what is the cost of each?

- Energy
- Instantaneous and sustained capacity
- Reserve carrying capacity
- Fast ramping

These costs are included in model results \$/MWhXXS from previous slide.

- Transmission grid reliability services:

- Voltage and reactive power: XXX MW for XXXX
- Frequency and inertial response: XXX MW for XXXX
- Blackstart capability: XXX MW for XXXX
- Short Circuit and Grounding Contribution: XXX MW for XXXX
- Voltage and Frequency Excursion Ride-Through: XXX MW for XXXX
- Participation in Remedial Action Schemes: XXX MW for XXXX

Does E3 have cost estimates for these?

DOE said these are small costs compared to power services, and some are provided by the replacement resources. If we can't quantify them, we omit the costs and the bracket. But we should still list the services. Then we could also remove all mention of costs in the upper section of this slide since that was on the previous slide, i.e. remove the green text

Resource	Capacity
Lower Granite	930
Little Goose	930
Lower Monumental	930
Ice Harbor	693

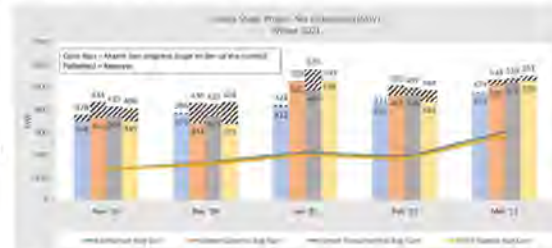
Total = 3,483

(U:\Bentley\proj\2010\01\7\01A\eswmpj)

3

Lower Snake River Dams' Capabilities

- Lower Snake River Dams are ~10% of the Northwest hydro capacity and provide **low cost**, reliable, **carbon-free energy**, and high flexibility
- Provide **more than 2,000 MW** of sustained peaking capabilities during the winter, as shown in the bar graph to the right
- Provide a quarter of Bonneville's current reserves holding capability which is **important for integrating variable generating resources** such as wind and solar.
- Also provide **essential transmission reliability** services such as voltage, reactive power, inertia, black start, etc...



The solid bars show what was generated in winter 2020-2021, and the patterned bars shows additional available capacity. As the graph shows, it's not atypical to call on more than 2,000 MW of peaking capacity in the winter to avoid a power shortage, even sometimes more than 2,200 MW. https://www.pse.com/~/media/Power_Solutions/Information/2021/08/18/2021%20Winter%20Power%20Supply%20Shortage%20Mitigation%20Plan.pdf

About the E3 study

- E3 conducted an independent analysis of replacing the power output from the four lower Snake River dams in the context of Pacific Northwest resource requirements.
- BPA contracted E3 to conduct the study, which includes independent analysis about the value of the four lower Snake River dams to the Northwest energy system, including the **cost** and **resource requirements** for replacement.
- This study takes a regional view of electricity supplies and uses E3's RESOLVE electricity planning model to optimize electricity resource requirements for the Northwest through 2045.



What's new in this study compared to CRSO EIS

Updated resource pricing and included emerging technology. The study uses an optimizer to determine the least-cost replacement resources for the four lower Snake River dams subject to **policy** and **reliability** constraints.

- **Policy example:** E3's modelling considers the effects of regional policy decisions and legislation to reduce carbon emissions
 - Includes aggressive clean energy laws which remove fossil fuel-based power resources from the grid all along the west coast (such as retiring coal plants)
 - Compounding the situation from removing fossil fuel resources, decarbonizing the region will result in increased electricity use in transportation and building heating/cooling
- **Reliability example:** The E3 modelling considers multiple variables – not just cost. For example, the modelling considers how much capacity a resource actually has, and then prioritizes it based on its ability to provide reliable electricity when needed.
 - During extended cold-weather periods the wind isn't always blowing and the sun goes down at night
 - Even if those resources are the cheapest, the optimizer doesn't choose them because the capacity is not always available to provide power when needed

Deliberative, pre-decisional, FOIA exempt

6

Transition slide. Does not need to say much

E3's modeling (called RESOLVE) occurred in two steps.

The first step looked at the energy landscape of the Northwest to provide critical context for the study of lower Snake River dam breaching.

Energy Policy Landscape: policy decisions in the region require reducing carbon emissions







Policy Landscape: Washington, Oregon, California

	RPS or Clean Energy Standard?	Coal Prohibition?	Cap-and-Trade?	New Gas?	Economy-Wide Carbon Reduction?
WA	✓ Carbon neutral by 2030, 100% carbon free electricity by 2045	✓ Eliminate by 2025	✓ Cap-and-invest program established in 2021, SCC in utility planning	✗ E3, when you say "gas" it is not clear if you mean natural gas or any gas including hydrogen. Best to always be clear.	✓ GHG emission reduction below 1990 levels and achieve net-zero emissions by 2050
OR	✓ 80% RPS by 2040, 100% GHG emission reduction by 2040, relative to 2010 levels	✓ Eliminate by 2030	✓ Climate Protection Plan adopted by DEQ in 2021 (power sector not included)	✗ HB 2021 bans expansion or construction of power plants that burn fossil fuels	✓ 80% GHG emission reduction from fossil fuel usage relative to 2022 baseline
CA	✓ 80% RPS by 2030, 100% clean energy by 2045	✓ Coal-fired electricity generation already phased out	✓	✗ CPUC IRP did not allow in recent procurement order	✓ 40% GHG emission reduction below 1990 levels by 2030 and 80% by 2050

Added from technical presentation since thought it added valuable context

Deliberative, predecisional, FDM, exempt

Key Modeling Assumptions of E3 Study

Element	Study Approach	Impact on Dams Replacement Needs
 Study Years	<ul style="list-style-type: none"> 2025 through 2045, including fuel price forecasts and declining renewable + storage costs 	Considers long-term needs
 Clean Energy Policy Scenarios	<ul style="list-style-type: none"> Aggressive OR+WA legislation reflected, including coal retirements + carbon pricing Two electric emissions scenarios considered: <ol style="list-style-type: none"> 100% clean retail sales (~85% carbon reduction*) Zero-emissions (100% carbon reduction) 	Clean energy policy requires long-term replacement of LSR dams with GHG-free energy
 Load Growth Scenarios	<ul style="list-style-type: none"> Two load scenarios: <ol style="list-style-type: none"> Baseline (per NWPPC 8th Power Plan) High electrification load growth (to support economy-wide decarbonization) 	Higher load scenarios increase the value of LSR dams energy + firm capacity
 Reliability Needs <small>DCM-E39 EAJ1</small>	<ul style="list-style-type: none"> Modeling ensures reliability needs during extreme conditions (e.g. high loads + low hydro) Captures ability (and limits) of renewables, battery storage, and demand response to support system reliability 	Reliability needs require replacement of LSR dams firm capacity contributions
 Consideration of Emerging Technologies	<ul style="list-style-type: none"> Broad range of dam replacement technology options considered: <ul style="list-style-type: none"> Baseline technologies: solar, wind, battery + pumped storage, energy efficiency, demand response, dual fuel natural gas + hydrogen combustion plants Sensitivities: <ul style="list-style-type: none"> Emerging technologies No New Combustion 	Technology available for LSR dams replacement determines cost + feasibility
 Distributed Energy Resource Options	<ul style="list-style-type: none"> Energy efficiency, demand response, and customer solar embedded into modeling inputs Additional energy efficiency and demand response can be selected 	Demand resource can help replace LSR dams, though low-cost supply is limited

* A 100% clean retail sales target allows emitters for electric generation beyond that needed to serve "retail sales", i.e. losses during transmission to retail loads and exported energy

Deliberative, pre-decisional, FOM, exempt

Scenarios in E3 Study

The study uses these two scenarios to represent bookends of how electricity use will change in the region to achieve carbon reduction goals

- Scenario 1: 100% Clean Retail Sales

- E3 how would you describe this to your next door neighbor? (we at BPA aren't even quite clear what is included)
- Business-as-usual load growth
- Can be achieved using existing mature technologies

Scott, CEQ will be tuned in to "decarbonization" as it is a big issue for the Biden administration

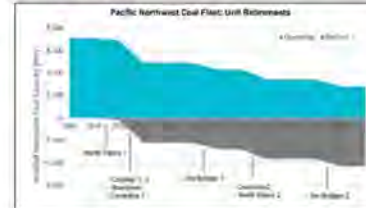
- Scenario 2: Deep Decarbonization and Electrification

- Zero carbon emissions remain in 2045
- Electricity use increases to replace carbon emissions from other sectors of the economy such as transportation (e.g. electric cars replacing gas-power cars)
- Emerging technologies are key to meeting higher winter reliability needs with carbon-free power (three variations represented by 2a, 2b, and 2c)

Key points for understanding the regional analysis (without breaching the four lower Snake River dams)

- Regional policy requirements and legislation to reduce emissions are removing resources fossil fuel resources from the grid. This is happening now, even without breaching the four lower Snake River dams.
- Consequently, with retiring coal and gas plants, the region is **already** facing resource adequacy issues.

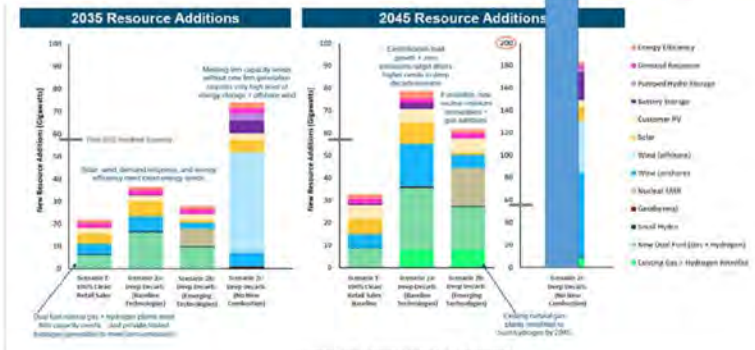
Blue area above the line shows coal plant nameplate capacity in the Pacific Northwest. The gray area below the line shows planned retirements as of 2021. Carbon policy changes and utility IRP decisions may accelerate or slow these retirements.



From Council's power plan (BPA power plan, i.e. 2021 plan)

The graph shows the concepts from the previous slide: Without breaching the lower Snake River Dams, all scenarios show large levels of new resource additions for the region due to fossil-fuel plant retirements and increased electric demand

E3, please make this to scale. People won't notice the small circle on the scale. It looks effective if this one bar shoves the text out of the way to stick up high



LOWERING THE PROBABILITIES OF A MAJOR DISASTER

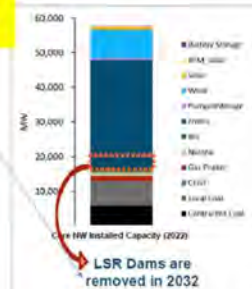
12

After the first modeling step, which showed the regional energy landscape, the second step in modeling analyzes breaching the lower Snake River dams

Transition slide:
Also note, throughout presentation, please use "breach" instead of "remove" when referring to the dams. Critical distinction is that we are not removing the whole dams.



The left box above shows the second step in the modeling. The difference between the first and second steps shows how many more new resources would the region need, and at what cost if the lower Snake River dams were breached?



(a sensitivity considered 2024 removal)
This graph shows the reduction in regional resources to reflect the loss of generation from the lower Snake River dams.

Cost of Generation of Replacement Resources for the Lower Snake River Dams (using utilities' metric of \$/MWh)

- Even in the best case scenario, replacement power would cost several times as much as the current cost of generation from the lower Snake River dams.
- Replacement resources for the four lower Snake River dams range in costs from \$77/MWh to over \$500/MWh, depending on carbon-reduction policies and the availability of emerging technology.

Incremental LSR Dam Replacement Resource	
	Lower Snake River Dam as an Generation Costs in 2022 Dollars
	\$13/MWh w/o LSRD ¹
	\$17/MWh w/ LSRD ²
2043 Costs to replace LSR Generation ³ (w/ 2022 \$/MWh)	
Scenario	Cost (\$/MWh)
E0: No Policy Reference	287/MWh
E1: 100% Clean Retail Sales	275/MWh
E1a: 100% Clean Retail Sales (no carbon price)	176/MWh
E1b: 100% Clean Retail Sales (2024 clean revenue)	162/MWh
E2: Deep Decarb	319/MWh
E2b: Deep Decarb, w/ Emerging Tech	500/MWh
E3a: Deep Decarb: Limited Tech (no new construction)	317/MWh
E3b: Deep Decarb: Limited Tech (no new gas, w/ allowed)	260/MWh

1. Based on the current generation mix of the lower Snake River dams. 2. Based on the current generation mix of the lower Snake River dams, including the incremental cost of the lower Snake River dams. 3. Based on the current generation mix of the lower Snake River dams, including the incremental cost of the lower Snake River dams, and the cost of the incremental generation resources needed to replace the lower Snake River dams. All costs are in 2022 dollars. All costs are in 2022 dollars. All costs are in 2022 dollars.

This slide is cost/MWh that DOE will relate to. Also it matches well with NGO studies that claim it is cheap to buy power, citing cost/MWh

E3 please take out scenarios not used in public deck for this table

Land use considerations – large footprint for replacement resources

- Replacing the lost power with new resources would require roughly ___ acres (about ___ square miles) of land.
- Such a large build-out of capacity would likely result in additional, but currently unknown impacts to natural and cultural resources, which may include vegetation, wildlife habitat, archeological resources, and traditional cultural properties (such as sites or land features that are important to tribes).
- Impacts from mining minerals for new technology may also impact availability of new resources



Et, can you produce this map? BPA is not producing it.

We would like to see a map of (land-use) footprint needed for replacement resources, overlaid. Maybe Seattle map? Or LSN dam area?

Table to the right is not meant for display but instead for generating the map.

Seattle is 142.55 square miles for reference (not sure if metro area)

Potentially use different boxes to show how much of Seattle gets covered for the different scenarios? Might take some experimenting.

Sample map at the right is one that our experts used as an example

Year	2100	1800	2200	2000	2500	3500 (H2)
Reliability Measure						
Gas (MW)						
DR (MW)						
Solar (MW)		500			1500	1600
Batteries (MW)		100	100	200	6000	300
Wind (MW)	200	1300		600	9400	600
Offshore Wind (MW)						13000
Pumped Storage (MW)					300	
Conservation (MW)					10	10
SMR (MW)						600
Wind (Sq Miles)	7.8	50.8	0.0	23.4	867.2	0.0
Offshore Wind (Sq Miles)						1204.4
Solar (Sq Miles)		-1.3	0.0	0.0	4.0	4.3

Conclusion and summary

- The study considers two important factors in replacing power from the four lower Snake River dams:
 - Power must **provide firm capacity** (reliable energy that is available at all times) to avoid power shortages
 - Power must be **free of greenhouse gases** to meet regional carbon policies
- Policies and laws to decarbonize the region will **increase electricity use** (electric cars, replacing gas appliances, etc.)
- Acquiring replacement resources could require **building new renewable resources at an unprecedented rate**.
 - This would also require building transmission to bring the power from new resources to utilities (E3 one of your slides had current resource build rate for NW- maybe add that here?)
- Replacing the dams comes at a **substantial cost** for new resource replacement
 - This would have a meaningful impact on the rates of Bonneville Power Administration's public power customers.
- The **availability of emerging technology** is a factor in achieving replacement resources that are free of greenhouse gases and the pace of development is highly uncertain.
- Loss of generation from the four lower Snake River dams, or reductions in their flexibility, while there are still fossil fuel generators on the grid will increase the timeframe and costs associated with shifting to a carbon-free electricity sector.

E3. We would like that last sentence to stand out.

Scott, this last bullet is important for our target audience.

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Appendix

- or slides we might save for a public presentation that can be more technical than the one we need asap for CEQ/DOE

Do we need to explain Capacity, energy, nameplate capacity?

Doug Johnson- thoughts on this for lay readers? Birgit thinks this is needed to ground reader –we'll keep this in the public version when we have more detail, but not in the CEQ version

It will provide a transition to next slide- study that E3 conducted sustained capacity was the most critical replacement needed from power perspective particularly for multi-day winter cold weather events

Two clean energy scenarios – with different electricity use assumptions and emerging technology availability

Maybe call Load Growth "increased electricity use or demand"

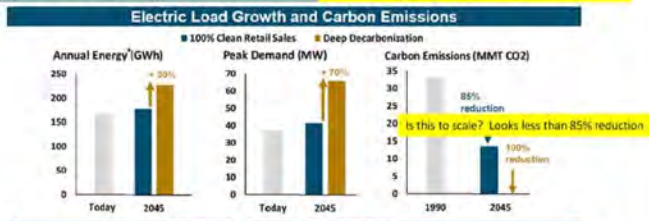
- Scenario 1: 100% Clean Retail Sales (S1)**
 - 100% of retail sales met with clean energy by 2045, ~85% carbon reduction
 - Business-as-usual load growth
 - Can be achieved using existing mature technologies

- Scenario 2: Deep Decarbonization**
 - Zero carbon emissions remain in 2045

Change text to "Electricity use increases to decrease carbon emissions from other sectors of the economy such as transportation and buildings" or something like that. "Economy-wide carbon abatement" seems too wonky

growth y-wide arios are key bon-

Emerging "Clean Firm" technologies



is this to scale? Looks less than 85% reduction

Emerging Technologies Considered

Technology	Description	S1 100% Clean	S2a Deep Decarb. Baseline	S2b Deep Decarb. Emerging Tech.	S2c Deep Decarb. No New Construction
Hydrogen (existing gas retrofits)	Burn green H ₂ existing gas infrastructure				
Hydrogen (new dual fuel gas + hydrogen)**	Burn either gas or hydrogen (product of electrolysis)				
Nuclear (small modular reactors)	Firm, dispatch using advanced				
Gas w/ Carbon Capture and Storage	Firm, dispatch 100% carbon capture				
Offshore Wind (floating)	High output w/ offshore waters				

For table use Natural Gas with carbon capture if that is what it means so not confused with other gases (hydrogen)
Also add check mark to green cells and X to red cells for color challenged folks

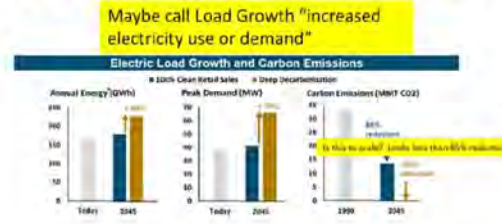
* Load based on 2021 MWPC Power Plan, shown as retail sales (after generation growth) in constant PV.
** Scenario 1: "dual fuel gas + hydrogen" but no hydrogen is utilized in that scenario

What's new in this study compared to CRSO EIS

The study uses these two scenarios to represent bookends of how electricity use will change in the region to achieve carbon reduction goals (see bar chart)

- Scenario 1: 100% Clean Retail Sales
 - E3 how would you describe this to your next door neighbor?
 - Business-as-usual load growth
 - Can be achieved using existing mature technologies

- Scenario 2: Deep Decarbonization (3 variations in emerging technology availability)
 - Zero carbon emissions remain in 2045
 - High electrification load growth consistent with economy-wide carbon abatement scenarios
 - Emerging technologies are key to meeting higher winter reliability needs with carbon-free power



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What's new in this study compared to CRSO EIS

Scenario 1 shows the impacts of carbon policy
Scenario 2 in three variations of emerging technology availability

The table below shows which resources can actually meet electricity demand (in green boxes), not just how much it costs. For example, the modelling considers how much capacity a resource actually has, and then prioritizes it based on its ability to provide reliable electricity when needed.

Handwritten notes:

- For table use Natural Gas with carbon capture if that is what it means so not confused with other gases (hydrogen)
- Also add check mark to green cells and X to red cells for color challenged folks

	2015	2040	2060	2080	2100
Technology					
Wind					
Solar					
Hydro					
Natural Gas					
Coal					
Nuclear					
Other					

Two clean energy scenarios – with different electricity use assumptions and emerging technology availability

Emerging Technology Considered

Technology	2045	2050	2055	2060	2065
Hydrogen					
Wind					
Solar					
Nuclear					
Coal					
Gas					
Geothermal					
Small Hydropower					
Biomass					
Hydro					
Coal with CCS					
Gas with CCS					
Nuclear Small Modular Reactors					
Advanced Nuclear					
Advanced Gas Reactors					
Advanced Water Reactors					
Advanced Sodium Reactors					
Advanced Molten Salt Reactors					
Advanced Fast Neutron Reactors					
Advanced Heavy Water Reactors					
Advanced Pressurized Water Reactors					
Advanced Boiling Water Reactors					
Advanced Very High Temperature Reactors					
Advanced High Temperature Gas-Cooled Reactors					
Advanced Low Temperature Gas-Cooled Reactors					
Advanced Sodium-Cooled Reactors					
Advanced Lead-Cooled Reactors					
Advanced Potassium-Cooled Reactors					
Advanced Sodium-Potassium Cooled Reactors					
Advanced Sodium-Potassium Cooled Fast Neutron Reactors					
Advanced Sodium-Potassium Cooled Fast Neutron Reactors with CCS					
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For table use Natural Gas with carbon capture if that is what it means so not confused with other gases (hydrogen)
Also add check mark to green cells and X to red cells for color challenged folks

The table above shows which resources can actually meet electricity demand (in green boxes), not just how much it costs. For example, the modelling considers how much capacity a resource actually has, and then prioritizes it based on its ability to provide reliable electricity when needed.

Two clean energy scenarios – with different electricity use assumptions and emerging technology availability

The study uses these two scenarios to represent bookends of how electricity use will change in the region to achieve carbon reduction goals

- Scenario 1: 100% Clean Retail Sales
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 - Zero carbon emissions remain in 2045
 - High electrification load growth consistent with economy-wide carbon abatement scenarios
 - Emerging technologies are key to meeting higher winter reliability needs with carbon-free power

Emerging Technologies Considered

Technology	2045 Demand (TWh)	2045 Capacity (GW)	2045 Capacity Factor (%)	2045 Capacity (GW)
Hydrogen	31	214	820	214
...

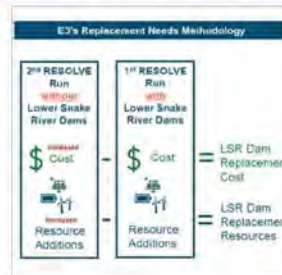
For table use Natural Gas with carbon capture if that is what it means so not confused with other gases (hydrogen)
Also add check mark to green cells and X to red cells for color challenged folks

The table above shows which resources can actually meet electricity demand (in green boxes), not just how much it costs. For example, the modelling considers how much capacity a resource actually has, and then prioritizes it based on its ability to provide reliable electricity when needed.

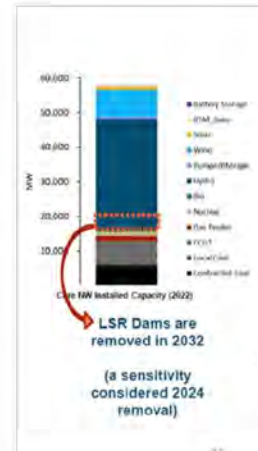
Replacing the lower Snake River dam capabilities

- RESOLVE model determines replacement needs and cost by optimizing regional requirements with the dams, and then again without the dams
- The model does not consider **essential reliability** services for the transmission grid, such as voltage, reactive power, inertia, black start, etc.
- The RESOLVE model shows that, without the four lower Snake River dams, the region will experience increased costs and increased requirement for resources.

Electric Grid Benefit
GHG-free Energy Output (MWh) GHG-free energy displaces the costs and carbon emissions of NW coal + gas generation or imported power
Reliable Capacity (MW) Firm capacity contributions towards resource adequacy
Flexibility and Operating Reserves (MW) Sub-hourly ancillary service provision and renewable integration benefits



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Scenario 1: 100% clean retail sales to replace lower Snake River dams

PSMR-E20
EAJ3 Bonneville's rates are structured to sell in long-term contracts the amount of electricity produced from a low water year since that can be assured. In average or high water conditions the system has additional power that Bonneville sells (often displacing fossil-fuel generators) to keep customer rates affordable.

- Capacity replaced with dual fuel natu
- Energy replaced by wind and net imp

Bullet point changes:
 - capacity replaced with 2,000 MW of dual fuel natural gas + hydrogen turbines and X GW wind
 - Wind and imports provide the most energy but the gas plant is needed for meeting winter cold weather events to avoid power shortages
 - E3 add bullet about Greenhouse gas emissions please

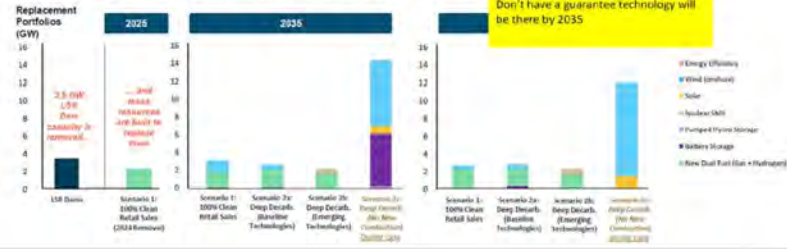


Comparing the scenarios: replacing four Lower Snake River dams' capacity

Capacity replacement for additional scenarios and years is shown below

- Scenario 1 (100% Clean Retail Sales, 2024 LSR Dam removal): similar to scenario 2b, but with hydrogen turbine replacement in 2025
- Scenario 2b (Deep Decarbonization, Emerging Technologies): small modular energy, instead of additional wind power
- Scenario 2c (Deep Decarbonization, No New Combustion): very high replacement capacity to replace LSR dam firm capacity and zero-carbon energy output

Add to bullets: Scenario 1 does not eliminate carbon emissions, and scenario 2b still has natural gas and depends on emerging technologies that are not yet scalable commercially (let's not call 2c outlier, it's a bookend - if we want to get rid of carbon and don't have new technology this is what it looks like) Don't have a guarantee technology will be there by 2035



Deliberative, predecisional, FDM, exempt

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From: James,Eve A L (BPA) - PG-5
Sent: Wednesday, June 29, 2022 5:55 PM
To: Koehler,Birgit G (BPA) - PG-5
Cc: Diffely,Robert J (BPA) - PGPL-5
Subject: review of E3 draft V2

Sounds good- I plan on compiling yours and Rob's and a few I had. I will do that in the morning once we get the copy from E3.

On Jun 29, 2022 5:34 PM, "Koehler,Birgit G (BPA) - PG-5" <bgkoehler@bpa.gov> wrote:

Eve,

I don't know how we will end up coordinating our reviews given that we are supposed to get another copy with Arne's edits. I thought it safer to send you this now rather than wait just in case tomorrow has more surprises that create chaos. Note too that I am out tomorrow afternoon. (b)(6)

(b)(6)

While I tried to stick with light touch, we may not want to send all of my edits in.

Birgit

From: Pruder Scruggs, Kathryn M (BPA) - E-4
Sent: Tuesday, May 24, 2022 9:59 AM
To: James, Eve A L (BPA) - PG-5; Koehler, Birgit G (BPA) - PG-5
Cc: Armentrout, Scott G (BPA) - E-4
Subject: suggestions to make E3 study less technical for lay audience 5 24.pptx
Attachments: suggestions to make E3 study less technical for lay audience 5 24.pptx

Importance: High

Scott – this is FYI only. Eve and Birgit will likely have edits so this is still draft. However, I do welcome your comments at any point in the process.

Eve and Birgit – Here’s my first take on this. I’m available to continue working with you, but I need to be offline for a few hours over lunchtime for a personal errand. I will, however, have my BPA phone and will take calls and I’ll be back at my post this afternoon.

Katie Pruder Scruggs
Environmental Communication Specialist
Bonneville Power Administration
503-230-3111

(b)(6)

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, July 12, 2022 10:06 AM
To: James,Eve A L (BPA) - PG-5; Godwin,Mary E (BPA) - LN-7
Subject: E3 to Inslee/Murray cover page
Attachments: E3report cover page, bk.docx

I'm making a go of having email subject lines be clearer about what the topic is. Makes it easier to find later.

I've added some edits as suggestions

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, July 12, 2022 9:43 AM
To: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Draft LSRD Benefit Replacement Report

How about this as a first cut- I put it in a word document so you can edit as needed:

From: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Sent: Tuesday, July 12, 2022 7:27 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: FW: Draft LSRD Benefit Replacement Report

Hi Birgit and Eve,
Could you two take a stab at putting together a few points for a very short cover letter on the E3 study to supplement our comments on the draft Inslee-Murray Report? Now that the E3 study is public, we can send it in to the contractors working on the final report. We can use existing talking points and tie it to our comments on the studies that the Draft Report references.

Thanks,
Mary

From: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Tuesday, July 12, 2022 7:18 AM
To: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Cc: Renner,Marcella P (BPA) - E-4 <mprenner@bpa.gov>
Subject: RE: Draft LSRD Benefit Replacement Report

Do we want to cut a cover letter today and mail the E3 study in? Scott

SCOTT G ARMENTROUT
Executive Vice President, Environment, Fish & Wildlife, SES | E-4
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-3076 | C (b)(6)



From: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>

Sent: Monday, July 11, 2022 4:47 PM

To: Hairston, John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Cook, Joel D (BPA) - K-7 <jdcCook@bpa.gov>; Cooper, Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>; Cathcart, Michelle M (BPA) - TO-DITT-2 <mmcathcart@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Sullivan, Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; Sweet, Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Senters, Anne E (BPA) - LN-7 <aesenters@bpa.gov>; Chong Tim, Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>; Chan, Allen C (BPA) - LT-7 <acchan@bpa.gov>; Anasis, John G (TFE)(BPA) - TOOP-DITT-2 <iganasis@bpa.gov>; Klumpp, Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>
Subject: FW: Draft LSRD Benefit Replacement Report

Hi All,

Bonneville submitted its comments on the draft Inslee-Murray Lower Snake River Dams Benefit Replacement Report this afternoon. Comments were due today. The Draft Report is located here: **[Lower Snake River Dams: Benefit Replacement Draft Report \(lsrdoptions.org\)](https://www.lsrdoptions.org)**

Thanks,
Mary

From: Renner, Marcella P (BPA) - E-4 <mprenner@bpa.gov> On Behalf Of Armentrout, Scott G (BPA) - E-4

Sent: Monday, July 11, 2022 4:38 PM

To: info@lsrdoptions.org

Cc: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Klumpp, Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>

Subject: Draft LSRD Benefit Replacement Report

To whom it may concern,

This serves as Bonneville Power Administration (Bonneville) comments to Senator Murray and Governor Inslee on the draft *Lower Snake River Dams: Benefits Replacement Study* report (Draft Report). Bonneville provided input into the draft report on the power replacement analysis completed in the 2020 Columbia River System Operations (CRSO) Environmental Impact Statement (EIS) and Bonneville's comments focus on key technical points contained in the Draft Report and for inclusion in the Final Report.

Bonneville markets and transmits the hydropower generated at thirty-one Federal Columbia River Power System (FCRPS) projects, including the four lower Snake River dams.^[1] Bonneville, is one of four Power Marketing Administration's and is part of the U.S. Department of Energy. Bonneville operates as a not-for-profit federal entity, selling cost-based electrical power and transmission services to benefit the Pacific Northwest, including the public bodies and cooperatives that serve domestic and rural consumers. In providing these services, Bonneville balances multiple public duties and purposes, including: assuring the Pacific Northwest has an adequate, efficient, economical and reliable power supply; promoting energy conservation and the use of renewable resources; respecting and upholding its relationship with Tribal Nations; and, acting in a manner consistent with the program developed by the Northwest Power and Conservation Council by protecting, mitigating, and enhancing fish and wildlife in the Columbia River basin that are affected by the development and operations of the federal facilities from which Bonneville markets power.^[2]

The U.S. Army Corps of Engineers (Corps) operates and maintains these four projects for multiple congressionally authorized purposes including flood risk management, navigation, hydropower generation, fish and wildlife conservation, irrigation, recreation, water quality, and municipal and industrial water supply though not every facility is authorized for every one of these purposes. While the Corps is congressionally authorized to operate these four projects for multiple purposes, Bonneville is the federal agency Congress authorized to market and transmit the power generated at these facilities. In return, Bonneville is required to pay, either directly to the Corps, or as a reimbursement to the U.S. Treasury,

(1) all costs associated with power-specific operations and assets (e.g., turbines); and (2) a share of “joint costs,” which benefit or mitigate, for all purposes of the facility (e.g., fish mitigation, water quality).

Bonneville’s comments are separated into six sections: 1) General comments on the Executive Summary and Context and Purpose; 2) Technical comments on the Power Information; 3) Technical comments on Transmission Analysis; 4) Technical comments on Fish Information; 5) Technical comments on Water Quality Information and 6) Clerical Error Correction.

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

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^[1] The Columbia River System (CRS) is a subset of the 31 FCRPS dams and includes 14 projects operated as a coordinated water management system. The 14 CRS projects are comprised of 12 Corps projects and two Bureau of Reclamation (“Reclamation”) projects located throughout the Pacific Northwest in the states of Idaho, Oregon, Montana, and Washington. BPA markets and transmits the hydropower generated from these 14 projects. These projects are operated in a coordinated manner for purposes specifically authorized by Congress, including flood risk management, navigation, fish and wildlife conservation, hydropower generation, recreation, irrigation, and municipal and industrial water supply, but the authorized projects vary by project. The four lower Columbia projects are part of the CRS.

^[2] 16 U.S.C. § 839. Unlike most federal agencies, Bonneville does not receive annual congressional appropriations; instead, the agency is self-financed from revenues received from the sale of power and transmission services. Bonneville utilizes this revenue to not only pay for the continuing costs associated with its programs (including power, transmission, and fish and wildlife investments and maintenance) but also to repay the United States Treasury for the power share of the original federal investment used to construct the Federal Columbia River Power System. The Bonneville Administrator must operate the agency in a manner that allows it to recover its costs “in accordance with sound business principles.” 16 U.S.C. § 839e(a)(1). This includes the objectives of setting the lowest possible rates for Bonneville services, while enabling Bonneville to make timely repayments to the Treasury and simultaneously fulfilling multiple public purposes for the benefit of the Pacific Northwest.

Title slide

Executive summary

- Replacement power from removing the four lower Snake River dams:
 - Must provide firm capacity (reliable energy that is **available at all times and dispatchable**) to avoid power shortages and meet Bonneville's statutory requirements for its public power customers **PSM(-E31)**
 - Must be emission-free to comply with **regional carbon policies**
- If new, firm capacity is not available to replace the dams, acquiring new resources could require **building renewable resources at an unrealistic level**
 - At high cost to public power rate payers
 - Would require new transmission infrastructure (siting and building new transmission would likely take a decade) **PSM(-E30)**
 - Would impact land use – large footprint for new resources, such as massive solar arrays
- Replacing the output of the dams comes at a **substantial cost** that would have a meaningful impact on the rates of Bonneville Power Administration's public power customers
 - Increase of up to 65% for firm, carbon-free energy replacement
 - Residential electricity costs could go up by up to \$850 per year
 - Lower income residents would experience a greater disparity because electricity bill is a larger portion of their income.
- The **availability of emerging technology** is a factor in achieving emission-free replacement resources (technology such as small modular nuclear reactors, green hydrogen, batteries)

About this study

- E3 conducted an independent analysis of replacing the power output from the four lower Snake River dams in the context of Pacific Northwest resource requirements.
- BPA contracted E3 to conduct the study, which includes independent analysis about the value of the four lower Snake River dams to the Northwest energy system, including the **cost** and **resource requirements** for replacement.
- This study takes a regional view of electricity supplies and uses E3's RESOLVE electricity planning model to optimize electricity resource requirements for the Northwest through 2045.



Illustrative, pre-conditional, FOIA exempt

What's new in this study

The study uses an optimizer to determine the least-cost replacement resources for the four lower Snake River dams subject to **reliability** and **policy** constraints

- **Reliability example:** The E3 modelling considers multiple variables – not just cost. For example, the modelling considers how much capacity a resource actually has, and then prioritizes it based on its ability to provide reliable electricity.
 - The wind isn't always blowing and the sun goes down at night (when temperatures are usually lowest during a cold snap)
 - Even if those resources are the cheapest, the optimizer doesn't choose them because they have no capacity (not always available) to provide power when it's required
- **Policy example:** E3's modelling considers the very real effects of regional policy decisions and legislation to reduce carbon emissions
 - New laws are removing fossil fuel-based power resources from the grid all along the west coast (such as retiring coal plants)
 - Compounding the situation from removing fossil fuel resources, decarbonizing the region will result in increased electricity use (load)

E3 view of California, Oregon, and Washington

- + **State policy is moving aggressively toward a decarbonized power sector in California, Oregon, and Washington**
 - California has an established national leadership position in the pursuit of decarbonization
 - Oregon and Washington have accelerated the adoption of aggressive decarbonization legislation since 2019
 - Across all three states, decarbonization is creating a current and deepening need for capacity, especially if that capacity is clean and firm
- + **Generation in the region can take advantage of wholesale market opportunities in California, or reliability-driven need in the Pacific Northwest (PNW), or both**
 - Energy storage deployment has accelerated rapidly in California as storage assets pursue lucrative but shallow Ancillary Services value; while this market is saturating quickly, energy arbitrage value is likely to persist as solar capacity continues to grow
 - In the PNW, retirement of firm fossil fuel capacity and volatility in hydropower generation is coinciding with the implementation of the Western Resource Adequacy Program (WRAP) for compensating reliability providers through deeper regional coordination
- + **While California's capacity deficit is on course to be addressed by the end of the decade through rapid deployment of energy storage and other resources, the Pacific Northwest continues to face a capacity deficit whether viewed from the top down (regional level) or bottom up (via utility IRPs)**
 - Given average rate of capacity additions in the PNW over the past decade (~1GW/year since 2010), there is significant execution risk associated with utility IRP resource plans
- + **The Pacific Northwest market is in the midst of an evolution that is likely to lead to increasing regionalization of power markets, with significant uncertainty around the timing and depth of these changes**
 - In the context of decarbonization policies culminating in goals for 2040 (Oregon) and 2045 (Washington), the region will likely need to explore multiple potential pathways to achieve climate, cost, and reliability targets as utilities navigate the energy transition



Policy Landscape: Washington, Oregon, California

	RPS or Clean Energy Standard?	Coal Prohibition?	Cap-and-Trade?	New Gas?	Economy-Wide Carbon Reduction?
WA	✓ Carbon neutral by 2030, 100% carbon free electricity by 2045	✓ Eliminate by 2025	✓ Cap-and-invest program established in 2021, SCC in utility planning	✓	✓ 95% GHG emission reduction below 1990 levels and achieve net zero emissions by 2050
OR	✓ 50% RPS by 2040, 100% GHG emission reduction by 2040, relative to 2010 levels	✓ Eliminate by 2030	✓ Climate Protection Plan adopted by DEQ in 2021 (power sector not included)	✗ HB 2021 bans expansion or construction of power plants that burn fossil fuels	✓ 90% GHG emission reduction from fossil fuel usage relative to 2022 baseline
CA	✓ 60% RPS by 2030, 100% clean energy by 2045	✓ Coal-fired electricity generation already phased out	✓	✗ CPUC IRP did not allow in recent procurement order	✓ 40% GHG emission reduction below 1990 levels by 2030 and 80% by 2050

Distasteful, provisional, TQA exempt



Role of Hydropower to Meet Regional Requirements

+ Hydropower resources provide unique system benefits to support system needs in California and the Northwest

System Benefit	Hydropower Capabilities	Value Over Time
Capacity for Resource Adequacy	<ul style="list-style-type: none"> Hydropower provides significant RA capacity through its maximum expected generation (CA) or sustained peaking capability (NW) 	<ul style="list-style-type: none"> RA will be highly valuable across the planning horizon
Carbon Free Energy	<ul style="list-style-type: none"> Hydropower's carbon-free energy comes at low-cost without any new transmission needs or development risk Hydro energy also provides the financial benefit of avoiding natural gas fuel costs 	<ul style="list-style-type: none"> Carbon-free energy will be increasingly valuable to both CA and the NW as clean energy policy targets become more stringent
Reserves and Flexibility	<ul style="list-style-type: none"> Hydro provides a zero-emissions source of ancillary services (spin, regulation, etc.) and ramping capabilities to integrate variable renewable energy Flexibility may change as a function of time of year and water availability 	<ul style="list-style-type: none"> Renewable integration value will be increasingly valuable though batteries can provide some similar services
Essential Reliability Services (ERS)	<ul style="list-style-type: none"> Hydro also provides key reliability services (reactive power, inertia, blackstart, etc.), including some that cannot currently be provided by asynchronous generators 	<ul style="list-style-type: none"> ERS will be increasingly valuable as other synchronous generators retire



Lower Snake River Dams

† The lower snake river dams:

- Are ~10% of the Northwest regional hydropower capacity
- Provide relatively low-cost and flexible carbon free power

Plant	Nameplate Capacity (MW)*	50-year Forecasted Costs** (real 2022 \$/MWh)
Lower Granite	930	\$22.69
Little Goose	930	\$15.71
Lower Monumental	930	\$12.58
Ice Harbor	693	\$15.84

Total = 3,483

* Nameplate capacities from BPA's 1976 book.

** Costs provided by BPA based on the CRSD EIS, including sustaining capex, O&M, and fish + wildlife related costs. PSM(-)ES

Deliberative, pre-decisional, FOIA exempt

Comparison to the recent NWECC study

- The Northwest Energy Coalition study incorrectly describes the nameplate capacity of the four lower Snake River dams as 1,000 MW, when in fact, the capacity is more than 2,000 MW.
 - Although output averages at 1,000 MW, the region draws on the nameplate capacity of 2,000 MW often to avoid power shortages, such as during heat waves or cold snaps.
- The NWECC study understates the benefits that the four lower Snake River dams provide in terms of grid stability—the services required to keep the lights on.
 - For example, Bonneville is required to keep reserve power to avoid blackouts if a generator trips offline (this is not hypothetical – it happens). PSM(-E37)
 - Obtaining these services would add to the cost of replacing the output of the dams, which is not articulated in the NWECC study.
- Baseline for the NWECC study assumes that Bonneville purchases 300 MW from the market to provide firm power.
 - By statute, Bonneville relies on the federal hydropower system to provide firm power to its public power customers PSM(-E35)
 - BPA typically purchases market power when the hydropower system can't produce enough to serve its customers during emergencies.

PSM(-E14)

PSM(-E33)

PSM(-E34)

Placeholder for graphic showing capacity of four Lower Snake River dams

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Important note about dam output







- By law, Bonneville can only provide **firm** sales of electricity (reliable energy that is available at all times) to its public power customers.
- That means the agency can only commit to providing the amount of electricity produced from a **low water year**, because that's the only amount of electricity that can be assured – high water years provide a "bonus," or surplus.
- If Bonneville committed to providing the amount of electricity produced from an average or high water year, there would be a **power shortage** during low water years.
- During extremely low water years, or during emergencies such as cold or heat snaps, Bonneville purchases power on the market to avoid a power shortage. **PSM-E38**
- During average or high water years, Bonneville sells the surplus on the secondary market to help keep public power rates low.

PSM-E17

PSM-E28

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Assumptions, or “dials” in the modeling

Element	Study Approach	Impact on Dams Replacement Needs
 Study Years	<ul style="list-style-type: none"> 2025 through 2045, including fuel price forecasts and declining renewable + storage costs 	Considers long-term needs
 Clean Energy Policy Scenarios	<ul style="list-style-type: none"> Aggressive OR+WA legislation reflected, including coal retirements + carbon pricing Two electric emissions scenarios considered: <ol style="list-style-type: none"> 100% clean retail sales (~85% carbon reduction*) Zero-emissions (100% carbon reduction) 	Clean energy policy requires long-term replacement of LSR dams with GHG-free energy
 Load Growth Scenarios	<ul style="list-style-type: none"> Two load scenarios: <ol style="list-style-type: none"> Baseline (per NWPPCC 8th Power Plan) High electrification load growth (to support economy-wide decarbonization) 	Higher load scenarios increase the value of LSR dams energy + firm capacity
 Reliability Needs <small>PSM-E39</small>	<ul style="list-style-type: none"> Modeling ensures reliability needs during extreme conditions (e.g. high loads + low hydro) Captures ability (and limits) of renewables, battery storage, and demand response to support system reliability 	Reliability needs require replacement of LSR dams firm capacity contributions
 Consideration of Emerging Technologies	<ul style="list-style-type: none"> Broad range of dam replacement technology options considered: <ul style="list-style-type: none"> Baseline technologies: solar, wind, battery + pumped storage, energy efficiency, demand response, dual fuel natural gas + hydrogen combustion plants Sensitivities: <ul style="list-style-type: none"> Emerging technologies No New Combustion 	Technology available for LSR dams replacement determines cost + feasibility
 Distributed Energy Resource Options	<ul style="list-style-type: none"> Energy efficiency, demand response, and customer solar embedded into modeling inputs Additional energy efficiency and demand response can be selected 	Demand resource can help replace LSR dams, though low-cost supply is limited

* A 100% clean retail sales target allows emissions that exceed the target to occur, "retail sales", i.e. losses during transmission to retail loads and exported energy.

Deliberative, pre-decisional, FOIA exempt

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Two clean energy scenarios – both consider emerging tech availability and the *increased* electricity use from *decreased* fossil fuels on the grid

Scenario 1: 100% Clean Retail Sales (S1)

- 100% of retail sales met with clean energy by 2045, ~65% carbon reduction
- Business-as-usual load growth
- Can be achieved using existing mature technologies

Scenario 2: Deep Decarbonization

- Zero carbon emissions remain in 2045
- High electrification load growth consistent with economy-wide carbon abatement scenarios
- Emerging technologies are key to meeting higher winter reliability needs with carbon-free power

Electric Load Growth and Carbon Emissions



Emerging Technologies Considered

Technology	Description	S1 with Clean	S2a Peak Demand Scenario	S2b Deep Decarb Scenario Tech. 1	S2c Deep Decarb Scenario Tech. 2
Hydrogen (existing gas plants)	Burn green hydrogen (produced off-grid) in existing gas plants				
Hydrogen (new fossil fuel gas + hydrogen)	Burn either natural gas or green hydrogen (produced off-grid) in new gas plants				
Nuclear (small modular reactors)	Fast, diphasic nuclear power generation using advanced modular construction				
Direct Air Capture and Storage	Form, transport, capture CO2 generation with 100% carbon capture + storage (full cycle)				
Offshore Wind (floating)	High output wind farms floating in deep offshore waters				

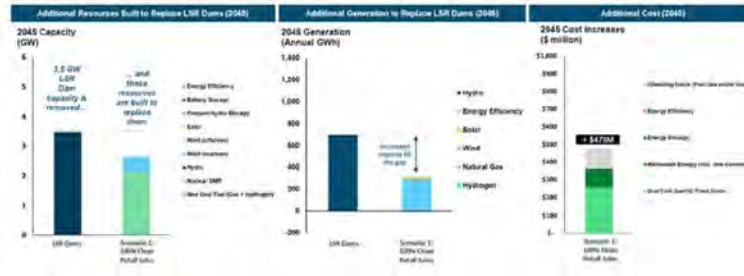
Emerging
Clean Firm
Technologies

Energy Environmental Economics

¹ Load based on 2021 NRECA's Power Plan (shows an initial sales (after) sustained growth to customer PEV)
² 2022 NRECA's Power Plan (Hydrogen) and the hydrogen is added to the scenario

Scenario 1: 100% clean retail sales to replace lower Snake River dams

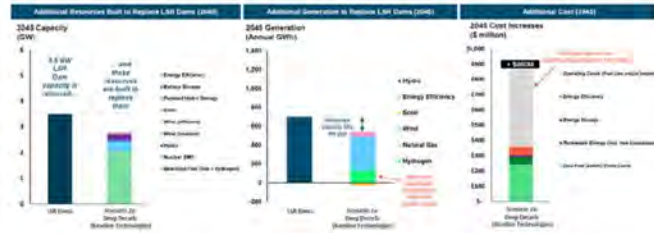
- + Capacity replaced with dual fuel natural gas + hydrogen turbines
- + Energy replaced by wind and net imports



Discretionary, pre-decisional, FOIA exempt

Scenario 2: deep carbonization (baseline technologies) to replace lower Snake River dams

- Capacity replaced with dual fuel natural gas + hydrogen turbines, energy efficiency, and energy storage
- Energy replaced by wind, reduced exports, energy efficiency, and increased hydrogen generation



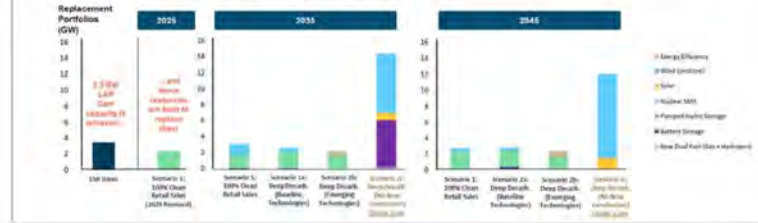
PSM(-E18)

Deliberative, pre-decisional, FOIA exempt

Across all scenarios: replacing four Lower Snake River dams capacity

Capacity replacement for additional scenarios and years is shown below:

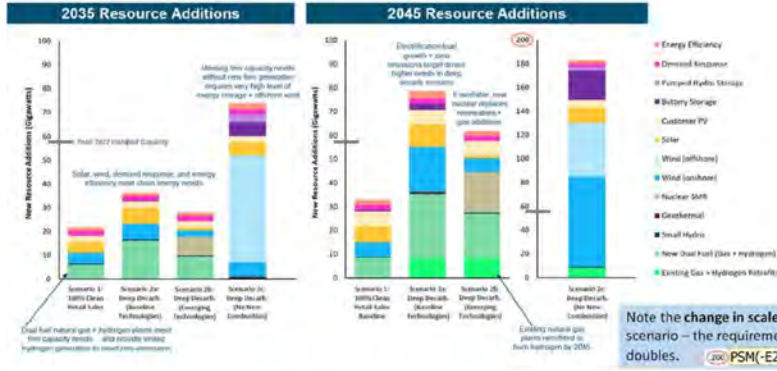
- Scenario 1 (100% Clean Retail Sales, 2024 LSR Dam removal): similar to scenario 1, but with dual fuel natural gas + hydrogen turbine replacement in 2025
- Scenario 2b (Deep Decarbonization, Emerging Technologies): small modular nuclear reactors replace LSR capacity and energy, instead of additional wind power
- Scenario 2c (Deep Decarbonization, No New Combustion): very high replacement need as wind and solar alone struggle to replace LSR dam firm capacity and zero-carbon energy output



(Deliberative, pre-decisional, FOIA exempt)

33

All scenarios show large levels of new resource additions



Deliberative, pre-decisional, FOIA exempt

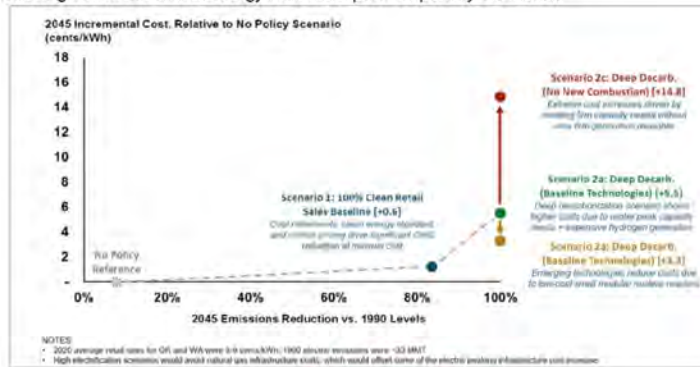
Even before we consider taking out the four lower Snake River dams...

- Regional policy requirements and legislation to reduce emissions is removing resources fossil fuel resources from the grid. This is happening now.
- Consequently, with retiring coal and gas plants, the region is **already** facing resource adequacy issues.
- Loss of the four lower Snake River dams, or reductions in their flexibility, while there are still fossil fuel generators on the grid will increase the timeframe and costs associated with shifting to a carbon-free electricity sector.

Placeholder for
graphic showing
coal retirements

Cost of carbon reductions

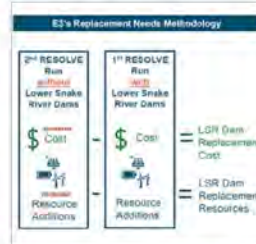
- Significant carbon reductions are possible at modest cost
- Cost to reach zero emissions depends on technologies available
- Achieving 100% carbon-free energy is the hard part – especially the last bit



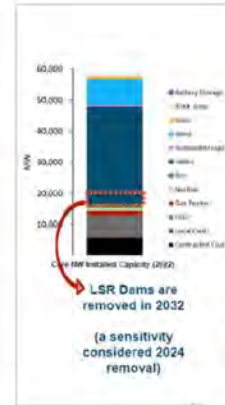
Increased costs and requirement for resources

- RESOLVE model determines replacement needs and cost by optimizing regional requirements with the dams, and then again without the dams
- The model does not consider **essential reliability** services for the transmission grid, such as voltage, reactive power, inertia, black start, etc.
- The RESOLVE model shows that, without the four lower Snake River dams, the region will experience increased costs and increased requirement for resources.

Electric Grid Benefit	
GHG-free Energy Output (MWh)	GHG-free energy displaces the costs and carbon emissions of NW coal + gas generation or imported power
Reliable Capacity (MW)	Firm capacity contributions towards resource adequacy
Flexibility and Operating Reserves (MW)	Sub-hourly ancillary service provision and renewable integration benefits



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The cost of replacing power

- Replacing the greenhouse gas-free energy, capacity, and operational benefits of the dams requires investment in new resources at increased total system costs
 - Cost differences between scenarios driven by 2045 greenhouse gas-PSM(-E26)rgy replacement and the availability of "clean firm" emerging technologies
- Costs are expected to fall on Bonneville Power Administration's public power customers
 - Could increase public power costs by 8% (best case scenario with emerging tech) to 65%
 - Could raise residential electricity costs by ~\$100 –850 per year

Scenario	Total Clean Net Present Value	Annual Cost Increase			Incremental Public Power Costs (% increase over 2045 average cost) 2045
		2025	2030	2040	
Scenario 1: 100% Clean Retail Sales	\$3.3 billion	---	\$438 million	\$479 million	0.8 cents/kWh (+8%)
Scenario 1: 100% Clean Retail Sales (2025 date removal)	\$7.2 billion	\$465 million	\$488 million	\$509 million	0.8 cents/kWh (+8%)
Scenario 2a: Deep Decarb. (Renewable Technologies)	\$5.0 billion	---	\$495 million	\$800 million	1.5 cents/kWh (+18%)
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$3.0 billion	---	\$415 million	\$428 million	0.7 cents/kWh (+4%)
Scenario 2c: Deep Decarb. (Renewable Technologies)	\$2.0 billion	---	\$130 million	\$139 million	0.2 cents/kWh (+0.2%)

NOTES:

- Cost increases account for replacement energy, capacity, and revenues as well as avoided LSR capital + expense, but do not include any costs for dewatering the dams, which would be an additional cost
- NPV and annual cost increase are shown for the Northwest Region as a whole, but the incremental costs are calculated relative to the 2045 Year 1 annual sales for public power customers
- % increase versus average public customer CIP + VAS average retail sales are ~0.5 cents/kWh. This does not include additional rate increases shown for higher loads of clean energy exports. But increase regional rates as shown in the earlier 2045 incremental cost table
- Actual residential customer cost impact assumes 1,300 kilowatts for average residential customer in Oregon and Washington (based on 1,000 kilowatts average + 30% from decontamination growth)

Disclaimer: pre-decisional, FOIA exempt

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Land use considerations

- Replacing the lost power with new solar-power resources would require roughly X acres (about X square miles) of land. PSM(-E36)
- Such a large build out of solar capacity would likely result in additional, but currently unknown impacts to natural and cultural resources, which may include vegetation, wildlife habitat, archeological resources, and traditional cultural properties (such as sites or land features that are important to tribes).



Figure 4.7. Estimated Area of Proposed Solar Project



4. Impact of differing operating patterns on capacity value of Diablo Canyon

Conclusion and summary

- The study considers two important factors in replacing power from the four lower Snake River dams:
 - Power must **provide firm capacity** (reliable energy that is available at all times) to avoid power shortages
 - Power must be **free of greenhouse gasses** to meet regional carbon policies
- Policies and laws to decarbonize the region will **increase electricity use** (electric cars, replacing gas appliances, etc.)
- Acquiring replacement resources could require **building renewable resources at an unrealistic level**.
 - This would also require building transmission to bring the power from new resources to utilities
- Replacing the dams comes at a **substantial cost** for new resource replacement.
 - This would have a meaningful impact on the rates of Bonneville Power Administration's public power customers.
- The **availability of emerging technology** is a factor in achieving replacement resources that are free of greenhouse gasses.

Document title and author(s) / PPA / 2016

Thank you slide

From: James,Eve A L (BPA) - PG-5
Sent: Tuesday, July 12, 2022 9:43 AM
To: Godwin,Mary E (BPA) - LN-7; Koehler,Birgit G (BPA) - PG-5
Subject: RE: Draft LSRD Benefit Replacement Report
Attachments: E3reportTP.docx

How about this as a first cut- I put it in a word document so you can edit as needed:

From: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Sent: Tuesday, July 12, 2022 7:27 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>
Subject: FW: Draft LSRD Benefit Replacement Report

Hi Birgit and Eve,
Could you two take a stab at putting together a few points for a very short cover letter on the E3 study to supplement our comments on the draft Inslee-Murray Report? Now that the E3 study is public, we can send it in to the contractors working on the final report. We can use existing talking points and tie it to our comments on the studies that the Draft Report references.

Thanks,
Mary

From: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Tuesday, July 12, 2022 7:18 AM
To: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Cc: Renner,Marcella P (BPA) - E-4 <mprenner@bpa.gov>
Subject: RE: Draft LSRD Benefit Replacement Report

Do we want to cut a cover letter today and mail the E3 study in? Scott

SCOTT G ARMENTROUT
Executive Vice President, Environment, Fish & Wildlife, SES | E-4
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-3076 | c(b)(6)



From: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Sent: Monday, July 11, 2022 4:47 PM
To: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>; Cathcart,Michelle M (BPA) - TO-DITT-2 <mmcathcart@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <ejames@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; Sweet,Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Senters,Anne E (BPA) - LN-7 <aesenters@bpa.gov>; Chong Tim,Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>; Chan,Allen C (BPA) - LT-7 <acchan@bpa.gov>; Anasis,John G

(TFE)(BPA) - TOOP-DITT-2 <iganasis@bpa.gov>; Klumpp,Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>
Subject: FW: Draft LSRD Benefit Replacement Report

Hi All,

Bonneville submitted its comments on the draft Inslee-Murray Lower Snake River Dams Benefit Replacement Report this afternoon. Comments were due today. The Draft Report is located here: **[Lower Snake River Dams: Benefit Replacement Draft Report \(lsrdoptions.org\)](https://www.lsrdoptions.org)**

Thanks,
Mary

From: Renner,Marcella P (BPA) - E-4 <mprenner@bpa.gov> On Behalf Of Armentrout,Scott G (BPA) - E-4
Sent: Monday, July 11, 2022 4:38 PM
To: info@lsrdoptions.org
Cc: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Klumpp,Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>
Subject: Draft LSRD Benefit Replacement Report

To whom it may concern,

This serves as Bonneville Power Administration (Bonneville) comments to Senator Murray and Governor Inslee on the draft *Lower Snake River Dams: Benefits Replacement Study* report (Draft Report). Bonneville provided input into the draft report on the power replacement analysis completed in the 2020 Columbia River System Operations (CRSO) Environmental Impact Statement (EIS) and Bonneville's comments focus on key technical points contained in the Draft Report and for inclusion in the Final Report.

Bonneville markets and transmits the hydropower generated at thirty-one Federal Columbia River Power System (FCRPS) projects, including the four lower Snake River dams.^[1] Bonneville, is one of four Power Marketing Administration's and is part of the U.S. Department of Energy. Bonneville operates as a not-for-profit federal entity, selling cost-based electrical power and transmission services to benefit the Pacific Northwest, including the public bodies and cooperatives that serve domestic and rural consumers. In providing these services, Bonneville balances multiple public duties and purposes, including: assuring the Pacific Northwest has an adequate, efficient, economical and reliable power supply; promoting energy conservation and the use of renewable resources; respecting and upholding its relationship with Tribal Nations; and, acting in a manner consistent with the program developed by the Northwest Power and Conservation Council by protecting, mitigating, and enhancing fish and wildlife in the Columbia River basin that are affected by the development and operations of the federal facilities from which Bonneville markets power.^[2]

The U.S. Army Corps of Engineers (Corps) operates and maintains these four projects for multiple congressionally authorized purposes including flood risk management, navigation, hydropower generation, fish and wildlife conservation, irrigation, recreation, water quality, and municipal and industrial water supply though not every facility is authorized for every one of these purposes. While the Corps is congressionally authorized to operate these four projects for multiple purposes, Bonneville is the federal agency Congress authorized to market and transmit the power generated at these facilities. In return, Bonneville is required to pay, either directly to the Corps, or as a reimbursement to the U.S. Treasury, (1) all costs associated with power-specific operations and assets (e.g., turbines); and (2) a share of "joint costs," which benefit or mitigate, for all purposes of the facility (e.g., fish mitigation, water quality).

Bonneville's comments are separated into six sections: 1) General comments on the Executive Summary and Context and Purpose; 2) Technical comments on the Power Information; 3) Technical comments on Transmission Analysis; 4) Technical comments on Fish Information; 5) Technical comments on Water Quality Information and 6) Clerical Error Correction.

SCOTT G ARMENTROUT
Executive Vice President, Environment, Fish & Wildlife, SES | E-4



^[1] The Columbia River System (CRS) is a subset of the 31 FCRPS dams and includes 14 projects operated as a coordinated water management system. The 14 CRS projects are comprised of 12 Corps projects and two Bureau of Reclamation (“Reclamation”) projects located throughout the Pacific Northwest in the states of Idaho, Oregon, Montana, and Washington. BPA markets and transmits the hydropower generated from these 14 projects. These projects are operated in a coordinated manner for purposes specifically authorized by Congress, including flood risk management, navigation, fish and wildlife conservation, hydropower generation, recreation, irrigation, and municipal and industrial water supply, but the authorized projects vary by project. The four lower Columbia projects are part of the CRS.

^[2] 16 U.S.C. § 839. Unlike most federal agencies, Bonneville does not receive annual congressional appropriations; instead, the agency is self-financed from revenues received from the sale of power and transmission services. Bonneville utilizes this revenue to not only pay for the continuing costs associated with its programs (including power, transmission, and fish and wildlife investments and maintenance) but also to repay the United States Treasury for the power share of the original federal investment used to construct the Federal Columbia River Power System. The Bonneville Administrator must operate the agency in a manner that allows it to recover its costs “in accordance with sound business principles.” 16 U.S.C. § 839e(a)(1). This includes the objectives of setting the lowest possible rates for Bonneville services, while enabling Bonneville to make timely repayments to the Treasury and simultaneously fulfilling multiple public purposes for the benefit of the Pacific Northwest.

From: Godwin, Mary E (BPA) - LN-7
Sent: Tuesday, July 12, 2022 3:17 PM
To: Hairston, John L (BPA) - A-7; Koehler, Birgit G (BPA) - PG-5; Cooper, Suzanne B (BPA) - P-6; Baskerville, Sonya L (BPA) - AIN-WASH; Cook, Joel D (BPA) - K-7; Cathcart, Michelle M (BPA) - TO-DITT-2; Armentrout, Scott G (BPA) - E-4
Cc: Sweet, Jason C (BPA) - EW-4; Chong Tim, Marcus H (BPA) - L-7; Zelinsky, Benjamin D (BPA) - E-4; Sullivan, Leah S (BPA) - EWP-4; James, Eve A L (BPA) - PG-5; Senters, Anne E (BPA) - LN-7; Leary, Jill C (BPA) - LN-7; Anasis, John G (TFE)(BPA) - TOOP-DITT-2; Chan, Allen C (BPA) - LT-7; Klumpp, Elizabeth C (BPA) - AIR-WSGL
Subject: RE: Draft LSRD Benefit Replacement Report
Attachments: Final E3 Report Analysis Addendums to 7.11.22 Murray-Inslee Comments Cover Letter 7.12.22.pdf

Hi All,
Here is the cover letter and E3 materials submitted in the Inslee-Murray Report process. Thanks to Eve and Birgit for preparing the cover letter.

Thanks,
Mary

From: Godwin, Mary E (BPA) - LN-7
Sent: Monday, July 11, 2022 9:17 PM
To: Hairston, John L (BPA) - A-7 <jlhairston@bpa.gov>; Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Cooper, Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Cook, Joel D (BPA) - K-7 <jdcook@bpa.gov>; Cathcart, Michelle M (BPA) - TO-DITT-2 <mmcathcart@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Cc: Sweet, Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Chong Tim, Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan, Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Senters, Anne E (BPA) - LN-7 <aesenters@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Anasis, John G (TFE)(BPA) - TOOP-DITT-2 <jganasis@bpa.gov>; Chan, Allen C (BPA) - LT-7 <acchan@bpa.gov>; Klumpp, Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>
Subject: RE: Draft LSRD Benefit Replacement Report

Comments from PNWA.

We saw draft comments from NOAA and Reclamation. I will circulate the final versions when we receive them.

Thanks,
Mary

From: Hairston, John L (BPA) - A-7 <jlhairston@bpa.gov>
Sent: Monday, July 11, 2022 7:11 PM
To: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Cooper, Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>; Cook, Joel D (BPA) - K-7 <jdcook@bpa.gov>; Cathcart, Michelle M (BPA) - TO-DITT-2 <mmcathcart@bpa.gov>; Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Cc: Sweet, Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Chong Tim, Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>;

Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Sullivan, Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Sinters, Anne E (BPA) - LN-7 <aesinters@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Anasis, John G (TFE)(BPA) - TOOP-DITT-2 <jganasis@bpa.gov>; Chan, Allen C (BPA) - LT-7 <acchan@bpa.gov>; Klumpp, Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>

Subject: RE: Draft LSRD Benefit Replacement Report

Thanks everyone for all of the great work getting these comments out the door.

Thanks
John

On Jul 11, 2022 4:53 PM, "Koehler, Birgit G (BPA) - PG-5" <bgkoehler@bpa.gov> wrote:
Busy day. Thanks for getting this over the finish line!

From: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>

Sent: Monday, July 11, 2022 4:47 PM

To: Hairston, John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout, Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Cook, Joel D (BPA) - K-7 <jcook@bpa.gov>; Cooper, Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>; Cathcart, Michelle M (BPA) - TO-DITT-2 <mmcathcart@bpa.gov>; Baskerville, Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>

Cc: Koehler, Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James, Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Sullivan, Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; Sweet, Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Zelinsky, Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Leary, Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Sinters, Anne E (BPA) - LN-7 <aesinters@bpa.gov>; Chong Tim, Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>; Chan, Allen C (BPA) - LT-7 <acchan@bpa.gov>; Anasis, John G (TFE)(BPA) - TOOP-DITT-2 <jganasis@bpa.gov>; Klumpp, Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>

Subject: FW: Draft LSRD Benefit Replacement Report

Hi All,

Bonneville submitted its comments on the draft Inslee-Murray Lower Snake River Dams Benefit Replacement Report this afternoon. Comments were due today. The Draft Report is located here: **[Lower Snake River Dams: Benefit Replacement Draft Report \(lsrdoptions.org\)](#)**

Thanks,
Mary

From: Renner, Marcella P (BPA) - E-4 <mprenner@bpa.gov> On Behalf Of Armentrout, Scott G (BPA) - E-4

Sent: Monday, July 11, 2022 4:38 PM

To: info@lsrdoptions.org

Cc: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Klumpp, Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>

Subject: Draft LSRD Benefit Replacement Report

To whom it may concern,

This serves as Bonneville Power Administration (Bonneville) comments to Senator Murray and Governor Inslee on the draft *Lower Snake River Dams: Benefits Replacement Study* report (Draft Report). Bonneville provided input into the draft report on the power replacement analysis completed in the 2020 Columbia River System Operations (CRSO) Environmental Impact Statement (EIS) and Bonneville's comments focus on key technical points contained in the Draft Report and for inclusion in the Final Report.

Bonneville markets and transmits the hydropower generated at thirty-one Federal Columbia River Power System (FCRPS) projects, including the four lower Snake River dams.^[1] Bonneville, is one of four Power Marketing

Administration's and is part of the U.S. Department of Energy. Bonneville operates as a not-for-profit federal entity, selling cost-based electrical power and transmission services to benefit the Pacific Northwest, including the public bodies and cooperatives that serve domestic and rural consumers. In providing these services, Bonneville balances multiple public duties and purposes, including: assuring the Pacific Northwest has an adequate, efficient, economical and reliable power supply; promoting energy conservation and the use of renewable resources; respecting and upholding its relationship with Tribal Nations; and, acting in a manner consistent with the program developed by the Northwest Power and Conservation Council by protecting, mitigating, and enhancing fish and wildlife in the Columbia River basin that are affected by the development and operations of the federal facilities from which Bonneville markets power.^[2]

The U.S. Army Corps of Engineers (Corps) operates and maintains these four projects for multiple congressionally authorized purposes including flood risk management, navigation, hydropower generation, fish and wildlife conservation, irrigation, recreation, water quality, and municipal and industrial water supply though not every facility is authorized for every one of these purposes. While the Corps is congressionally authorized to operate these four projects for multiple purposes, Bonneville is the federal agency Congress authorized to market and transmit the power generated at these facilities. In return, Bonneville is required to pay, either directly to the Corps, or as a reimbursement to the U.S. Treasury, (1) all costs associated with power-specific operations and assets (e.g., turbines); and (2) a share of "joint costs," which benefit or mitigate, for all purposes of the facility (e.g., fish mitigation, water quality).

Bonneville's comments are separated into six sections: 1) General comments on the Executive Summary and Context and Purpose; 2) Technical comments on the Power Information; 3) Technical comments on Transmission Analysis; 4) Technical comments on Fish Information; 5) Technical comments on Water Quality Information and 6) Clerical Error Correction.

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C (b)(6)



^[1] The Columbia River System (CRS) is a subset of the 31 FCRPS dams and includes 14 projects operated as a coordinated water management system. The 14 CRS projects are comprised of 12 Corps projects and two Bureau of Reclamation ("Reclamation") projects located throughout the Pacific Northwest in the states of Idaho, Oregon, Montana, and Washington. BPA markets and transmits the hydropower generated from these 14 projects. These projects are operated in a coordinated manner for purposes specifically authorized by Congress, including flood risk management, navigation, fish and wildlife conservation, hydropower generation, recreation, irrigation, and municipal and industrial water supply, but the authorized projects vary by project. The four lower Columbia projects are part of the CRS.

^[2] 16 U.S.C. § 839. Unlike most federal agencies, Bonneville does not receive annual congressional appropriations; instead, the agency is self-financed from revenues received from the sale of power and transmission services. Bonneville utilizes this revenue to not only pay for the continuing costs associated with its programs (including power, transmission, and fish and wildlife investments and maintenance) but also to repay the United States Treasury for the power share of the original federal investment used to construct the Federal Columbia River Power System. The Bonneville Administrator must operate the agency in a manner that allows it to recover its costs "in accordance with sound business principles." 16 U.S.C. § 839e(a)(1). This includes the objectives of setting the lowest possible rates for Bonneville services, while enabling Bonneville to make timely repayments to the Treasury and simultaneously fulfilling multiple public purposes for the benefit of the Pacific Northwest.

Earlier this year, BPA engaged electric industry research firm Energy and Environmental Economics (E3) to build on the analysis performed in the Columbia River System Operations (CRSO) Environmental Impact Statement (EIS) regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future. First, the analysis examined the resource needs for the region. As states move forward with clean energy policies, fossil fuel-generated power is being removed from the grid, and E3's analysis will include a resource portfolio optimizer model using their data sets and their criteria and objectives to create least-cost replacement portfolios in the new policy landscape. Second, the analysis examined the resource needs for the region with the lower Snake Dam generation removed. The E3 study information ~~will be~~ is important to include as at least two of the studies cited in the Draft Report include more generation from fossil-fuel plants on the grid than current state laws permit.

The Draft Report acknowledges the decarbonization goals of Oregon and Washington, which include shifting greater demand from high fossil-fuel sectors (e.g. transportation and heating) to the decarbonizing electricity sector. The E3 analysis included scenarios evaluating a replacement in light of future needs with variations in assumptions about the availability of emerging technology for replacement resources and variations in assumptions about demand for power with or without deep decarbonization of the wider economy, principally transportation and buildings.

Therefore, Bonneville would like to submit the E3 analysis as an addendum to the comments submitted for the Draft Report.



Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

ENVIRONMENT, FISH AND WILDLIFE

July 12, 2022

In reply refer to: E-4

ATTN: Kramer Consulting and Ross Strategic Consulting Team,

Earlier this year, Bonneville Power Administration (BPA) engaged electric industry research firm Energy and Environmental Economics (E3) to build on the analysis performed in the 2020 Columbia River System Operations (CRSO) Environmental Impact Statement (EIS) regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future. First, the E3 analysis examined the resource needs for the region. As states and the federal government move forward with clean energy policies, fossil fuel-generated power is being removed from the grid. E3's analysis includes a resource portfolio optimizer model using their data sets and their criteria and objectives to create least-cost replacement portfolios in the new policy landscape. Second, the E3 analysis examined the resource needs for the region with the generation from the lower Snake River dams removed.

BPA would like to submit the *Lower Snake River Dams Power Replacement Study* and Executive Summary (collectively, "E3 analysis") as an addendum to the comments on the Draft Report submitted on July 11, 2022 in order to inform the Final Report. BPA recommends that the E3 analysis be considered for the Final Report because at least two of the studies cited in the Draft Report include more generation from fossil-fuel plants on the power grid than current state laws permit. The Draft Report acknowledges the decarbonization goals of Oregon and Washington, which include shifting greater demand from high fossil-fuel sectors (e.g., transportation and heating) to the decarbonizing electricity sector. The E3 analysis can assist with the Final Report by providing information on different scenarios for replacement of the generation of the lower Snake River dams. The E3 analysis evaluated different assumptions both on the availability of emerging technology for replacement resources and on demand for power with or without deep decarbonization of the wider economy, principally transportation and heating.

Sincerely,

SCOTT G. ARMENTROUT
EVP, Environment, Fish and Wildlife

Attachments:

E3 BPA LSR Dams_071122.pdf
E3 BPA LSR Dams Report_071122.pdf



BPA Lower Snake River Dams Power Replacement Study

Executive Summary
July 2022

Arne Olson, Sr. Partner
Aaron Burdick, Associate Director
Dr. Angineh Zohrabian, Consultant
Sierra Spencer, Sr. Consultant
Sam Kramer, Consultant
Jack Moore, Sr. Director



Who is E3?

Thought Leadership, Fact Based, Trusted.

100+ full-time consultants | 30 years of deep expertise | Engineering, Economics, Mathematics, Public Policy...



San Francisco



New York



Boston



Calgary

E3 Clients

Recent Examples of E3 Projects

300+ projects per year across our diverse client base



Buy-side diligence support on several successful investments in **electric utilities (~\$10B in total)**

Acquisition support for investment in a **residential demand response company (~\$100M)**

Supporting investment in several **stand-alone storage** platforms and individual assets across North America (**10+ GW | ~\$1B**)

Acquisition support for several portfolios and individual **gas-fired and renewable generation assets (20+ GW | ~\$2B)**

United Nations Deep Decarbonization Pathways Project

California: 100% clean energy planning and carbon market design for California agencies

Net Zero New England study with Energy Futures Initiative

New York: NYSERDA 100% clean energy planning

Pacific Northwest: 100% renewables and resource adequacy studies for multiple utilities



About this study

- + BPA contracted with E3 to conduct an independent analysis of the electricity system value of the four lower Snake River (LSR) dams
- + E3 utilized our RESOLVE optimal capacity expansion model to identify least-cost portfolios of electricity resources needed to replace the electric energy and grid services provided by the dams through 2045
- + Replacement costs are considered within the context of the Northwest region's aggressive, long-run decarbonization goals



Key Study Questions:

- What **additional resources** would be needed to replace the power services provided by the LSR Dams through 2045?
- What is the **net cost to BPA ratepayers**?
- How do costs and resource needs change under **different types of clean energy futures**?
- How much does replacing the dams rely on **emerging, not-yet-commercialized technologies**?



What would it take to replace the output of the four lower Snake River dams?

+ What energy services are lost if the dams are breached?

- **3,483 MW of total capacity***, including approximately **2,300 MW of firm peaking** capability to avoid power shortages during extreme cold weather events
- **-900** annual average MW of low-cost, zero-carbon energy** (enough energy to support ~450,000 households or 1.7x the City of Portland) as well as **operational flexibility** services

+ How much would it cost to replace the power benefits of the four lower Snake River dams in E3's study with breaching in 2032?

- In E3's **baseline scenario**, total net present value (NPV)*** replacement costs would be **-\$12 billion**
- In a **deep decarbonization scenario** with higher loads and zero emissions electricity by 2045, NPV costs range from **\$11.2-19.6 billion** with at least one emerging technology
 - Reaching deep decarbonization **absent breakthroughs in not-yet-commercialized emerging technologies**, NPV costs could increase to **\$42-77 billion**

+ What are the long-term rate impacts to ~2 million public power households in 2045?

- Public power costs increase by **8-18% or ~\$100-230 per year across most scenarios**
 - Costs increase by **34-65% or ~\$450-850 per year** under deep decarbonization scenario **absent emerging technology breakthroughs**

+ What resources are needed to replace the dams?

- A combination of **renewable generation** (wind), "**clean firm**" **resources** (such as dual fuel natural gas + hydrogen plants, advanced nuclear, or gas with carbon capture and storage), and **energy efficiency**
- Battery storage cannot cost-effectively replace hydro capacity in the Northwest due to charging limitations during energy shortfall events

+ What is the timeline necessary to add the resources that would be required?

- E3 estimates that adding additional renewable energy and firm capacity additions would take approximately 5-7 years after congressional approval to breach the dams and possibly up to 10-20 years if additional new large-scale transmission was required. E3 assumed transmission would be built as needed for renewable additions.

Plant	Total Capacity (MW)
Lower Granite	930
Little Goose	930
Lower Monumental	930
Ice Harbor	693

Total = 3,483 MW

A large, leafy tree stands in the center of a wide, open landscape. The ground is flat and light-colored, possibly a field or plain. In the distance, there are low hills or mountains under a cloudy sky. A dark blue horizontal band is overlaid across the middle of the image, containing the text 'Study Approach'.

Study Approach



What grid services do the lower Snake River dams provide?



Little Goose



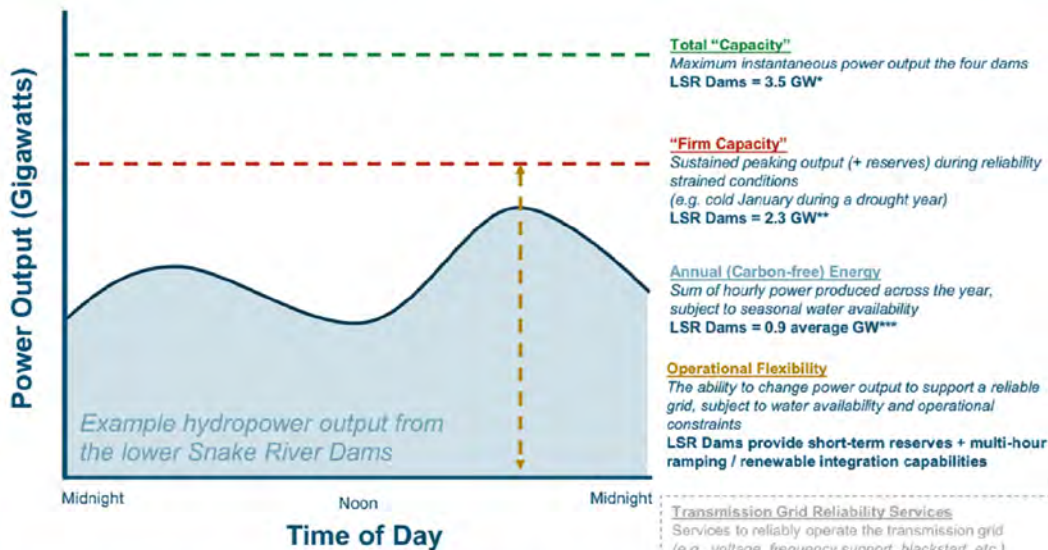
Lower Granite



Lower Monumental



Ice Harbor



E3's modeling selects the least-cost portfolio of resources to replace these services

Some of these services may be provided by modeled replacement resources, other may require additional investments

* Hydro traditionally operates above nameplate and closer to overload capacity (~15% above nameplate) and FERC uses these peak generation values in hydro licensing. Historical peak generation was 3,431 MW.

** Firm capacity assumed in this study is consistent with the ~65% Northwest hydro capacity value assumed by PNUCC (the Pacific Northwest Utilities Conference Committee).

*** Average GW means that on average across an average year the plant generated at ~0.9 GW, though its hourly output may be above or below that amount. LSR output was adjusted to reflect increased spill requirements of the EIS. However, E3's RESOLVE model uses 2001, 2005, and 2011 hydro years, which resulted in ~0.7 aMW of lower Snake River dams generation, making it a conservative estimate of the dams' GHG-free energy value.



The study uses an optimization model to determine the **least-cost** replacement resources for the four lower Snake River dams subject to **A) policy** and **B) reliability** constraints

- + **Least-cost optimization:** includes updated resource pricing and new emerging technologies
- + **Policy:** E3's modeling considers the effects of regional policies such as Washington's Clean Energy Transformation Act (CETA) and Oregon's 100% clean electricity standard
 - Aggressive clean energy laws drive coal power plant retirements, price carbon emissions, and require long-term carbon emissions reductions by 2045
 - Study includes significant electrification that increases demand for electricity to support carbon-reduction in other sectors such as transportation, buildings, and industry, consistent with Washington's Energy Strategy
- + **Reliability:** E3's modeling captures the need for the Northwest system to meet peak load during extreme weather and low hydro conditions (known as "resource adequacy").
 - Captures the abilities and limits of different technologies to serve load during reliability challenging conditions
 - E.g. during extended cold-weather periods with high load, low hydropower availability, and low wind and solar production
 - Resources with high energy production costs may be selected for reliability needs but then run sparsely only during extreme conditions (e.g. natural gas + hydrogen combustion turbines)
- + **LSR operations:** incorporates preferred alternative operations selected in the EIS
 - Increases spill from the dams, lowering available annual energy and changing operational flexibility



Policy landscape: Washington, Oregon, California

+ The study includes the impacts from clean energy policies in the Pacific states

	RPS or Clean Energy Standard?	Coal Prohibition?	Cap-and-Trade?	New Natural Gas?	Economy-Wide Carbon Reduction?
WA	✓ Carbon neutral by 2030, 100% carbon free electricity by 2045	✓ Eliminate by 2025	✓ Cap-and-invest program established in 2021, SCC in utility planning	✓	✓ 95% GHG emission reduction below 1990 levels and achieve net zero emissions by 2050
OR	✓ 50% RPS by 2040, 100% GHG emission reduction by 2040, relative to 2010 levels	✓ Eliminate by 2030	✓ Climate Protection Plan adopted by DEQ in 2021 (power sector not included)	✗ HB 2021 bans expansion or construction of power plants that burn fossil fuels	✓ 90% GHG emission reduction from fossil fuel usage relative to 2022 baseline
CA	✓ 60% RPS by 2030, 100% clean energy by 2045	✓ Coal-fired electricity generation already phased out	✓	✗ CPUC IRP did not allow in recent procurement order	✓ 40% GHG emission reduction below 1990 levels by 2030 and 80% by 2050



Study uses E3's Northwest RESOLVE Model

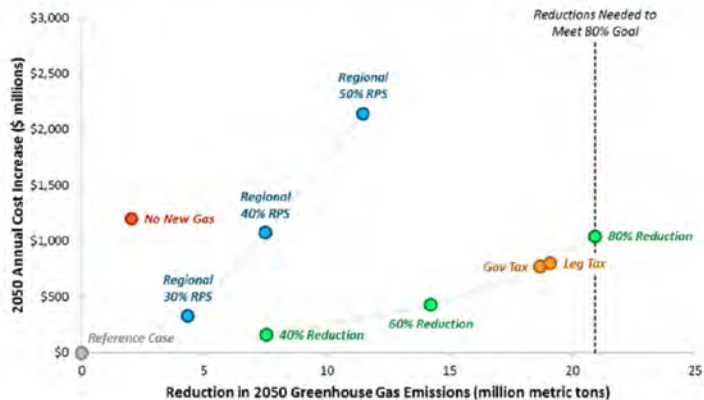
- + E3 has used RESOLVE across North America to tackle complex policy and planning questions
 - RESOLVE develops optimal portfolios of **zero-carbon resources** to meet policy and reliability goals

- + E3 has used RESOLVE in several prior Pacific Northwest studies
 - PNW Low-Carbon Scenario Analysis (PGP, 2017)
 - PNW Zero-Emitting Resources Study (ENW, 2021)

RESOLVE Case Studies



Pacific Northwest Low-Carbon Scenarios





1

With the lower Snake River dams, optimize long-term resource needs and operations for the Pacific Northwest

- Produces necessary resource additions and total system costs and emissions

2

Remove the lower Snake River dam generating capacity, then re-optimize long-term resource needs and operations for the Pacific Northwest

- Produces a second set of resource additions and total system costs and emissions
- All scenarios breach the dams in 2032, except for one scenario in 2024

3

Calculate additional resources and investment + operational costs required to replace the dams

- Calculated as the difference between steps 1 and 2 above



Key modeling assumptions



Element	Study Approach	Impact on Dams Replacement Needs
Study Years	<ul style="list-style-type: none"> 2025 through 2045*, including fuel price forecasts and declining renewable + storage costs 	Considers long-term needs
Clean Energy Policy Scenarios	<ul style="list-style-type: none"> Aggressive OR+WA legislation reflected, including coal retirements + carbon pricing** Two electric emissions scenarios considered: <ol style="list-style-type: none"> 100% clean retail sales (~65-85% carbon reduction***) Zero-emissions (100% carbon reduction) 	Clean energy policy requires long-term replacement of LSR dams with GHG-free energy
Load Growth Scenarios	<ul style="list-style-type: none"> Two load scenarios: <ol style="list-style-type: none"> Baseline (per NWPCC 8th Power Plan) High electrification load growth (to support economy-wide decarbonization) Significant quantities of energy efficiency are embedded in all scenarios 	Higher load scenarios increase the value of LSR dams energy + firm capacity
Reliability Needs	<ul style="list-style-type: none"> Modeling ensures reliability needs during extreme conditions (e.g. high loads + low hydro) Captures ability (and limits) of renewables, battery storage, and demand response to support system reliability 	Reliability needs require replacement of LSR dams firm capacity contributions
Technologies Modeled, including "Emerging" Technologies	<ul style="list-style-type: none"> Broad range of dam replacement technology options considered: <ul style="list-style-type: none"> Baseline technologies: solar, wind, battery + pumped storage, energy efficiency, demand response, dual fuel natural gas + hydrogen combustion plants Sensitivities include Emerging Technologies and Limited Technologies (No New Combustion) scenarios Resource costs developed by E3 using NREL 2021 ATB, Lazard Cost of Storage v.7, NuScale Power (for small modular reactor costs) 	Technology available for LSR dams replacement determines replacement cost
Distributed Energy Resource Options	<ul style="list-style-type: none"> Energy efficiency, demand response, and customer solar embedded into modeling inputs Additional energy efficiency and demand response can be selected 	Demand resource can help replace LSR dams , though low-cost supply is limited

* 20-years of end effects are also considered in RESOLVE (2045-2065) and LSR Dam replacement costs were calculated based on 50-years (e.g. 2032-2082)

** The carbon price assumed drives the region to >100% CES by 2045, so a scenario without a carbon price was modeled to understand the LSR dam replacement impacts of a binding CES target.

*** A 100% clean retail sales target allows emissions for electric generation beyond that needed to serve "retail sales", i.e. losses during transmission to retail loads and exported energy.



+ Scenario 1: 100% Clean Retail Sales

- Northwest resources produce enough clean energy to meet **100% of retail electricity sales** on an annual average basis
- Some gas generation is retained for reliability, but carbon emissions are reduced **85% below 1990 levels**
- **Business-as-usual** load growth

+ Scenario 2: Deep Decarbonization

- **Zero carbon emissions** by 2045
- **High electrification** of buildings, transportation, and industry to reduce carbon emissions in other sectors
- **Emerging technologies** become available to provide firm, carbon-free power

Technology	S1 100% Clean	S2a Deep Decarb Baseline	S2b Deep Decarb Emerging Tech.	S2c Deep Decarb No New Combustion	
Mature technologies (solar, wind, battery + pumped storage, energy efficiency, demand response)	Available	Available	Available	Available	Available
Hydrogen (existing natural gas retrofits)	Available	Available	Available	Available	Available
Hydrogen (new dual fuel natural gas + hydrogen)	Available	Available	Available	Not available	Not available
Nuclear (small modular reactors)	Not available	Not available	Available	Not available	Not available
Natural Gas w/ Carbon Capture and Storage	Not available	Not available	Not available	Not available	Not available
Offshore Wind (floating)	Not available	Not available	Available	Available	Available

Emerging Technologies



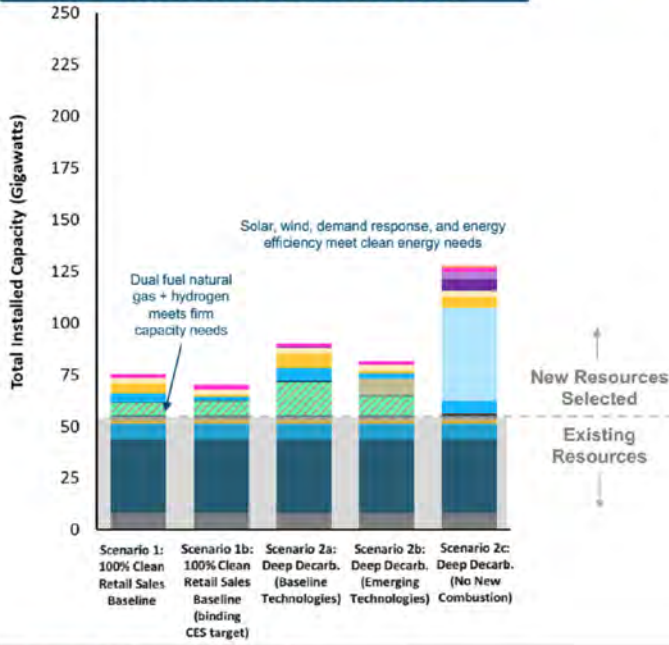


Northwest Resource Needs in Scenarios With the Lower Snake River Dams

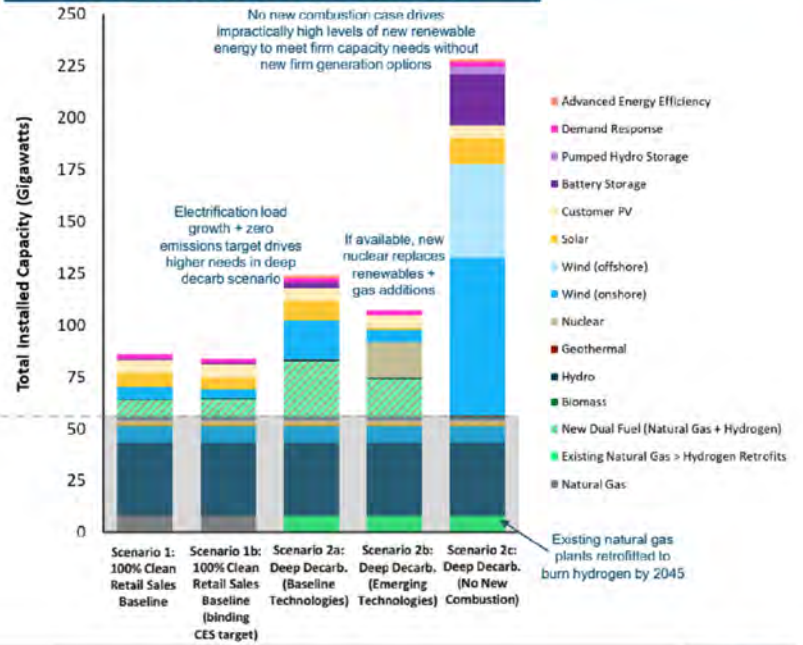


Even without breaching the dams, all scenarios show large levels of new resource additions

2035 Northwest Resource Mix



2045 Northwest Resource Mix





Replacing the Power from the Lower Snake River Dams



Replacement resources selected to replace the lower Snake River dams

- + RESOLVE selects an optimal portfolio of replacement resources including additional advanced energy efficiency, wind, solar, green hydrogen, and/or advanced nuclear
- + Firm capacity is mostly replaced with ~2 GW of dual fuel natural gas + hydrogen turbines
 - These turbines may initially burn natural gas when needed during reliability challenged periods, but would transition to hydrogen by 2045 to reach zero-emissions
- + If advanced nuclear is available, it replaces renewables and some of the gas plants
- + The “no new combustion” scenario requires impractically large (~12 GW) buildout of renewable energy to replace the dams’ firm capacity contributions and GHG-free energy
 - A range of costs was developed for this scenario based on the assumed transmission needs for renewable additions

Scenario	Replacement Resources Selected, Cumulative by 2045 (GW*)
Scenario 1: 100% Clean Retail Sales	+ 2.1 GW dual fuel NG/H2 CCGT + 0.5 GW wind
Scenario 1b: 100% Clean Retail Sales (binding CES target)**	+ 1.8 GW dual fuel NG/H2 CCGT + 1.3 GW solar + 1.2 GW wind
Scenario 2a: Deep Decarb. (Baseline Technologies)	+ 2.0 GW dual fuel NG/H2 CCGT + 0.3 GW li-ion battery + 0.4 GW wind + 0.05 GW advanced energy efficiency + additional H2 generation***
Scenario 2b: Deep Decarb. (Emerging Technologies)	+ 1.5 GW dual fuel NG/H2 CCGT + 0.7 GW nuclear SMR
Scenario 2c: Deep Decarb. (No New Combustion)	+ 10.6 GW wind + 1.4 GW solar

* 1 GW = 1,000 MW

** In scenario 1b, the 100% CES target is binding in 2045, causing the need to fully replace the GHG-free energy output of the LSR dams. In scenario 1, the high carbon price assumed drives the region higher than the 100% CES target, making it a non-binding constraint in the model.

*** Replacing LSR dams GHG-free energy at least-cost leads RESOLVE to generate an additional 1.2 TWh of hydrogen generation during low renewable conditions (or 0.14 average GW).

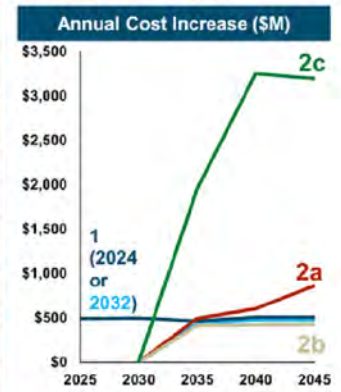


Total costs for replacing the lower Snake River dams

+ Costs are expected to fall on Bonneville Power Administration's public power customers

- Costs could increase public power retail costs by 8-18%, or up to 34-65% absent emerging technologies
- Costs could raise annual residential electricity bills by up to \$100-230/year, or up to \$450-850/yr absent emerging technologies

	Total Costs (real 2022 \$)	Annual Cost Increase (real 2022 \$)			Incremental Public Power Costs [% increase vs. ~8.5 cents/kWh NW average retail rates]
	Net Present Value in year of breaching	2025	2035	2045	2045
Scenario 1: 100% Clean Retail Sales	\$12.4 billion	n/a	\$434 million	\$478 million	0.8 cents/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$12.8 billion	\$495 million	\$466 million	\$509 million	0.8 cents/kWh [+9%]
Scenario 1b: 100% Clean Retail Sales (binding CES target)	\$12.0 billion	n/a	\$445 million	\$473 million	0.8 cents/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$19.6 billion	n/a	\$496 million	\$860 million	1.5 cents/kWh [+18%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$11.2 billion	n/a	\$415 million	\$428 million	0.7 cents/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$42 – 77 billion	n/a	\$1,045 – 1,953 million	\$1,711 – 3,199 million	2.9 – 5.5 cents/kWh [+34 – 65%]



Deep decarbonization without emerging technologies drives very high costs

Cost differences driven primarily by 2045 carbon policy and availability of emerging technologies

Costs increase over time as loads grow and carbon policy becomes more stringent

- Cost increases account for replacement energy, capacity, and reserves as well as avoided LSR capital expense, but do not include any costs for breaching the dams, which would be an additional cost.
- NPV and annual cost increase are shown for the Northwest Region as a whole, but the incremental costs are calculated relative to the BPA Tier I annual sales for public power customers. NPV calculated over a 50-year period following the date of breaching, using a 3% discount rate based on the public power cost of capital.
- % increase versus average retail rates assumes ~8.5 cents/kWh retail rates (estimated from OR and WA average retail rates). This does not include additional rate increases driven by higher loads or clean energy needs that increase regional rates as shown in the earlier 2045 incremental cost chart.
- Annual residential customer cost impact assumes 1,280 kWh/month for average residential customers in Oregon and Washington (current ~1,000 kWh/month average + 28% from electrification load growth).
- New federal tax credits for hydrogen plants/fuels or ITC/PTC extension for renewables would provide a cost reduction to public power customers from taxpayers
- Lower end of range for scenario 2c assumes limited transmission build out (based on replacement resource additions' marginal ELCC instead of delivering the full nameplate capacity). annual cost plot shows only high end of range



Cost of generation for lower Snake River dams replacement resources (using common utility metric of \$/MWh)

- + The lower Snake River dams provide a low-cost source of GHG-free energy and firm capacity
- + Even in a best-case scenario, replacement power would cost several times as much as the lower Snake River dams costs
 - This is driven by both energy replacement as well as replacement of firm capacity and operational flexibility
- + Compared to ~\$13-17/MWh for the lower Snake River dams, replacement resources cost between \$77-139/MWh
 - Replacement costs rise to ~\$275-500/MWh in a deep decarbonization scenario absent emerging technology

Incremental LSR Dam Replacement Resource Costs

Lower Snake River Dams All-in Generation Costs (2022 \$/MWh)
\$13/MWh w/o LSRCP*
\$17/MWh w/ LSRCP*

Scenario	2045 Costs to replace LSR Generation** (real 2022 \$/MWh)
Scenario 1: 100% Clean Retail Sales	\$77/MWh
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$82/MWh
Scenario 1b: 100% Clean Retail Sales (binding CES target)	\$77/MWh
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$139/MWh
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$69/MWh
Scenario 2c: Deep Decarb. (No New Combustion)	\$277 – 517/MWh

* BPA directly funds the annual operations and maintenance of the Lower Snake River Compensation Plan (LSRCP) fish hatcheries and satellite facilities. Congress authorized the LSRCP as part of the Water Resources Development Act of 1976 (90 Stat 2917) to offset fish and wildlife losses caused by construction and operation of the four lower Snake River projects.

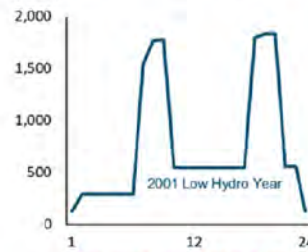
** Replacement \$/MWh costs are calculated as CoreNW revenue requirement increase with LSR dams breached divided by the annual MWh of the LSR dams assumed in E3's modeling (~700 aMW). These costs includes replacement of the LSR dam energy, capacity, and reserve provision. A significant portion of the costs is capacity costs to replace the dams' RA capacity contributions.



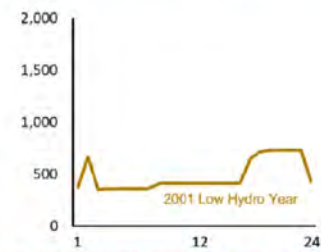
Firm capacity value of the lower Snake River dams

- + The firm capacity value is a significant driver of replacements costs
- + PNUCC 2021 estimate of NW hydro sustained peaking capacity was used for the lower Snake River dams' firm capacity value (65% or 2.3 GW)
- + E3 also analyzed modeled hourly LSR dam output during the 2001 low hydro year (using BPA data post EIS spill requirements)
 - Suggests a winter firm capacity value of ~56-60%
- + E3 predicts a continued concentration of risk in the winter in deep decarbonization scenarios with high space heating electrification
 - However, in a system with higher summer reliability risk, the LSR firm capacity value would be lower
 - E3 estimates the impact of a lower firm capacity value for S1 and S2a scenarios to be:
 - 1.5 GW firm capacity value (43%) → ~9-20% lower NPV replacement cost
 - 1.0 GW firm capacity value (29%) → ~14-33% lower NPV replacement cost

January Max. Power Output (MW)

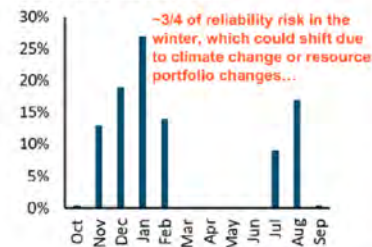


August Max. Power Output (MW)

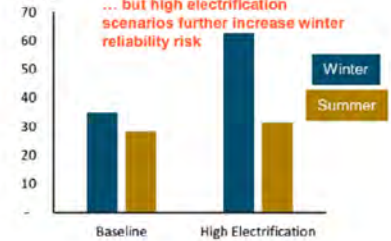


Assuming the Northwest remains winter reliability challenged, LSR Dams could have contributed ~56-60% of total capacity or 1.9-2.1 GW* in the 2001 low hydro year

NWPCC 2024 RA Assessment % of Annual Adequacy Events



Peak on RESOLVE Modeled Days in 2045 (MW)





Key conclusions

- 1. Replacing the four lower Snake River dams comes at a **substantial cost**, even assuming emerging technologies are available**
 - Require 2,300 – 4,300 MW of replacement resources
 - An annual cost of \$415 million – \$860 million by 2045*
 - Total net present value replacement cost of \$11.2 – 19.6 billion based on 3% discounting over a 50-year time horizon following the date of breaching
 - Increase in costs for public power customers of \$100 – 230 per household per year (an 8 – 18% increase) by 2045
- 2. The biggest cost drivers for replacement resources are the need to **replace the lost firm capacity** and the need to **replace the lost zero-carbon energy****
- 3. Replacement resources become **more costly over time** due to increasingly stringent clean energy standards and electrification-driven load growth**
- 4. **Emerging technologies** such as hydrogen, advanced nuclear, and carbon capture can limit the cost of replacement resources to meet a zero emissions electric system, but the pace of their commercialization is highly uncertain**
 - Replacing the dams in deep decarbonization scenarios without any emerging technologies requires impractical levels of renewable additions at a very high cost (\$42-77 billion NPV cost)

* Replacement resource costs are calculated assuming project financing per E3's pro forma calculator, rather than assuming upfront congressional appropriation



Thank you

Questions, please contact:

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Aaron Burdick, aaron.burdick@ethree.com

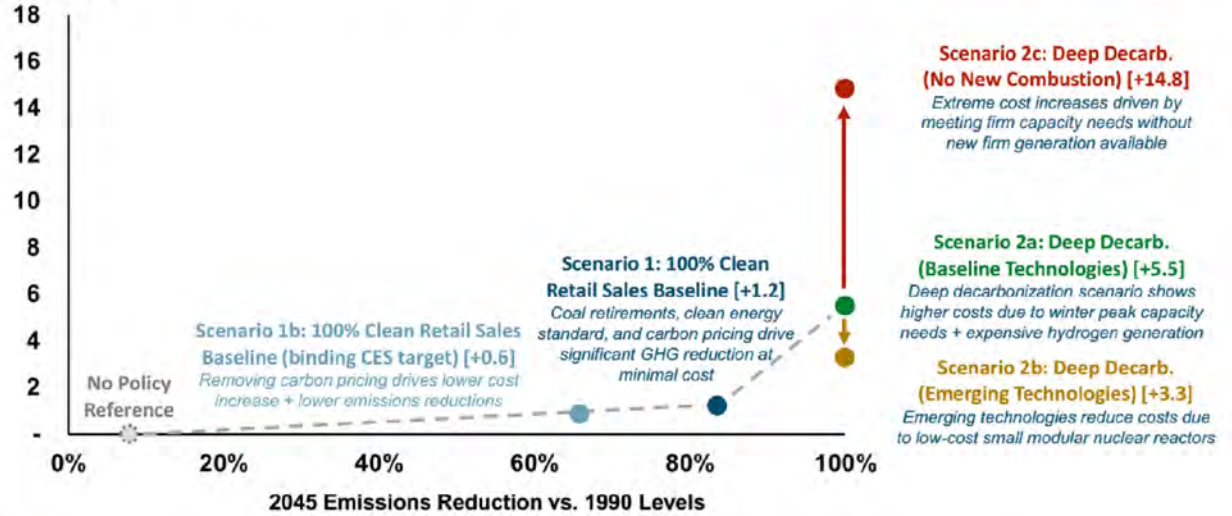


Appendix A: Additional Modeling Results



Significant carbon reductions are possible, but the cost of reaching zero emissions depends on technologies available

2045 Incremental Cost, Relative to No Policy Scenario (cents/kWh)



NOTES:

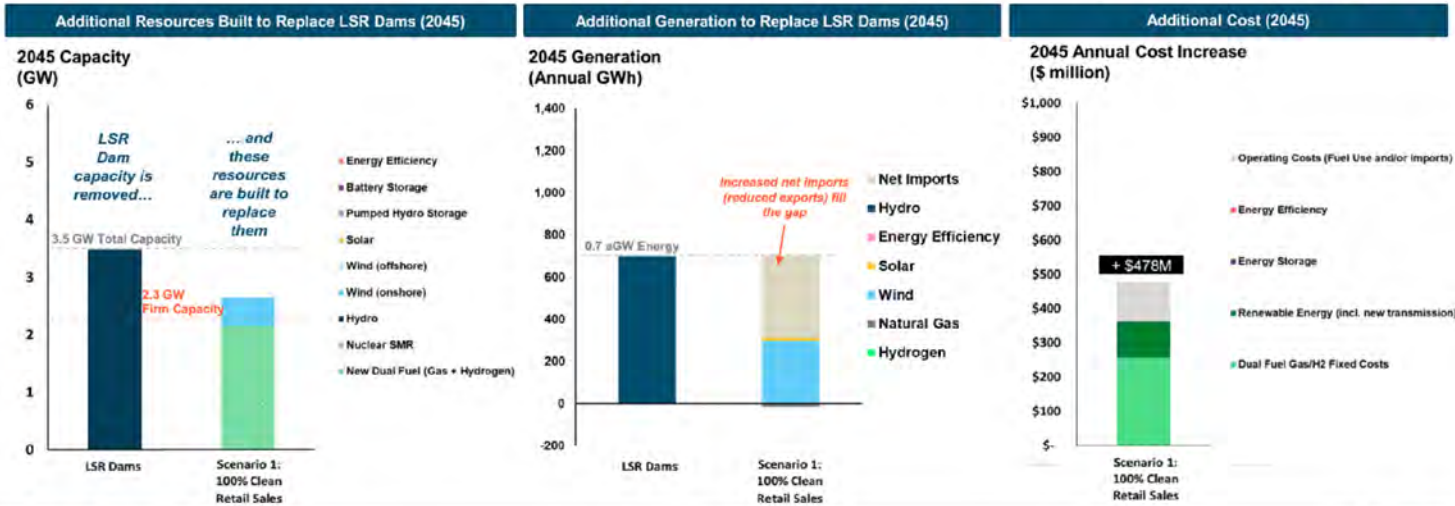
- 2020 average retail rates for OR and WA were 8-9 cents/kWh; 1990 electric emissions were ~33 MMT
- High electrification scenarios would avoid natural gas infrastructure costs, which would offset some of the electric peaking infrastructure cost increase



Replacing the Lower Snake River Dams

Scenario 1: 100% Clean Retail Sales

- + Capacity replaced with 2.2 GW of dual fuel natural gas + hydrogen turbines and 0.5 GW wind
- + Wind and imports provide the most energy replacement, but gas plant is needed for meeting extreme weather peak load events to avoid power shortages
- + 2045 GHG emissions increase ~11% as not all LSR generation needs to be replaced to still meet 100% clean retail sales target

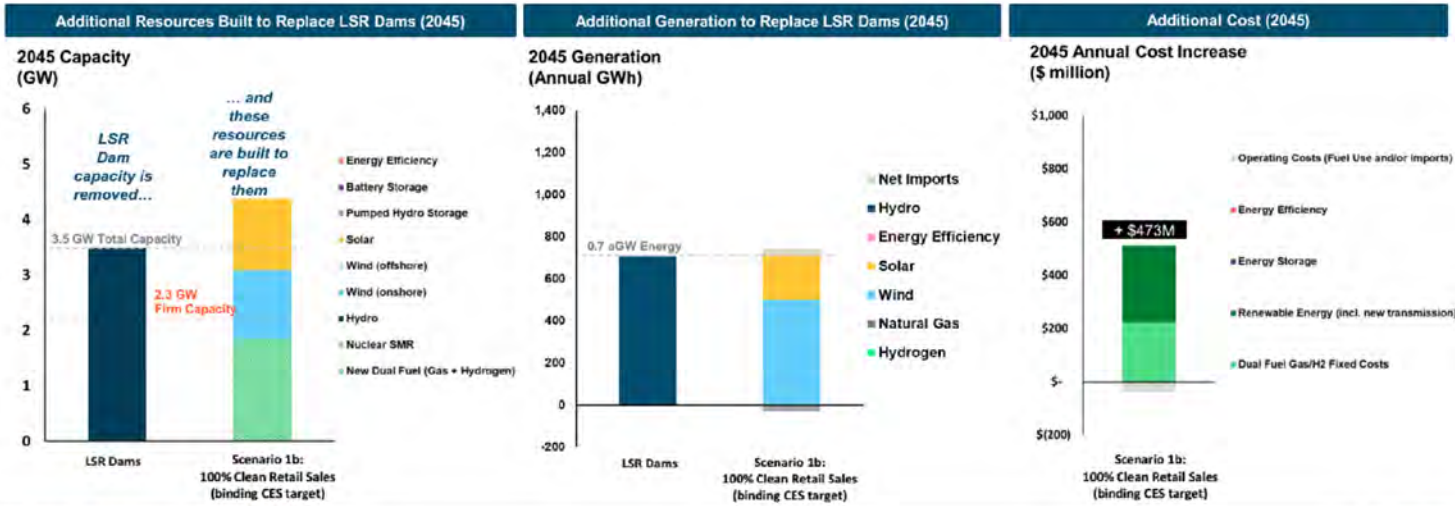




Replacing the Lower Snake River Dams

Scenario 1b: 100% Clean Retail Sales (binding CES target)

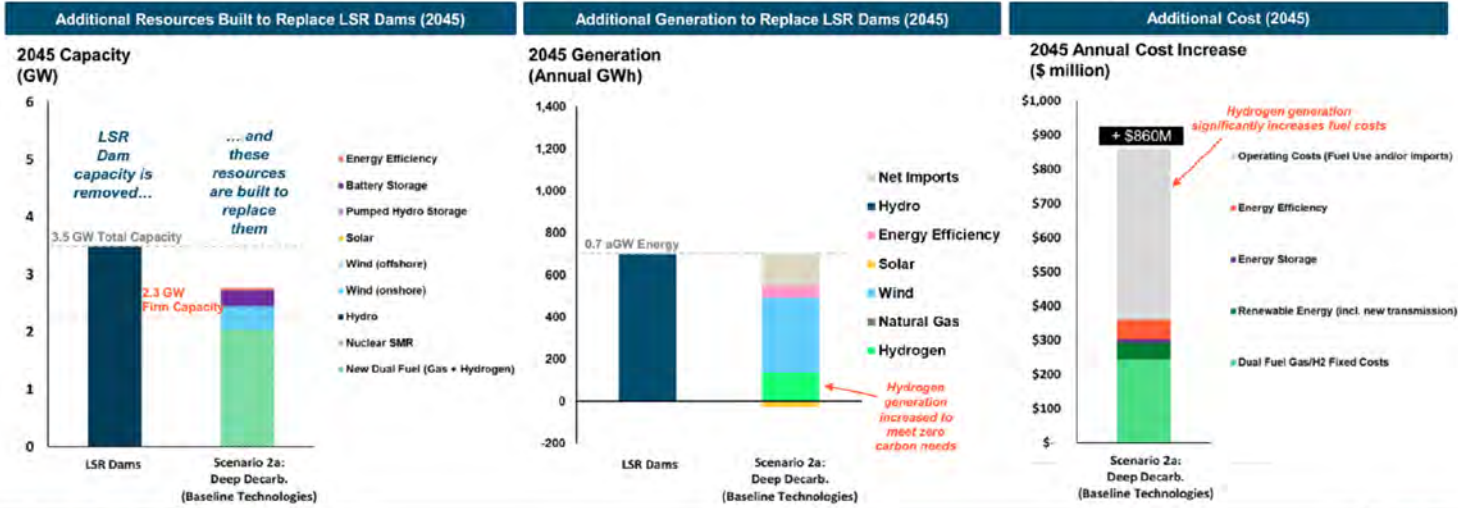
- + Capacity replaced with 1.8 GW of dual fuel natural gas + hydrogen turbines, 1.3 GW solar, and 1.2 GW wind
- + Wind and solar provide the energy replacement, but gas plant is needed for meeting extreme weather peak load events to avoid power shortages





Replacing the Lower Snake River Dams Scenario 2a: Deep Decarbonization (Baseline Technologies)

- + Scenario includes electric load increases for transportation and other sectors
- + In 2045, hydrogen generation is a key replacement resource and is assumed to be available, though not commercially available today
- + This scenario would cost \$860 million dollars per year in 2045, driven by high hydrogen fuel costs (~\$40/MMBtu)

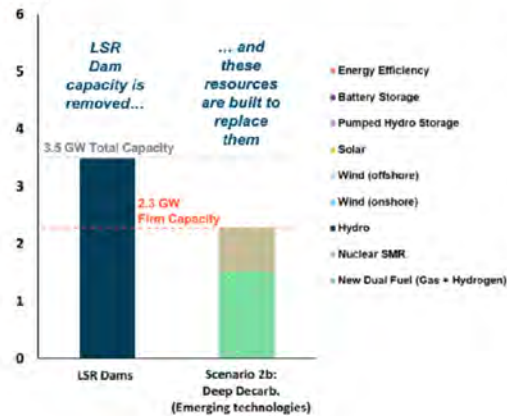




Replacing the Lower Snake River Dams Scenario 2b: Deep Decarbonization (Emerging Technologies)

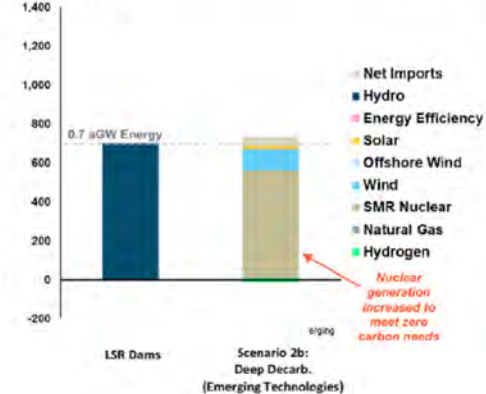
Additional Resources Built to Replace LSR Dams (2045)

2045 Capacity (GW)



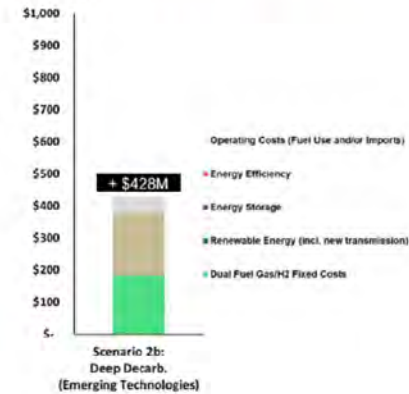
Additional Generation to Replace LSR Dams (2045)

2045 Generation (Annual GWh)



Additional Cost (2045)

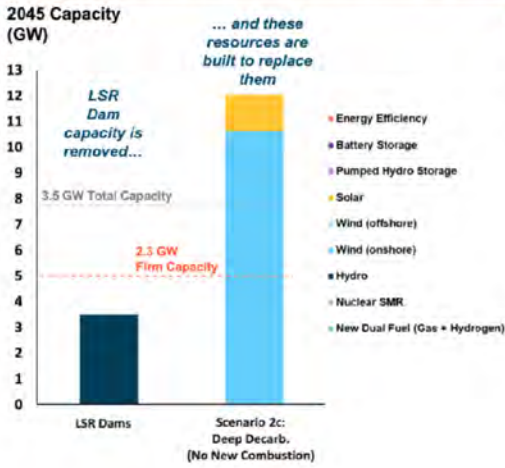
2045 Annual Cost Increase (\$ million)



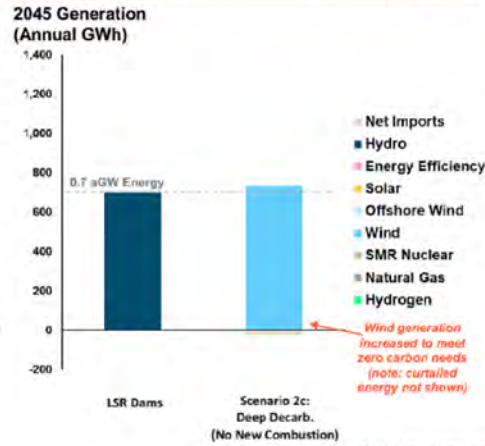


Replacing the Lower Snake River Dams Scenario 2c: Deep Decarbonization (No New Combustion)

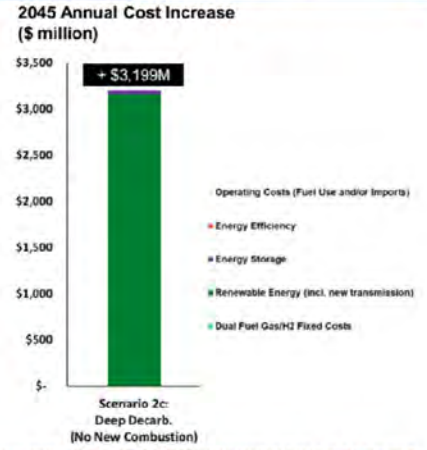
Additional Resources Built to Replace LSR Dams (2045)



Additional Generation to Replace LSR Dams (2045)



Additional Cost (2045)



- Note: in the cost summary, a range of costs was developed for this scenario based on the assumed transmission needs for renewable additions
- High end assumes 100% of nameplate, low end assumes 25% of nameplate (approx. marginal ELCC of renewable additions)
- Low end represents a higher ratio of renewable capacity to transmission capacity, recognizing that much of the additional energy added by 2045 would be curtailed due to over-supply

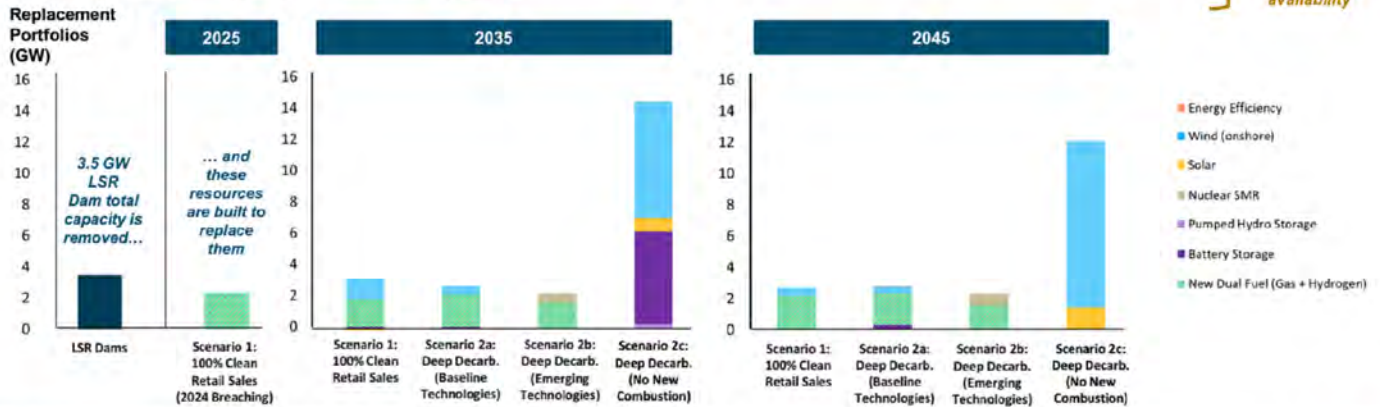


Replacing the Lower Snake River Dams Capacity Across All Scenarios

- + Scenario 1 (100% Clean Retail Sales, 2032 LSR Dams breaching): shown in previous slide
- + Scenario 1 (100% Clean Retail Sales, 2024 LSR Dams breaching): similar to scenario 1, but with dual fuel natural gas + hydrogen turbine replacement in 2025
- + Scenario 2a (Deep Decarbonization, Baseline Technologies): shown in previous slide
- + Scenario 2b (Deep Decarbonization, Emerging Technologies): small modular nuclear reactors replace LSR capacity and energy, instead of additional wind power
- + Scenario 2c (Deep Decarbonization, No New Combustion): very high replacement need as wind and solar alone struggle to replace LSR dam firm capacity and zero-carbon energy output

Limited load growth, carbon emissions remain in 2045

High load growth, carbon emissions eliminated by 2045... sensitive to emerging technology availability





632.33

89.635

632.33

12.569

Appendix B: Additional Modeling Inputs

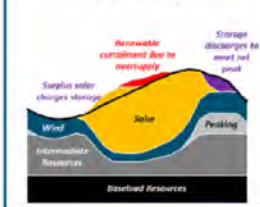


RESOLVE optimizes investments to meet clean energy targets reliably

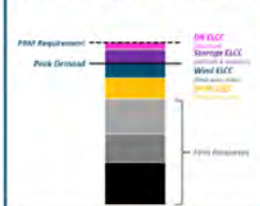
RESOLVE is an optimal capacity expansion model specifically designed to identify least-cost plans to meet reliability needs and achieve compliance with regulatory and policy requirements

- + Linear optimization model explicitly tailored to study challenges to arise at high penetrations of variable renewables and energy storage
- + Optimization balances fixed costs of new investments with variable costs of system operations, identifying a least-cost portfolio of resources to meet needs across a long time horizon

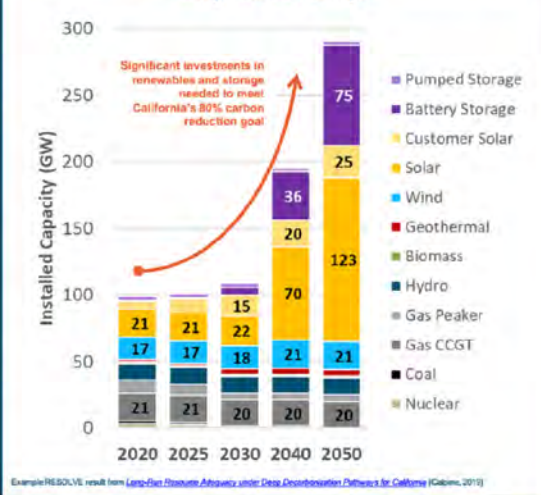
Operational module simulates hourly system operations for a sample of representative days



Reliability module ensures portfolio can meet load during extreme conditions using an ELCC approach



Least-cost plan cooptimizes investments and operations to meet clean energy policy targets, selecting from a diverse set of potential resources including wind, solar, storage, DSM, and natural gas





Load growth and carbon emissions in two clean energy scenarios modeled

Increases in Electricity Use and Declines in Carbon Emissions



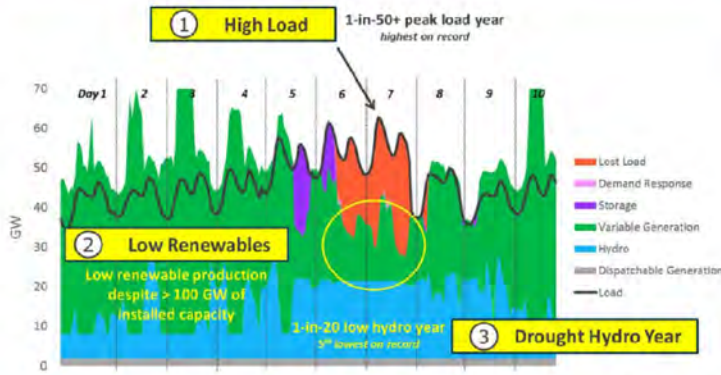
* Load based on 2021 NWPC Power Plan, shown as retail sales (after assumed growth in customer PV and energy efficiency)



Resource Adequacy Resource Options

- + RESOLVE resource adequacy constraint requires capacity to meet peak demand + a 15% planning reserve margin
 - Planning reserve margin (PRM) constraint is "installed capacity" (ICAP) based for firm resources, peaking capacity for hydro, ELCC for other non-firm resources
- + The nature of the Northwest reliability risk limits the ability of battery storage to provide reliable capacity contributions
 - Storage and hydro show "antagonistic" interactions, which limit energy storage reliability value in "energy-limited" conditions where energy storage resources are unable to charge (with low hydro and renewable output) and run out of discharge (during extended energy shortfall events)

Key Drivers of Future Pacific Northwest Reliability Events

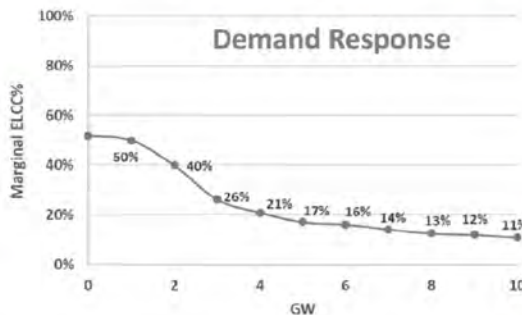
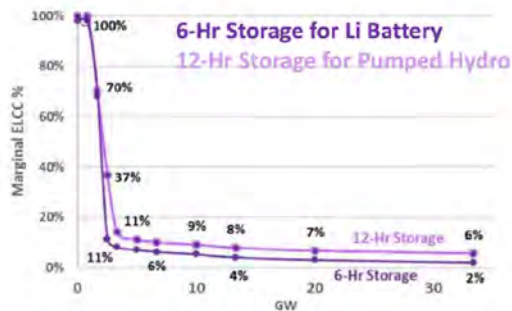
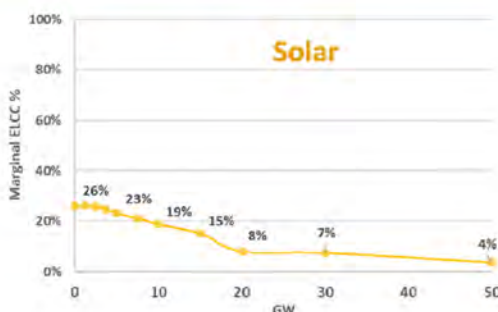
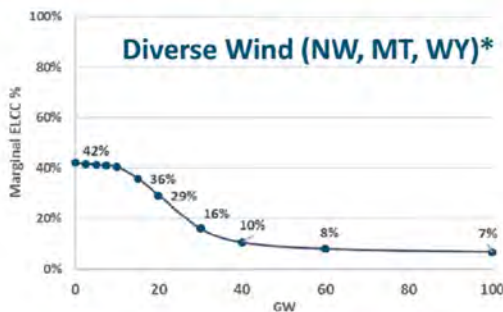


Sample week in 2050 in a 100% GHG reduction scenario, from E3, *Resource Adequacy in the Pacific Northwest*, 2019.

Resource	RA Capacity Contributions
Hydro	65%, based on sustained winter peaking capacity in critical water year conditions (per BPA/PNUCC)... WRAP method is still evolving
Battery storage	Sharply declining ELCCs*
Pumped storage	Sharply declining ELCCs*
Solar	Declining ELCCs
Wind	Declining ELCCs
Demand Response	Declining ELCCs
Energy Efficiency	Limited potential vs. cost
Small Hydro	Limited potential
Geothermal	Limited potential
Natural gas to H2 retrofits	Clean firm, but not fully commercialized
New dual fuel natural gas + H2 plants	Clean firm, but not fully commercialized
New H2 only plants	Clean firm, but not fully commercialized
Gas w/ 90-100% carbon capture + storage	Clean firm, but not fully commercialized
Nuclear Small Modular Reactors	Clean firm, but not fully commercialized



Incorporating Declining Capacity Contributions of Renewables, Storage, and DR



- + A reliable electric system requires enough capacity to meet peak loads and contingencies
- + This study incorporates information from E3's 2019 report *Resource Adequacy in the Northwest* about the effective capacity contribution of renewables, storage, and DR at various penetration levels

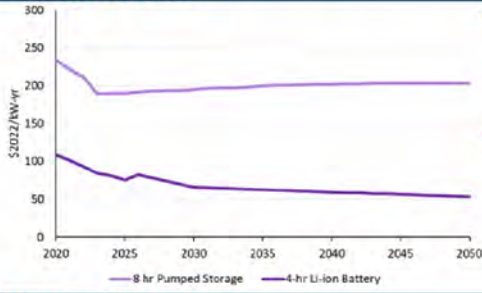
* The offshore wind sensitivity in this study assumed the same ELCC curve as modeled for diverse on-shore wind resources in the Resource Adequacy in the Northwest report.



New Resource Options

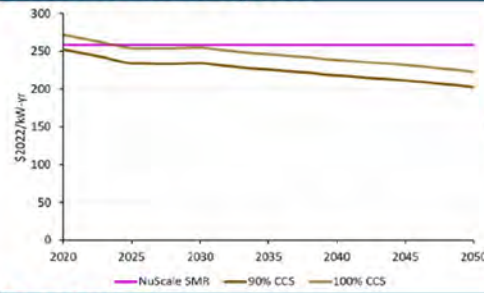
All-in Fixed Costs

Storage Options



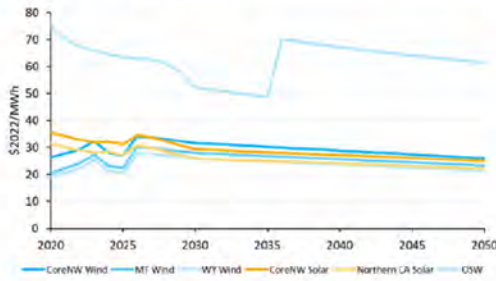
- + Battery Storage costs derived from E3's inhouse and Lazard LCOS 7.0 (Oct 2021)
- + Pumped storage is from Lazard's last published PHS costs (LCOS 4.0). Assumes CAPEX and FO&M are flat + financing cost trends same for battery storage.

Firm Low Carbon Options



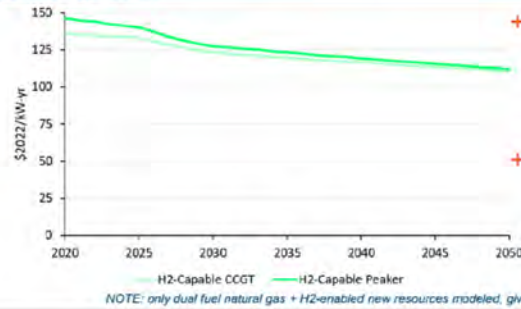
- + CCS costs derived from E3's inhouse "Emerging Tech" ProForma
- + SMR costs are derived from the vendor NuScale, for an "nth of a kind" installation of the technology they are developing

Renewable Options



- Renewable costs derived from E3's inhouse Pro Forma which integrates NREL ATB 2021
- Costs shown here do not include the cost of upgraded or new Transmission lines

Gas Options



- + CCGT and peaker costs are derived from E3's inhouse ProForma which integrates NREL ATB 2021
- + New Hydrogen or upgrades include a ~10% additional cost that converges by 2050

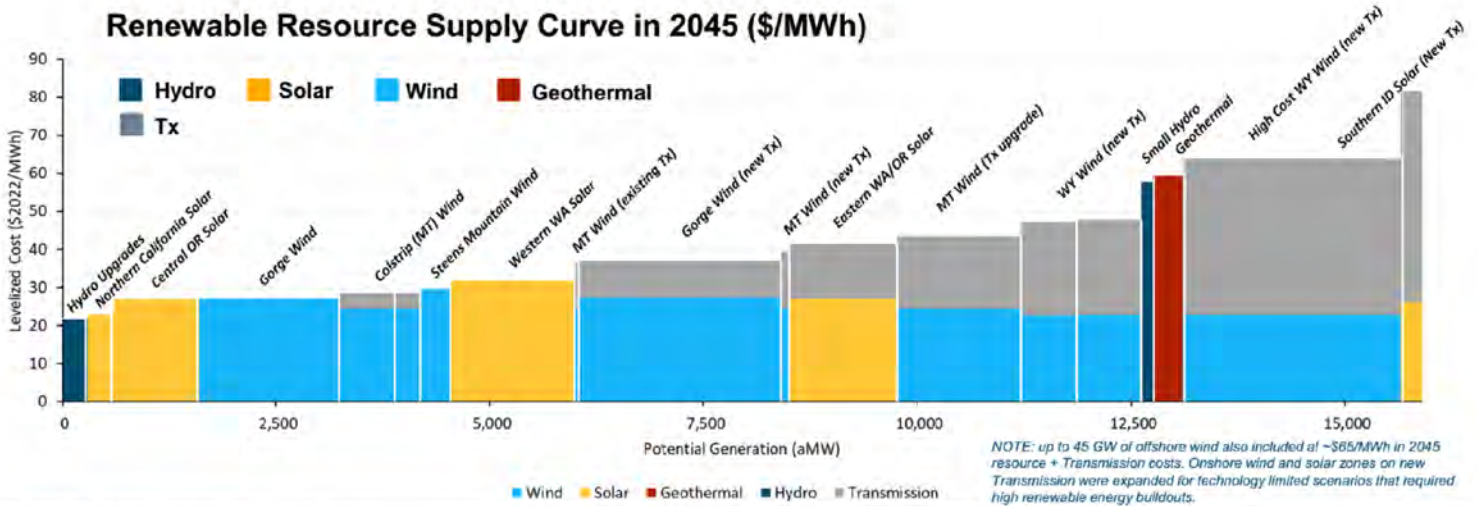
NOTE: only dual fuel natural gas + H2-enabled new resources modeled, given NW policy constraints



New Resource Options Renewables

- + The following supply curves integrate Transmission costs that RESOLVE sees
- + The “no new combustion” scenario required increases in the supply of wind on new transmission (Northwest, MT+WY, and offshore) to enable a feasible solution

Renewable Resource Supply Curve in 2045 (\$/MWh)





Hydro Operating Data

+ Key RESOLVE inputs (for each representative RESOLVE day)

- Max generation MW
- Min generation MW
- Daily MWh hydro budget
- Ramp

+ Hydro operating data is parameterized using representative conditions for 3 low/mid/high historical years (2001, 2005, 2011)

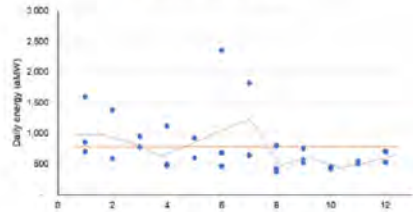
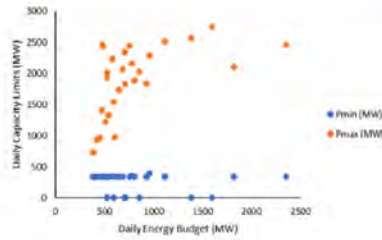
- Lower Snake River and lower Columbia River dams were adjusted per BPA hydro modeling w/ latest fish spill constraints

+ Hydro firm capacity contribution is assumed to be 65% of total MW, per PNUCC methodology (based on BPA 10-hr sustaining peaking capacity)

LSR Hydro

Ramp Rates

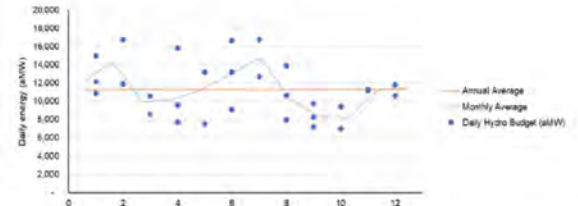
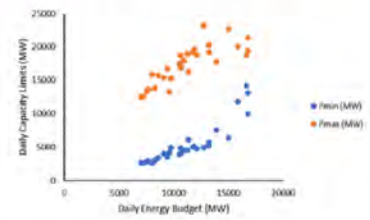
Hydro Resource	1-hr	2-hr	3-hr	4-hr
LSR_Hydro	36%	43%	45%	48%



Non-LSR NW Hydro

Ramp Rates

Hydro Resource	1-hr	2-hr	3-hr	4-hr
CoreNW_Hydro	14%	23%	30%	34%



BPA Lower Snake River Dams Power Replacement Study

July 2022



Energy+Environmental Economics

BPA Lower Snake River Dams Power Replacement Study

July 2022

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Acronym Definitions

Acronym	Definition
BPA	Bonneville Power Administration
BTM Solar	Behind-the-meter Solar
CA	California
CCGT	Combined cycle gas turbine
CCS	Carbon capture and storage
CES	Clean Energy Standard
CRSO EIS	Columbia River System Operations Environmental Impact Statement
DR	Demand response
EE	Energy efficiency
EIA	Energy Information Administration
ELCC	Effective load carrying capability
HDV	Heavy-duty vehicles
H2	Hydrogen
LDV	Light-duty vehicles
LSR	Lower Snake River
NERC	North American Electric Reliability Corporation
NG	Natural Gas
NV	Nevada
NW	Northwest
PNUCC	Pacific Northwest Utilities Conference Committee
PRM	Planning Reserve Margin
RM	Rocky Mountains
RPS	Renewable Energy Standard
SMR	Small modular reactor
SW	Southwest
WECC	Western Electricity Coordinating Council

Executive Summary

E3 was contracted by the Bonneville Power Administration to conduct an independent study of the value of the lower Snake River dams (“LSR dams”) to the Northwest power system. The dams provide approximately 3,500 megawatts (“MW”) of total capacity¹ and approximately 2,300 MW of firm peaking capability² to support regional reliability. They also generate approximately 900 average MW of zero-carbon energy each year³, provide essential grid services such as operating reserves and voltage support, and operational flexibility to support renewable integration. If the dams are breached, these power services will need to be replaced to ensure the Northwest power system can continue to provide reliable electricity service. Replacing the dams is complicated by the clean energy policies adopted either statutorily or voluntarily by jurisdictions and utilities throughout the region, which will necessitate a transformation of the power system over time toward non-emitting resources even as electricity demand grows substantially due to electrification of the transportation and building sectors.

This study uses E3’s Northwest RESOLVE model to study optimal capacity expansion scenarios with and without the lower Snake River dams, to determine the replacement resources and cost impacts to replace the dams’ power output. RESOLVE is an optimal capacity expansion and dispatch model that determines a least-cost set of investment and operational strategies to enable the “Core Northwest” region – consisting of Washington, Oregon, Northern Idaho, and Western Montana – to achieve its long-term clean energy policy goals at least-cost, while ensuring resource adequacy and operational reliability. RESOLVE has been used in several prior studies of electricity sector decarbonization in the Pacific Northwest⁴. Using RESOLVE allows for a dynamic optimization that considers replacement resource needs in the context of long-term system load and policy drivers, not just the near-term resource mix and needs of the system today. The dams are assumed to be breached in 2032, except for one sensitivity that considered 2024 breaching.

¹ Hydro traditionally operates above nameplate and closer to overload capacity (~15% above nameplate) and FERC uses these peak generation values in hydro licensing. The “total capacity” refers to the overload capacity, not the nameplate capacity. Historical peak generation was 3,431 MW.

² LSR dam firm capacity contributions are estimated using the PNUCC regional hydropower 65% capacity value, which was validated by looking at LSR Dam wintertime power and reserve provision during low hydro conditions. Additionally, E3 considered estimates on the impact of a lower firm capacity value in the results chapter.

³ The data for the LSR dams was adjusted to reflect the Preferred Alternative operations defined in the Columbia River Systems Operation Environmental Impact Statement (CRSO EIS). E3’s RESOLVE model uses 2001, 2005, and 2011 hydro years, which resulted in ~700 average MW of lower Snake River dams generation, making it a conservative estimate of the dams’ GHG-free energy value.

⁴ Pacific Northwest Low Carbon Scenario Analysis, December 2017, <https://www.ethree.com/projects/study-policies-decarbonize-electric-sector-northwest-public-generating-pool-2017-present/>; Pacific Northwest Zero-Emitting Resources Study, January 2020, <https://www.ethree.com/e3-examines-role-of-nuclear-power-in-a-deeply-decarbonized-pacific-northwest/>

This study's scenario design focuses on three key variables – clean energy policy, load growth, and emerging technology availability – that impact the cost to replace the dams. The scenarios and key assumptions are shown in Table 1.

Even with the dams in place, the region's clean energy goals and potential electrification load growth drive a significant need for new resources. In all scenarios, significant energy efficiency and customer solar is

embedded into the load forecast, based on the NWPPC's 8th Power Plan. Additionally, 6 gigawatts ("GW" or 6,000 MW) of coal capacity is retired by 2030, while increasing carbon prices incentivize further clean energy resource additions. In Scenario 1, the regional power system is required to meet a goal of generating enough clean energy to provide 100% of retail electricity sales, on an average basis over a calendar year. This requires an additional 5.5-7 GW of solar and 4.6-6 GW of wind by 2045 to achieve the clean energy goal; 0.6 GW of battery storage, 2 GW of demand response, and 9 GW of dual fuel natural gas + hydrogen combustion plants are also added to meet the region's resource adequacy needs.⁵

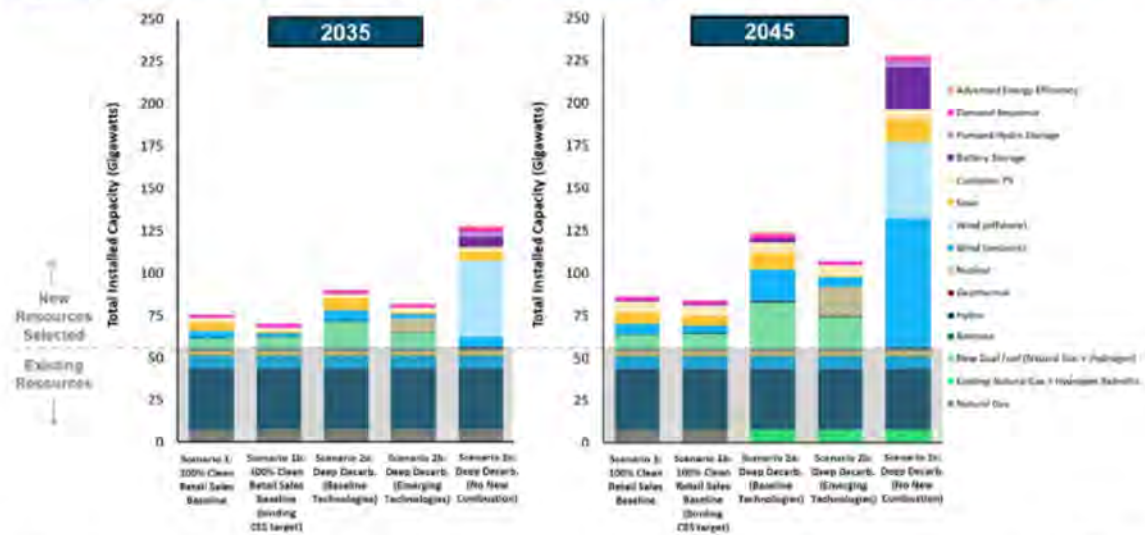
Though all scenarios require more "firm" resources – resources that can start when needed and operate for as long as needed – to meet peak loads, these resources are in higher demand in Scenario 2, in which all greenhouse gas emissions are eliminated from the regional power system by 2045. This scenario also assumes that electrification results in much higher electric loads, particularly in wintertime due to electrification of natural gas space heating in buildings. The baseline scenario (2a) selects additional wind, solar, and geothermal to meet clean energy needs as well as demand response, some battery storage, and 27 GW natural gas and hydrogen dual fuel combustion plants to meet reliability needs. An alternative "emerging technology" scenario selects 17 GW of advanced nuclear technology (small modular reactors or "SMRs") by 2045, in place of the firm capacity provided by natural gas generators while reducing the required quantities of wind, solar and batteries that are needed. The "no new combustion" scenario does not allow clean firm technologies such as hydrogen combustion turbines, gas generation with carbon capture and sequestration (CCS) or SMRs. As a result, it requires impractically high levels of additional onshore wind, offshore wind, and battery storage to meet firm capacity and carbon reduction needs, quadrupling the total installed MW of the Northwest grid by 2045.

Table 1. Scenario Design

Scenario	Clean Energy Policy	Load Growth	Technology Availability
1 100% Clean Retail Sales	100% retail sales (65-85% carbon reduction)	8 th Power Plan Baseline	Baseline (incl. natural gas / hydrogen dual fuel plants)
2a Deep Decarbonization (Baseline Tech.)	100% carbon reduction	High Electrification	Baseline
2b Deep Decarbonization (Emerging Tech.)	100% carbon reduction	High Electrification	Baseline + offshore wind, gas w/ CCS, nuclear SMR
2c Deep Decarbonization (No New Combustion)	100% carbon reduction	High Electrification	Baseline (excluding natural gas / hydrogen dual fuel plants)

⁵ E3 ran two versions of scenario 1. In scenario 1, the high carbon price assumed drives the region higher than the 100% CES target, making it a non-binding constraint in the model. In scenario 1b, the 100% CES target is binding in 2045, causing the need to fully replace the GHG-free energy output of the LSR dams. The values shown here represent the range of additions across both scenarios.

Figure 1. Northwest Installed Capacity Mix in Scenarios with the Lower Snake River Dams



When the power services provided by the dams are removed from the regional power system, RESOLVE selects an optimal, i.e., least-cost portfolio of replacement resources that meets the Northwest’s clean energy and system reliability needs. These replacement resources require a large investment and come at a substantial cost that increase over time as the region’s clean energy goals become more stringent. In the latter years, the replacement costs are highly dependent on scenario-specific assumptions about the availability of emerging technologies. RESOLVE primarily replaces the carbon-free energy from the dams with additional wind and solar power and the firm capacity with dual fuel natural gas and hydrogen combustion plants. Small amounts of additional energy efficiency and battery storage are also selected in some scenarios. By 2045, the dual fuel plants added burn additional hydrogen on low wind days to replace the carbon-free energy provided by the dams. Scenario 2b selects additional nuclear SMRs in lieu of some of the wind and gas resources. Scenario 2c disallows the new combustion plants, even those that would burn green hydrogen, and other emerging technologies, requiring a very large buildout of wind and solar power to replace both the firm capacity and the carbon-free energy of the dams.

The long-term emissions impact of removing the generation of the lower Snake River dams will depend on the implementation of the Oregon and Washington electric clean energy policies. Both a 100% clean retail sales and a zero-carbon emissions target require replacement of most or all of the LSR dams’ GHG-free energy. However, without additional earlier carbon-free resource investments beyond those modeled in this study to meet clean energy policy trajectories, carbon emissions may increase initially when the dams are breached, before declining by 2045 as the carbon policy becomes more stringent.

Table 2. Summary of LSR Dams Replacement Resources and Cost Impacts (costs in the table below and throughout this report are shown in real 2022 dollars)

Scenario	Replacement Resources Selected, Cumulative by 2045 (GW)	NPV Replacement Costs ⁶	Annual Replacement Costs ⁷			Public Power Rate Impact ⁸
			2025	2035	2045	2045
Scenario 1: 100% Clean Retail Sales	+ 2.1 GW dual fuel NG/H ₂ CCGT + 0.5 GW wind	\$12.4 Billion	-	\$434 million/yr	\$478 million/yr	0.8 ¢/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam removal)	+ 2.1 GW dual fuel NG/H ₂ CCGT + 0.5 GW wind	\$12.8 Billion	\$495 million/yr	\$466 million/yr	\$509 million/yr	0.8 ¢/kWh [+9%]
Scenario 1b: 100% Clean Retail Sales (binding CES target)	+ 1.8 GW dual fuel NG/H ₂ CCGT + 1.3 GW solar + 1.2 GW wind	\$12.0 Billion	-	\$445 million/yr	\$473 million/yr	0.8 ¢/kWh [+9%]
Scenario 2a: Deep Decarbonization (Baseline Technologies)	+ 2.0 GW dual fuel NG/H ₂ CCGT + 0.3 GW li-ion battery + 0.4 GW wind + 0.05 GW solar + 1.2 TWh H ₂ -fueled generation	\$19.6 Billion	-	\$496 million/yr	\$860 million/yr	1.5 ¢/kWh [+18%]
Scenario 2b: Deep Decarbonization (Emerging Technologies)	+ 1.5 GW dual fuel NG/H ₂ CCGT + 0.7 GW nuclear SMR	\$11.2 Billion	-	\$415 million/yr	\$428 million/yr	0.7 ¢/kWh [+8%]
Scenario 2c: Deep Decarbonization (No New Combustion)	+ 10.6 GW wind + 1.4 GW solar	\$42 – 77 billion ⁹	-	\$ 1,045 – 1,953 million/yr	\$1,711 – 3,199 million/yr	2.9 – 5.5 ¢/kWh [+ 34 – 65%]

KEY FINDINGS:

✦ **Replacing the four lower Snake River dams while meeting clean energy goals and system reliability is possible but comes at a substantial cost**, even assuming emerging technologies are available:

- Requires 2,300 – 4,300 MW of replacement resources
- An annual cost of \$415 million – \$860 million by 2045
- Total net present value cost of \$11.2-19.6 billion based on 3% discounting over a 50-year time horizon following the date of breaching
- Increase in costs for public power customers of \$100 – 230 per household per year (an 8 – 18% increase) by 2045

⁶ These NPV values are calculated assuming a 3% discount rate to represent the public power cost of capital, discounting 50-year of costs starting from the year of breaching (either 2032 or 2024).

⁷ Replacement resource costs are calculated assuming project financing per E3's pro forma calculator, rather than assuming upfront congressional appropriation.

⁸ This assumes that the annual replacement costs will be borne by BPA's Tier I public power customers. Percentage changes are shown relative to today's average OR + WA retail rate of ~8.5 ¢/kWh.

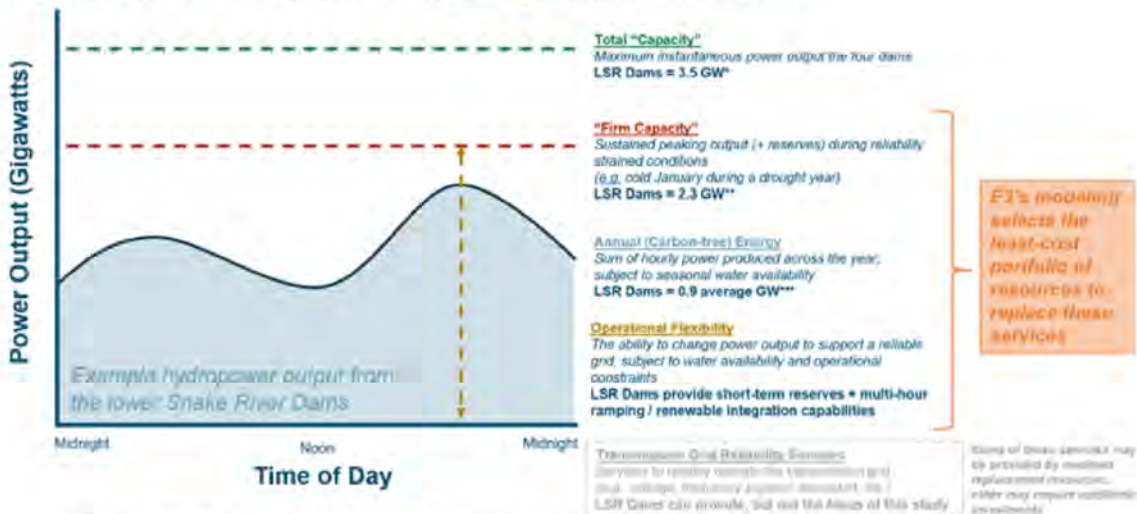
⁹ A range of costs was developed for this scenario based on the assumed transmission needs for renewable additions. High end assumes 100% of nameplate, low end assumes 25% of nameplate (approx. marginal ELCC of renewable additions). Low end represents a higher ratio of renewable capacity to transmission capacity, recognizing that much of the additional energy added by 2045 would be curtailed due to over-supply.

- + The biggest cost drivers for replacement resources are the need to replace the lost ***firm capacity for regional resource adequacy*** and the need to replace the lost ***zero-carbon energy***
- + Replacement becomes ***more costly over time*** due to increasingly stringent clean energy standards and electrification-driven load growth
- + ***Emerging technologies*** such as hydrogen, advanced nuclear, and carbon capture ***can limit the cost of replacement resources*** to meet a zero emissions electric system, but the pace of their commercialization is highly uncertain
 - In economy-wide deep decarbonization scenarios, ***replacement without any emerging technologies requires very large renewable resource additions at a very high cost*** (12 GW of wind and solar at \$42 – 77 billion NPV cost)

Background

E3 was contracted by the Bonneville Power Administration to conduct an independent study of the value of the lower Snake River dams (“LSR dams”) to the Northwest power system. The dams provide approximately 3,500 megawatts (“MW”) of total capacity¹⁰ and approximately 2,300 MW of firm peaking capability¹¹ to support regional reliability. They also generate approximately 900 average MW of zero-carbon energy each year, provide essential grid services such as operating reserves and voltage support, and operational flexibility to support renewable integration. Figure 2 shows the power services that are the focus of this study and those that are out of scope.

Figure 2. Power Services Considered for Replacement in this Study



* Hydro traditionally operates above nameplate and closer to overload capacity (~15% above nameplate) and FERC uses these peak generation values in hydro licensing. Historical peak generation was 3,431 MW.

** Firm capacity assumed in this study is consistent with the ~65% Northwest hydro capacity value assumed by PNUCC (the Pacific Northwest Utilities Conference Committee).

*** Average GW means that on average across an average year the plant generated at 0.9 GW, though its hourly output may be above or below that amount. The data for the LSR dams was adjusted to reflect the Preferred Alternative operations defined in the Columbia River Systems Operation Environmental Impact Statement ("CRSO EIS"). E3's RESOLVE model uses 2001, 2005, and 2011 hydro years, which resulted in ~700 average MW of lower Snake River dams generation, making it a conservative estimate of the dams' GHG-free energy value.

If the dams are breached, these power services will need to be replaced to ensure the Northwest power system can continue to provide reliable electricity service. Replacing the dams is complicated by the clean energy policies adopted either statutorily or voluntarily by jurisdictions and utilities throughout the region,

¹⁰ Hydro traditionally operates above nameplate and closer to overload capacity (~15% above nameplate) and FERC uses these peak generation values in hydro licensing. The "total capacity" refers to the overload capacity, not the nameplate capacity. Historical peak generation was 3,431 MW.

¹¹ LSR dam firm capacity contributions are estimated using the PNUCC regional hydropower 65% capacity value, which was validated by looking at LSR Dam wintertime power and reserve provision during low hydro conditions. Additionally, E3 considered estimates on the impact of a lower firm capacity value in the results chapter.

which will necessitate a transformation of the power system over time toward non-emitting resources even as electricity demand grows substantially due to electrification of the transportation and building sectors.

This study uses E3's Northwest RESOLVE model to study optimal capacity expansion scenarios with and without the lower Snake River dams, to determine the replacement resources and cost impacts to replace the dams' power output. RESOLVE is an optimal capacity expansion and dispatch model that determines a least-cost set of investment and operational strategies to enable the "Core Northwest" region – consisting of Washington, Oregon, Northern Idaho and Western Montana – to achieve its long-term clean energy policy goals at least-cost, while ensuring resource adequacy and operational reliability. RESOLVE has been used in several prior studies of electricity sector decarbonization in the Pacific Northwest¹². Using RESOLVE allows for a dynamic optimization that considers replacement resource needs in the context of long-term system load and policy drivers, not just the near-term resource mix and needs of the system today. The dams are assumed to be breached in 2032, except for one sensitivity that considered 2024 breaching.¹³

Key Study Questions:

- + What **additional resources** would be needed to replace the power services provided by the LSR Dams through 2045?
- + What is the **net cost** to BPA ratepayers?
- + How do costs and resource needs change under **different types of clean energy futures**?
- + How much does replacing the dams rely on **emerging, not-yet-commercialized technologies**?

This study builds off previous LSR dams replacement analysis by using a least-cost optimization-based modeling framework to replace the dams' power services. This optimization ensures that the region meets its aggressive clean energy policy goals, including both decarbonization of electricity as well as high electrification load growth consistent with economy-wide decarbonization goals set by Oregon and Washington.

The other key component of the optimization is maintaining resource adequacy for the region to ensure a reliable electricity supply to existing and any newly electrified loads. This is done using a planning reserve margin constraint and counting non-firm resources like solar, wind, battery storage, pumped hydro storage, and demand response at their effective load carrying capability ("ELCC"), based on E3's prior detailed loss of load probability modeling of the Northwest region.¹⁴

¹² Pacific Northwest Low Carbon Scenario Analysis, December 2017, <https://www.ethree.com/projects/study-policies-decarbonize-electric-sector-northwest-public-generating-pool-2017-present/>; Pacific Northwest Zero-Emitting Resources Study, January 2020, <https://www.ethree.com/e3-examines-role-of-nuclear-power-in-a-deeply-decarbonized-pacific-northwest/>

¹³ The study examines LSRD breaching in 10 years (2032) and in 2 years (2024), based on with the approach used in the CRSO EIS.

¹⁴ Resource Adequacy in the Pacific Northwest, March 2019, https://www.ethree.com/wp-content/uploads/2019/03/E3_Resource_Adequacy_in_the_Pacific-Northwest_March_2019.pdf

This modeling framework ensures that when the LSR dams are removed from the Northwest power system, a least-cost replacement mix of new investments and operational changes is found. Through the constraints of the optimization, this least-cost replacement mix meets the same clean energy policy and level of reliability as a system with the LSR dams still intact. This dynamic approach considers replacement resource needs in the context of the evolving long-term system load and policy drivers, not just the near-term resource mix and needs of the system today. It recognizes that significant levels of new renewable energy and other resources are already needed to meet long-term regional needs, ensuring that the replacement resource mix selected is incremental to the long-term buildout, not just an interim solution before clean energy policies reach their apex in the 2040s.

Scenario Design

Regional Policy Landscape

To properly understand the resources needed to replace the power services of the lower Snake River dams, it is critical to consider the regional policy landscape of the Pacific Northwest. In the last few years, the states of Oregon and Washington have adopted some of the most aggressive clean energy policies in the nation. While the Pacific Northwest was already a leader in renewable energy production due to its abundant hydropower resource, these aggressive policies will require key changes to the region. First, coal power must be phased out in the Northwest during this decade and, at least in Washington, carbon will be priced via a market-based cap-and-trade mechanism¹⁵. Second, additional zero-carbon generation must be added to replace that coal power and to displace remaining emissions from natural gas resources whose firm capacity may still be needed by the region, but which will operate less over time as electric carbon emissions are reduced. Ultimately, to reach a zero-carbon system, those natural gas plants must retire, be converted to zero-carbon fuels (such as green hydrogen), or their emissions be offset in some other manner. Third, economy-wide carbon reduction goals will drive the transformation of the Northwest transportation, building, and industrial sectors, with the general expectation of significant electric load growth in annual energy and peak demand. Key policies in the Northwest and California are summarized in Table 3.

Table 3. Policy landscape in Washington, Oregon, and California

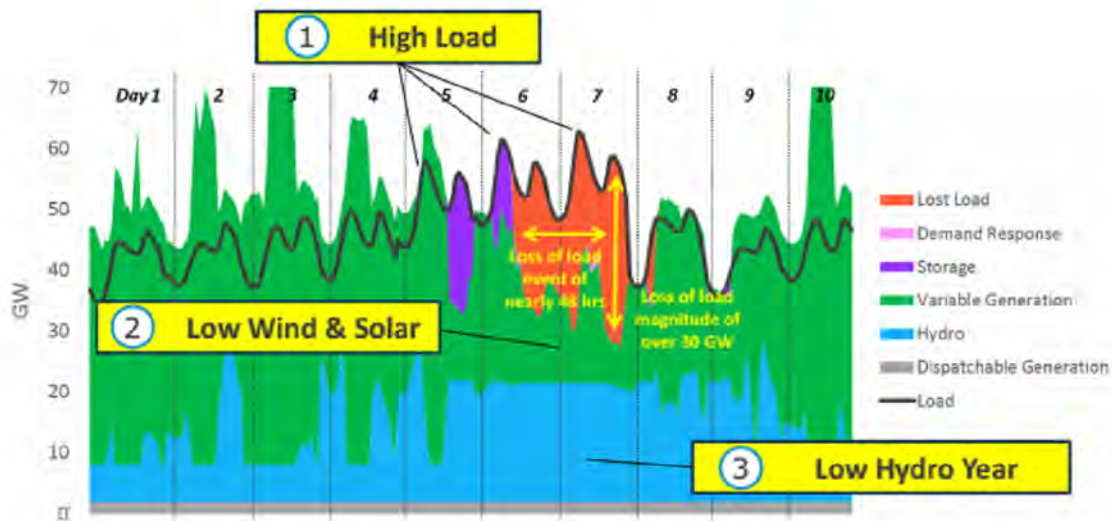
	RPS or Clean Energy Standard?	Coal Prohibition?	Cap-and-Trade?	New Gas?	Economy-Wide Carbon Reduction?
WA	✓ Carbon neutral by 2030, 100% carbon free electricity by 2045	✓ Eliminate by 2025	✓ Cap-and-invest program established in 2021. SCC in utility planning	✓	✓ 95% GHG emission reduction below 1990 levels and achieve net zero emissions by 2050
OR	✓ 50% RPS by 2040, 100% GHG emission reduction by 2040, relative to 2010 levels	✓ Eliminate by 2030	✓ Climate Protection Plan adopted by DEQ in 2021 (power sector not included)	✗ HB 2021 bans expansion or construction of power plants that burn fossil fuels	✓ 90% GHG emission reduction from fossil fuel usage relative to 2022 baseline
CA	✓ 60% RPS by 2030, 100% clean energy by 2045	✓ Coal-fired electricity generation already phased out	✓	✗ CPUC IRP did not allow in recent procurement order	✓ 40% GHG emission reduction below 1990 levels by 2030 and 80% by 2050

¹⁵ For simplicity, this study assumes a uniform carbon price across the Core Northwest region beginning in 2023.

Maintaining Resource Adequacy in Low-carbon Grids

Like other regions pursuing aggressive climate policies, the Northwest faces a key decarbonization challenge: how to maintain a reliable electricity supply, while simultaneously increasing electric loads and retiring the firm, but emitting, capacity that currently supports regional reliability. In 2019, E3 used its RECAP loss of load probability model to study how decarbonizing the electricity supply impacts regional reliability.¹⁶ This study found that clean energy resources such as solar, wind, batteries, and demand response can each provide a certain amount of reliable capacity and that combinations of them can provide even more by capturing “diversity benefits” (such as solar shifting the reliability risk into evening hours when wind output is higher). However, these resources also have limits to the amount of reliable capacity they can provide, and their contributions decline as more of them are added (the decline in capacity contributions of these resources is known as “saturation effects”). Figure 3 shows a graph from E3’s 2019 study that illustrates the key drivers of reliability in a decarbonized grid: high load, low renewables, and low hydro conditions. Unlike a summer peaking *capacity constrained* system like the desert southwest, these conditions make it particularly challenging for battery storage to replace the Northwest’s firm capacity resources, since batteries are unable to charge during *energy constrained* periods of low renewable energy and low hydro availability. The study concluded therefore that additional firm generating capacity may be needed, even in scenarios that add significant amounts of non-firm solar, wind, batteries, and demand response. The resource adequacy modeling approach is described further in the section *Resource Adequacy Needs and Resource Contributions*.

Figure 3. Key Drivers of Pacific Northwest Reliability Events in a Decarbonized Grid



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¹⁶ E3, 2019. *Resource Adequacy in the Pacific Northwest*. https://www.ethree.com/wp-content/uploads/2019/03/E3_Resource_Adequacy_in_the_Pacific-Northwest_March_2019.pdf

Since the 2019 study, “emerging” technologies are increasingly seen as potentially viable options to reduce all of the carbon emissions in the Northwest. “Clean firm” resources like green hydrogen, gas with carbon capture and storage, and nuclear small modular reactors provide the firm capacity necessary to backup renewable resources and can provide the zero-carbon energy needed on low renewable days to operate a zero-carbon grid. While their costs and commercialization trajectories remain uncertain, this LSR dams replacement study considers various scenarios of their availability.

Table 4. Summary of Resource Adequacy Capacity Contributions of LSR Dam Replacement Resource Options

Replacement Resource Option	RA Capacity Contributions
Battery storage	Sharply declining ELCCs ¹⁷
Pumped storage	Sharply declining ELCCs
Solar	Declining ELCCs
Wind	Declining ELCCs
Demand Response	Declining ELCCs
Energy Efficiency	Limited potential vs. cost
Small Hydro	Limited potential
Geothermal	Limited potential
Natural gas to H2 retrofits	Clean firm, but not fully commercialized
New dual fuel natural gas + H2 plants	Clean firm, but not fully commercialized
New H2 only plants	Clean firm, but not fully commercialized
Gas w/ 90-100% carbon capture + storage	Clean firm, but not fully commercialized
Nuclear Small Modular Reactors	Clean firm, but not fully commercialized

Scenarios Modeled

This study focuses on three key variables (clean energy policy, load growth, and emerging technology availability) that impact the cost to replace the dams.

Clean Energy Policy

Clean energy policy for the electric sector is modeled at either 100% clean retail sales or zero-carbon by 2045. A 100% clean retail sales policy requires serving 100% of electricity sold on an annual basis to be met by clean energy resources. This allows generation not used to serve retail sales (i.e., transmission and distribution losses) to be met by emitting resources. It also allows emitting generation or unspecified

¹⁷ E3 performed a sensitivity with battery ELCCs that do not decline so sharply. This sensitivity shows minor changes in the LSR dam replacement resources, but little to no change in the replacement costs.

imports in one hour to be offset by exported generation in another hour of the year. In the baseline load scenario, reaching 100% clean retail sales by 2045 results in ~65-85% carbon reduction compared to 1990 levels. The zero-carbon scenario ensures that all electricity generated in the Northwest or imported from other regions emits no carbon emissions in every hour of the year.

Load Growth

With aggressive clean energy policies, load growth determines the amount of new zero-emitting resources that must be added to the Northwest power system. A baseline load growth scenario is modeled, based on the forecast in the NWPCC 8th Power Plan. A second high electrification scenario is developed based on the high electrification case in the Washington State Energy Strategy.¹⁸ Based on E3's analysis of the electrification of transportation, buildings, and industry in that study, this scenario results in an additional annual energy demand increase of 28% by 2045 (above the baseline scenario) and an additional winter peak demand increase of 68%. The peak demand increase is high due to the electrification of space heating end uses, which requires replacing the significant quantities of energy provided by the natural gas system during extreme wintertime cold weather events with electricity.

Technology Availability

It is expected that the availability of emerging technologies may be critically important for replacing the LSR dam power services while reaching a deeply decarbonized grid. All scenarios include "mature technologies" such as solar, wind, battery storage, pumped hydro storage, demand response, energy efficiency, small hydro, and geothermal. Three scenarios of emerging technology availability are developed as follows:

- A. **Baseline technologies:** mature technologies and dual fuel natural gas + hydrogen combustion plants
- B. **Emerging technologies:** mature technologies, dual fuel natural gas + hydrogen combustion plants, small modular nuclear reactors, natural gas with carbon capture and storage, and floating offshore wind
- C. **No new combustion (limited technologies):** mature technologies and floating offshore wind

All scenarios assume that the existing natural gas capacity fleet can convert to green hydrogen, i.e., hydrogen produced using zero-carbon electricity. However, new firm resources are needed in all scenarios to replace retiring resources and meet growing electric loads.

Table 5 shows a summary of the four scenarios that are the primary focus of this study.

¹⁸ See Washington State's 2021 State Energy Strategy, <https://www.commerce.wa.gov/growing-the-economy/energy/2021-state-energy-strategy/>

Table 5. Scenario Design

Scenario	Clean Energy Policy	Load Growth	Technology Availability
1 100% Clean Retail Sales	100% retail sales (65-85% carbon reduction)	8 th Power Plan Baseline	Baseline (incl. natural gas / hydrogen dual fuel plants)
2a Deep Decarbonization (Baseline Tech.)	100% carbon reduction	High Electrification	Baseline
2b Deep Decarbonization (Emerging Tech.)	100% carbon reduction	High Electrification	Baseline + offshore wind, gas w/ CCS, nuclear SMR
2c Deep Decarbonization (No New Combustion)	100% carbon reduction	High Electrification	Baseline (excluding natural gas / hydrogen dual fuel plants)

The following additional sensitivities were considered:

- **Scenario 1: 100% Clean Retail Sales (2024 dam removal):** same as scenario 1, but with 2024 LSR Dams breaching instead of 2032.
- **Scenario 1b 100% Clean Retail Sales (Binding CES Target):** E3 ran two versions of scenario 1. In scenario 1, the high carbon price assumed drives the region higher than the 100% CES target, making it a non-binding constraint in the model. In scenario 1b, no carbon price was assumed and the 100% CES target is binding in 2045, causing the need to fully replace the GHG-free energy output of the LSR dams.
- **High Storage ELCC Sensitivity:** sensitivities were run on both Scenarios 1 and 2a to test whether a higher Northwest storage ELCC would change the marginal resources and replacement costs for the LSR dams.

Modeling Approach

RESOLVE Model

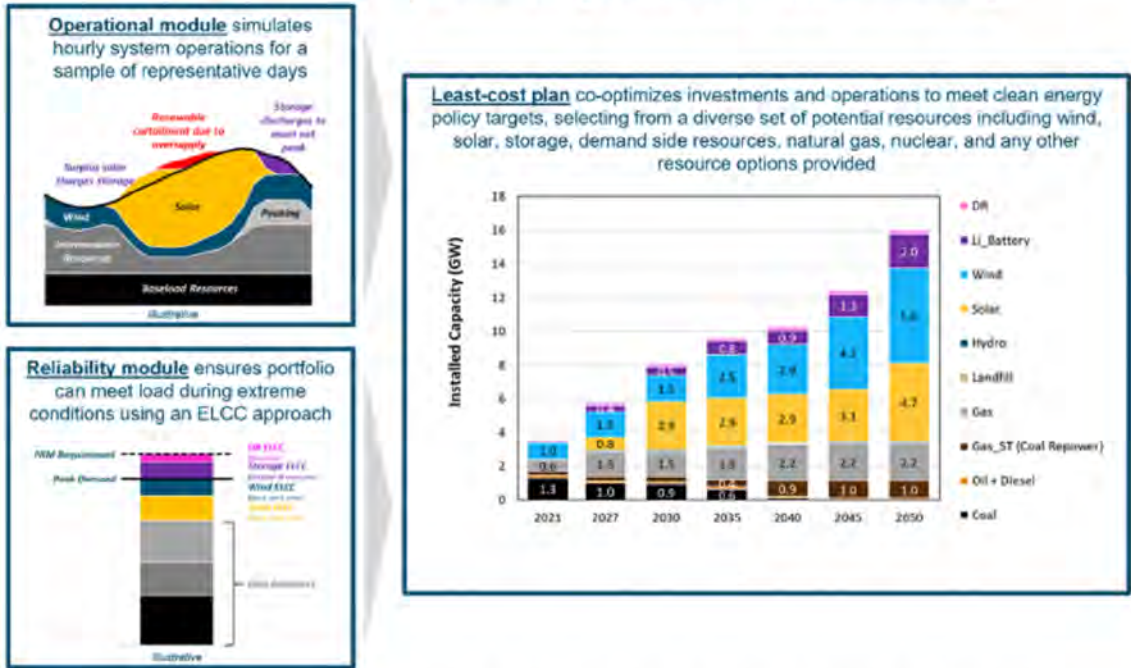
E3's Renewable Energy Solutions Model (RESOLVE) is used to perform a portfolio optimization of Northwest system's electric generating resource needs between 2025 and 2045. RESOLVE is an optimal capacity expansion and dispatch model that uses linear programming to identify optimal long-term generation and transmission investments in an electric system, subject to reliability, operational, and policy constraints. Designed specifically to address the capacity expansion questions for systems seeking to integrate large quantities of variable energy resources, RESOLVE layers capacity expansion logic on top of a production cost model to determine the least-cost investment plan, accounting for both the up-front capital costs of new resources and the variable costs to operate the grid reliably over time. In an environment in which most new investments in the electric system have fixed costs significantly larger than their variable operating costs, this type of model provides a strong foundation to identify potential investment benefits associated with alternative scenarios.

The three primary drivers of optimized resource portfolios include:

- + **Reliability:** all portfolios ensure system meets resource adequacy requirements. In this case, the target reliability need is to meet 1-in-2 system peak plus additional 15% of planning reserve margin (PRM) requirement.
- + **Clean Energy Standard ("CES") and/or carbon reduction targets:** all portfolios meet the clean energy standard and/or a carbon-reduction trajectory
- + **Least cost:** the model's optimization develops a portfolio that minimizes costs

Figure 4 illustrates the use of RESOLVE's operational module, which tracks hourly system operations including cost and greenhouse gas emissions across a representative set of days, and RESOLVE's reliability module, that uses exogenously calculated input parameters to characterize system reliability of candidate portfolios using effective load carrying capability (ELCC) for solar and wind resources.

Figure 4. Schematic Representation of the RESOLVE Model Functionality



RESOLVE develops least-cost portfolios using key inputs and assumptions including loads, existing resources, new resource options, retirement or repowering resource options, resource costs, resource operating characteristics including resource adequacy contributions, a zonal transmission transfer topology, and new resource transmission costs.

Northwest RESOLVE Model

The Northwest RESOLVE model was developed in 2017 for E3’s *Pacific Northwest Low Carbon Scenario Analysis* study.¹⁹ It uses a zonal transmission topology to simulate flows among the various regions in the Western Interconnection. In this study, RESOLVE is designed to include six zones: the Core Northwest region and five external areas that represent the loads and resources of utilities throughout the rest of the Western Interconnection (see Figure 5). This study focuses on the Core Northwest region as the “Primary Zone”—the zone for which RESOLVE makes resource investment decisions. This zone covers Washington, Oregon, Northern Idaho and Western Montana. The remaining balancing authorities outside of the Core Northwest are grouped into five additional zones: (1) Other Northwest, (2) California, (3) Southwest, (4) Nevada and (5) Rockies. For these zones, investments are not optimized; rather, the trajectory of new builds is established based on regional capacity needs to meet PRM targets, as well as renewable needs to comply with existing RPS and GHG policies in their respective regions, and held

¹⁹ Pacific Northwest Low Carbon Scenario Analysis - Achieving Least-Cost Carbon Emissions Reductions in the Electricity Sector, 2017. https://www.ethree.com/wp-content/uploads/2018/01/E3_PGP_GHGReductionStudy_2017-12-15_FINAL.pdf

constant across all scenarios. E3's WECC-wide resource mix incorporates aggressive climate policy across the interconnection, as described in section *Baseline resources*.

Figure 5. RESOLVE Northwest zonal representation



The Northwest RESOLVE model simulates the operations of the WECC system for 41 independent days sampled from the historical meteorological record of the period 2007-2009. An optimization algorithm is used to select the 41 days and identify the weight for each day such that distributions of load, net load, wind, and solar generation match long-run distributions. Daily hydro conditions are sampled separately from dry (2001), average (2005), and wet (2011) hydro years to provide a complete distribution of potential hydro conditions. This allows RESOLVE to approximate annual operating costs and dynamics while limiting detailed operational simulations of grid operations to 41 days.

LSR Dams Modeling Approach

The LSR dams' capacity and operation are characterized with several input parameters that are presented in Section *Hydro parameters*. The approach taken in this analysis is to model LSR dams as an *in/out* resource to determine the dams' replacement costs and replacement portfolio. In other words, "in" scenarios include LSR dams in the existing resource portfolio of Core Northwest throughout the entire modeling period (i.e., 2025-2045); whereas "out" scenarios exclude LSR dams with preset retirement dates of 2032. An earlier retirement of LSR dams, 2024, is considered in a sensitivity case. The difference between the costs and resource portfolios for in and out cases reveals the value of LSR dams, as shown in Figure 6. Total NPV costs of resources replacing LSR dams are estimated in the year of breaching the dams.²⁰ NPV replacement costs are calculating using a 3% discount rate to represent the public power cost of capital.

²⁰ I.e. when the dams are removed in 2032, future costs after 2032 are discounted to the year 2032 to calculate the NPV replacement costs.

Figure 6. Modeling Approach to Calculate the LSR Dams Replacement Resources and Costs

- 1 **With the lower Snake River dams**, optimize long-term resource needs and operations for the Pacific Northwest
 - Produces necessary resource additions and total system costs and emissions
- 2 **Remove the lower Snake River dam generating capacity, then re-optimize long-term resource needs and operations for the Pacific Northwest**
 - Produces a second set of resource additions and total system costs and emissions
 - All scenarios breach the dams in 2032, except for one scenario in 2024
- 3 **Calculate additional resources and investment + operational costs required to replace the dams**
 - Calculated as the difference between steps 1 and 2 above

This modeling approach inherently considers the benefits of avoiding the LSR dams ongoing fixed and variable costs. The costs associated with breaching the LSR dams themselves are not included in this study. Other power services (i.e., transmission grid reliability services provided by the dams) are also not included but are summarized qualitatively in the Appendix.

Key Input Assumptions

Load forecast

Base load forecast is from NWPCC 2021 Plan and is adjusted to E3's boundary of Core Northwest which roughly represents 87.5% of load of the Northwest system in the NWPCC 2021 Plan. Additionally, a high electrification scenario is modeled which takes Washington's State Energy Strategy high electrification load, scaled up and benchmarked to the Core Northwest region. The baseline high electrification load trajectories are displayed in Figure 7. It is notable that in the high electrification scenario, electric energy demand grows by about 28% by 2045 across all sectors, most noticeably in the commercial building and transportation sectors, to meet net-zero emissions by 2050. In the commercial and residential space heating sectors, electrification indicates a switch to high electric resistance and heat pump adoption, which will significantly impact load profiles and ultimately peak load. Hourly loads are modeled in RESOLVE by scaling normalized hourly shapes with annual energy forecasts. The normalized shapes are adopted from E3's 2017 study *Pacific Northwest Low Carbon Scenario Analysis*.²¹

²¹ Pacific Northwest Low Carbon Scenario Analysis - Achieving Least-Cost Carbon Emissions Reductions in the Electricity Sector, 2017. https://www.ethree.com/wp-content/uploads/2018/01/E3_PGP_GHGRReductionStudy_2017-12-15_FINAL.pdf

Figure 7. Annual energy load forecasts for Core Northwest

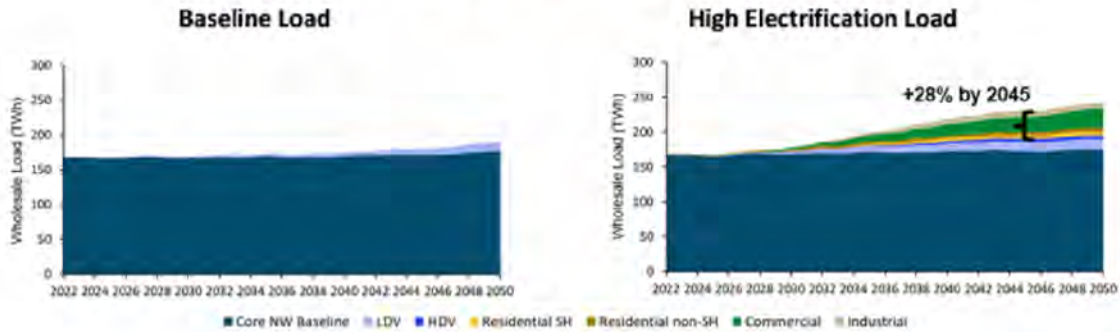
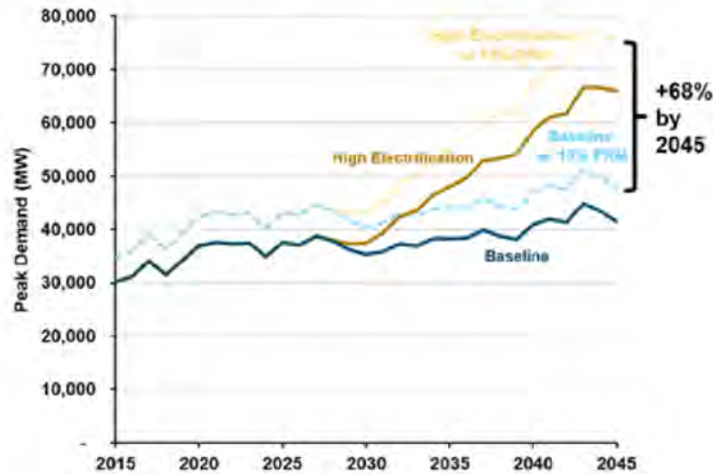


Figure 8 shows the peak demand impacts (including the 15% planning reserve margin) of the high electrification case relative to the baseline, showing a 68% increase by 2045. This high growth is driven by the winter peaking capacity required to replace the gas system peaking capacity to serve peak space heating needs.

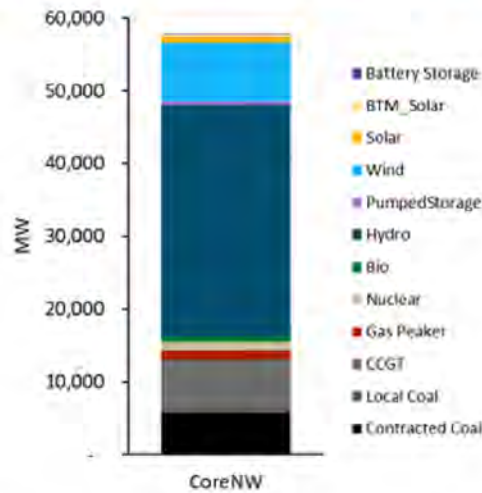
Figure 8. Peak demand forecasts for Core Northwest



Baseline resources

Baseline resources include the existing conventional resources such as natural gas and coal-fired technologies, existing nuclear capacity, hydro as well as pumped storage, battery storage, solar PV, BTM PV and onshore wind technologies. As shown in Figure 9, today’s Northwest system has 58 GW capacity. The 1,185 MW nuclear capacity in the Northwest zone remains active throughout the modeling period while the 670 MW local coal capacity is retired by 2025 and the 5,700 MW contracted out of region coal capacity is retired by 2030. The WECC 2020 Anchor Data Set is used for Northwest’s existing and planned resources. By 2045, about 5.8 GW additional customer PV is included as planned capacity to capture the growth in behind-the-meter generation forecasted in NWPC 2021 Power Plan.

Figure 9. Northwest resource capacity in 2022



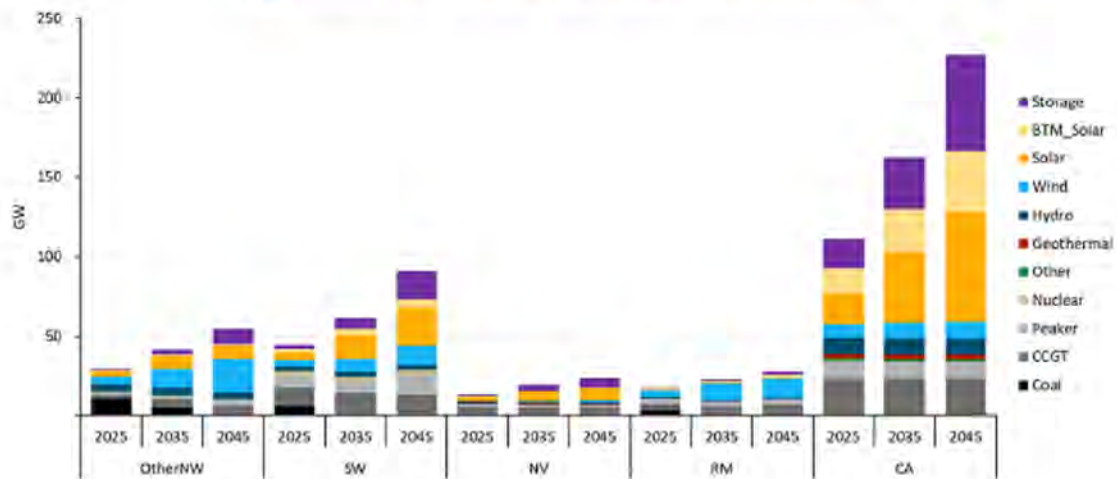
The investment decisions for external zones are pre-determined based on capacity expansion analysis completed by E3 that accounts for policy targets in each zone as summarized in Table 6. The new builds consist of significant increases in solar and battery capacity additions due to the more aggressive RPS targets, assumed electrification, and the decline of technology cost forecasts (see Figure 10). All future builds in these zones include mature technologies but as discussed in the next section, emerging technologies are made available for RESOLVE to optimize the future resource portfolios in the Northwest zone. There is significant solar and battery storage growth in California, the Southwest, and Nevada that generally lower the marginal value of solar energy produced across the WECC.

Table 6. Policy targets for builds in external zones

State	Requirement	Policy	2050 Renewable Target
AZ	40% by 2030; 60% by 2045	Transitions to CES ²²	70%
CA	60% by 2030; 100% by 2045	Transitions to CES	100%
CO	30% by 2020; 50% by 2030, 76% by 2050 (Xcel reaches 100% while other utilities stay at 50%)	Transitions to CES	75%
ID	90% by 2045 (ID Power’s announced utility goals)	RPS	90%
MT	87% by 2045 (state carbon reduction goal)	RPS	87%
NM	40% by 2025; 100% by 2045	Transitions to CES	100%
NV	50% by 2030; 100% by 2050	Transitions to CES	95%
UT	50% by 2030; 55% by 2045 (PacifiCorp’s IRP)	RPS	55%
WY	50% by 2030, 55% by 2045 (PacifiCorp’s IRP)	RPS	55%

²² CES = “Clean Energy Standard”, an annual based clean generation standard.

Figure 10. Total installed capacity for external zones



Candidate resource options, potential, and cost

A wide range of technologies and resources are made available in RESOLVE, including mature and emerging technologies. The list of technologies made available in each modeled scenario is presented in Table 7. Some technologies such as solar and onshore wind are low-cost zero-carbon energy resources with limited resource potential and declining capacity values. Storage resources such as battery storage and pumped hydro support renewable integration but show limited capacity value given the large shares of hydro in the Northwest region. Demand response supports peak reduction but also faces declining ELCCs. Energy efficiency supports energy and peak reduction but increasingly competes against low-cost renewables. Geothermal is relatively high cost and has limited potential but provides highly valuable “clean firm” capacity.

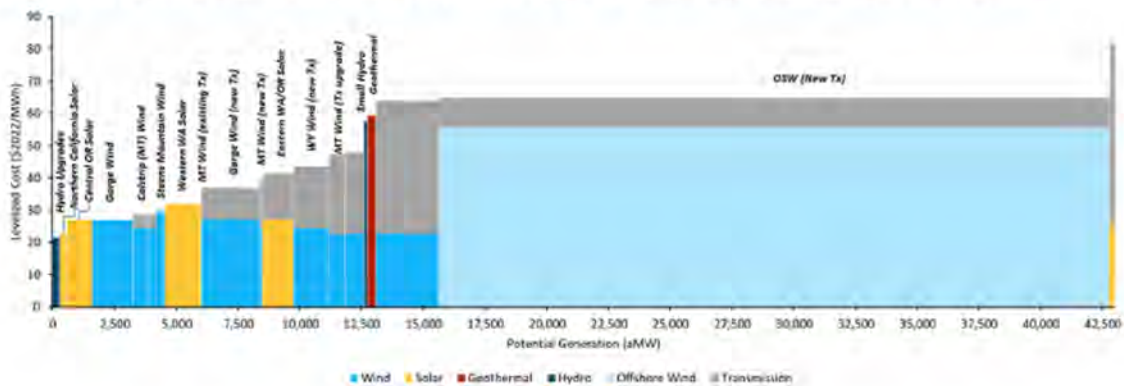
Some emerging technologies are also made available in several scenarios to allow for firm zero-carbon technologies to be selected from. Hydrogen-capable generators such as dual fuel combustion turbines and combined cycles (i.e., capable of burning both natural gas and hydrogen) as well as retrofits of existing gas generators to burn hydrogen are modeled. These technologies provide low-cost capacity options with very high energy cost when burning expensive hydrogen fuel, therefore RESOLVE selects them for firm capacity needs but limits their hydrogen energy production. Natural gas with carbon capture and storage (CCS) technologies are moderately high cost in terms of both energy and capacity. Nuclear SMR provides moderately high capital cost but low operating cost for firm zero-carbon energy generation. This technology is made available to the model after 2035, to account for the time needed for technology development, licensing, and installation. Floating offshore wind is also modeled as an emerging technology which address onshore resource and land constraints but is generally higher cost than onshore wind while providing a similar annual capacity factor to high quality Montana and Wyoming wind.

Table 7. Available technologies in each modeled scenario

Resource	A. Baseline	B. Emerging Tech	C. No New Combustion (Limited Tech)
Mature resources: solar, wind, battery storage, pumped storage, demand response, energy efficiency, small hydro, geothermal	✓	✓	✓
Natural gas to hydrogen retrofits	✓	✓	✓
Dual fuel natural gas + hydrogen plants	✓	✓	✗
Natural gas with 90-100% carbon capture and storage	✗	✓	✗
Nuclear small modular reactors	✗	✓	✗
Floating offshore wind	✗	✓	✓

There are physical limits to the quantity of renewable resources that can be developed in each location; RESOLVE enforces limits on the maximum potential of each new resource that can be included in the portfolio. Moreover, some new resources will need extensive transmission upgrades which are accounted for in the renewable energy supply curve.²³ Figure 11 shows a “supply curve” for renewables in the year 2045, ordered by total generation plus transmission cost. While the quantity of solar and onshore wind energy is limited, offshore wind potential is effectively unlimited in the model although its cost remains high relative to land-based renewables through 2045. It should be noted that RESOLVE doesn’t select resources based on their cost alone; it also considers the value these resources provide as part of a regional portfolio. More detail information on technology cost trajectories and data sources can be found in the Appendix.

Figure 11. Renewable resource supply curve in 2045, including transmission cost adders



²³ Note: certain solar resources (i.e., Western WA solar) might require transmission upgrades to bring the supply to load centers, which are not captured.

Clean energy policy targets

RESOLVE enforces a clean energy standard (“CES”) requirement as a percentage of retail sales to ensure that the total quantity of energy procured from renewable resources meets the CES target in each year. The clean energy standard percentage is calculated as follows, and the target values are summarized in Table 2:

$$CES \% = \frac{\text{Annual Renewable Energy or Zero Emitting Generation}}{\text{Annual CoreNW Retail Electric Sales}}$$

Eligible renewable energy and zero-emitting resources include: solar, wind, geothermal, hydropower, nuclear, biomass, green hydrogen, and natural gas with carbon capture and storage.

Regarding GHG emissions, RESOLVE enforces a greenhouse gas constraint on the CoreNW region such that total annual emission generated in the zone must be less than or equal to the emissions cap. The greenhouse gas accounting for the Northwest zone follows the rules established by the California Air Resources Board. The CoreNW carbon emissions baseline is set as 33 MMT at the 1990 level. The total greenhouse gas emissions attributed to the Core Northwest region include:

- + **In-region generation:** all greenhouse gas emissions emitted by fossil generators (coal and natural gas) within the region, based on the simulated fuel burned and fuel-specific CO₂ emissions intensity;
- + **External resources owned/contracted by Core Northwest utilities:** greenhouse gas emissions emitted by resources located outside the Core Northwest but currently owned or contracted by utilities that serve load within the region, based on fuel burn and fuel-specific CO₂ emissions intensity; and
- + **“Unspecified” imports to the Core Northwest:** assumed emissions associated with economic imports to the Core Northwest that are not attributed to a specific resource but represent unspecified flows of power into the region, based on a deemed emissions rate of 0.43 tons/MWh.

Table 8. Annual CES and carbon emissions targets modeled for CoreNW in RESOLVE

Resource	2025	2030	2035	2040	2045
Clean energy standard % (used in Scenarios 1 and 2 ²⁴)	29%	49%	68%	88%	100%
Carbon reduction emissions target (used only in Scenario 2)	22.7 MMT	17.0 MMT	11.3 MMT	5.7 MMT	0 MMT

Hydro parameters

RESOLVE characterizes the generation capability of the hydroelectric system by including three types of constraints from actual operational data: (1) daily energy budgets, which limit the amount of hydro generation in a day; (2) maximum and minimum hydro generation levels, which constrain the hourly hydro

²⁴ While a clean energy standard is modeled in scenario 2, the mass-based carbon reduction target constraint is a more binding constraint, pushing the model beyond the minimum CES %'s shown here.

generation; and (3) multi-hour ramp rates, which limit the rate at which the output of the collective hydro system can change from one to four hours. Combined, these constraints limit the generation of the hydro fleet to reflect realistic seasonal limits on water availability, downstream flow requirements, and non-power factors that impact the operations of the hydro system.

In this analysis, hydro operating data are parameterized using conditions for three different hydrological years, i.e., 2001 for dry, 2005 for average and 2011 for wet conditions. For LSR dams, we use hourly generation data provided by BPA, which are adjusted for latest fish protection and spill constraints. For the remainder of the northwest hydro fleet, we rely on historical hydro dispatch data used to develop the TEPPC 2022 Common Case dataset. Using multi-year historical hydro operational data allows capturing the complete set of physical and institutional factors, such as cascading hydro, streamflow constraints, fish protection, navigation, irrigation, and flood control, that limit the amount of flexibility in the hydro system.

For each RESOLVE sampled day, the hydro daily energy budget is calculated as the average of daily electricity generated in the month of each sampled RESOLVE day in its corresponding matched hydro year.²⁵ The maximum and minimum hydro generation levels (P_{\min} and P_{\max}) are calculated as the absolute min and max of generation in the month of each sampled RESOLVE day in its corresponding matched year. Multi-hour ramp rates are estimated based on the 99th percentile of upward ramps observed across the three hydrological years of hourly data. In addition, for non-LSR Northwest hydro, the model allows 5% of the hydro energy in each day to be shifted to a different day within two months to capture additional flexibility for day-to-day hydro energy shift.

²⁵ LSR dams generate about 900 average MW of energy during an average hydro year. However, during the three years modeled in RESOLVE, the LSR dams produced only ~700 average MW generation for LSR dams. This means our estimate of the replacement cost of the dams is quite conservative relative to a longer-term expected average of ~900 MW.

Figure 12. RESOLVE Hydro inputs for LSR Dams and other Northwest hydro

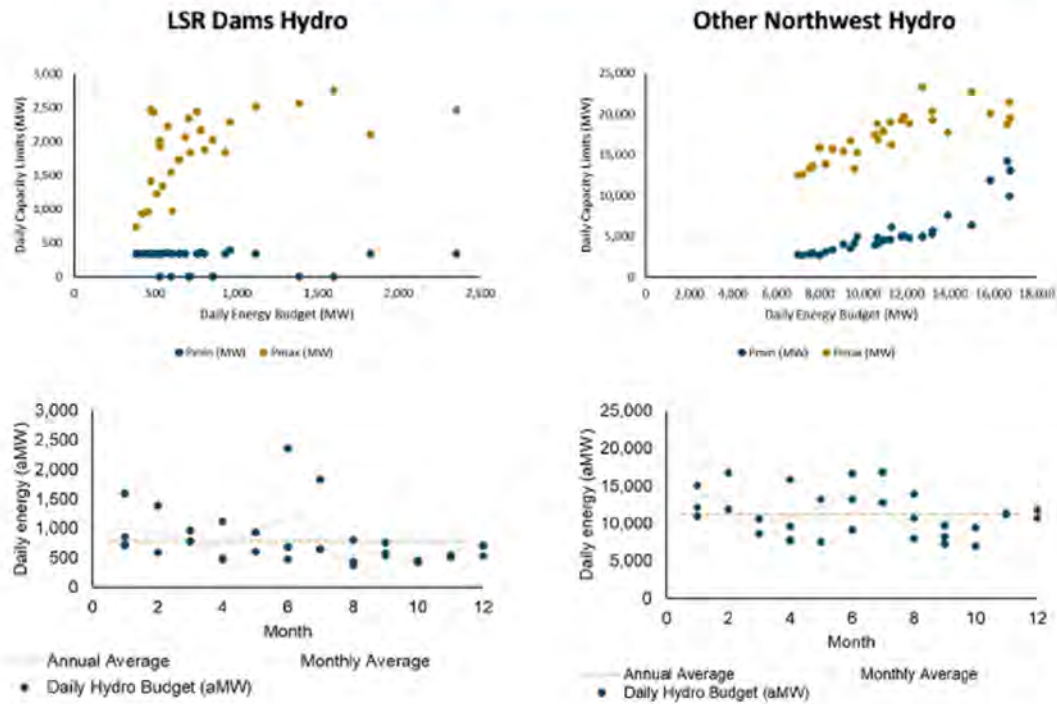


Table 9. Multi-hour ramping constraints applied to Northwest hydro

	One hour	Two hours	Three hours	Four hours
LSR Dams Hydro	36%	43%	45%	48%
Other Northwest Hydro	14%	23%	29%	32%

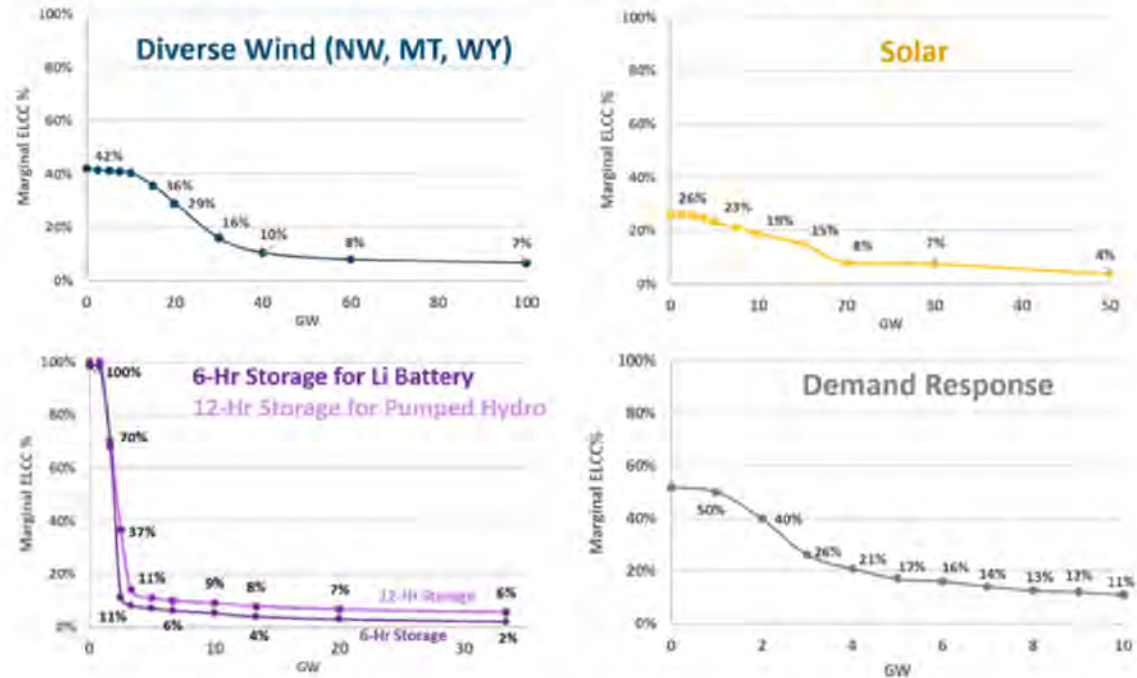
Resource Adequacy Needs and Resource Contributions

Hydro firm capacity contribution for both LSR dams and other Northwest hydro is assumed to be 65% of nameplate, per PNUCC methodology (based on 10-hr sustaining peaking capacity). This means that the LSR dams provide 2,284 MW of firm capacity that must be replaced if the dams are breached. This assumption was validated based on BPA modeled LSR dam performance data during the 2001 dry hydro year, as described in the section *Key Uncertainties for the Value of the Lower Snake River Dams*, which also describes estimates of the NPV impact of assuming a lower firm capacity value for the dams.

Resource adequacy needs are captured in RESOLVE by ensuring that all resource portfolios have enough capacity to meet the peak Core Northwest median peak demand plus a 15% planning reserve margin. Firm capacity resources are counted at their installed capacity. Hydro resources are counted at the 65% regional value used in PNUCC’s 2021 resource adequacy analysis. Solar, wind, battery storage, pumped hydro storage, and demand response are counted at their effective load carrying capability (“ELCC”) based

on E3's RECAP modeling from its 2019 *Resource Adequacy in the Pacific Northwest* study.²⁶ Figure 13 shows the initial capacity values for these resources, as well as the declining marginal contributions as more of the resource is added. RESOLVE uses these data points to develop tranches of energy storage and demand response resources with declining marginal ELCCs for each tranche. Solar and wind ELCCs are input into RESOLVE using a 2-dimensional ELCC surface that captures the interactive benefits of adding various combinations of solar and wind together. Resources on the surface (such as different wind zones) are scaled in their ELCC based on their capacity factor relative to the base capacity factor assumed in the surface, and the entire surface is scaled as peak demand grows.

Figure 13. Solar, Wind, Storage, and Demand Response Capacity Values



The capacity value for energy storage resources shown in Figure 13 are very different from those in other regions, such as California or the Desert Southwest, declining much more quickly as a function of penetration. There are two reasons for this. First, the Pacific Northwest is a winter peaking region in which loss-of-load events are primarily expected to occur during extreme cold weather events that occur under drought conditions in which the region faces an energy shortfall. These events, such as the one illustrated in Figure 3 above, result in multi-day periods in which there is insufficient energy available to charge storage resources, severely limiting their usefulness. This is unlike the Southwest, where the most stressful system conditions occur on hot summer days in which solar power is expected to be abundant and batteries can recharge on a diurnal cycle. Second, the Pacific Northwest already has a very substantial amount of reservoir storage which can shift energy production on a daily or even weekly basis. Thus, the

²⁶ Resource Adequacy in the Pacific Northwest, 2019. https://www.ethree.com/wp-content/uploads/2019/03/E3_Resource_Adequacy_in_the_Pacific-Northwest_March_2019.pdf

Pacific Northwest is already much closer to the saturation point where additional diurnal energy shifting has limited value.

Nevertheless, recognizing that the capacity value of energy storage is still being researched, in the Northwest and elsewhere, we include a sensitivity case in which energy storage resources are assumed to have much higher ELCC values, similar to what is expected in the Southwest at comparable penetrations. This test case was used to assess whether a higher energy storage ELCC would change the replacement resources and replacement cost of the LSR dams. The results are presented in the section *Replacement Resources Firm Capacity Counting*.

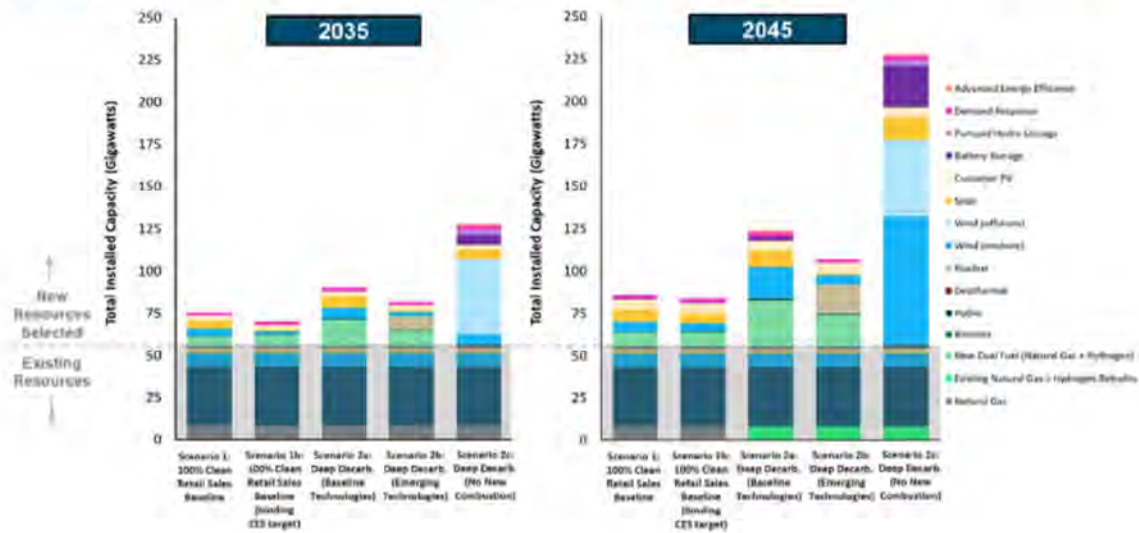
Results

RESOLVE model runs for the 2025-2045 period produce optimal resource portfolios of additions and retirements by resource type, as well as metrics of annual and hourly resource generation, carbon emissions, and total system costs. This section presents the RESOLVE modeling results, focused on the years of 2035 and 2045 to highlight the mid-term and long-term resource needs. Following that, the result of the RESOLVE runs with the LSR dams breached are presented, with the replacement resource and costs to replace the dams' power services.

Electricity Generation Portfolios with the Lower Snake River Dams Intact

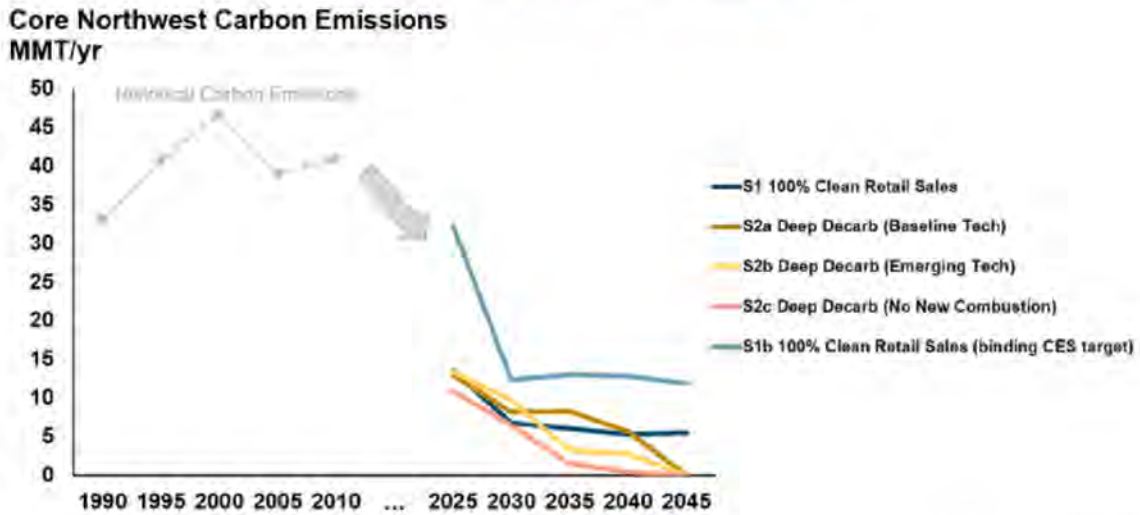
In the scenarios that do not assume breaching of the LSR dams, large amounts of utility-scale solar PV, onshore wind, offshore wind, hydrogen-capable combined cycle, and some amounts of energy efficiency and demand response are selected to meet the growing electricity demand, PRM, and emissions reductions. Electrification load growth along with zero emissions targets drive higher needs in deep decarbonization scenarios (i.e., S2a, S2b and S2c) compared to the reference scenario (S1) in both snapshot years of 2035 and 2045. In S2b, clean firm technologies such as SMR nuclear are selected in place of additional onshore wind, solar and dual-fuel CCGT selected in S2a. In the absence of clean firm technologies (no new combustion) in S2c, massive amounts of offshore wind (~45 GW) as well as more battery storage, pumped storage, demand response, and energy efficiency are selected as early as 2035 such that in this scenario, the new resource additions are almost five times the new builds in S1. These capacity additions increase even more substantially by 2045.

Figure 14. Large levels of new resource additions to meet the growing load, PRM needs and emissions reductions (assumes LSR Dams are NOT breached)



As shown in Figure 15 below, all four scenarios result in a sharp near-term decline in carbon emissions, driven by Washington and Oregon policies that drive coal retirement this decade. By 2045, Scenario 1, which requires 100% clean retail sales, shows an ~85% decline in carbon emissions relative to 1990 levels. Scenario 2 eliminates all carbon emissions by 2045.

Figure 15. Northwest Carbon Emissions

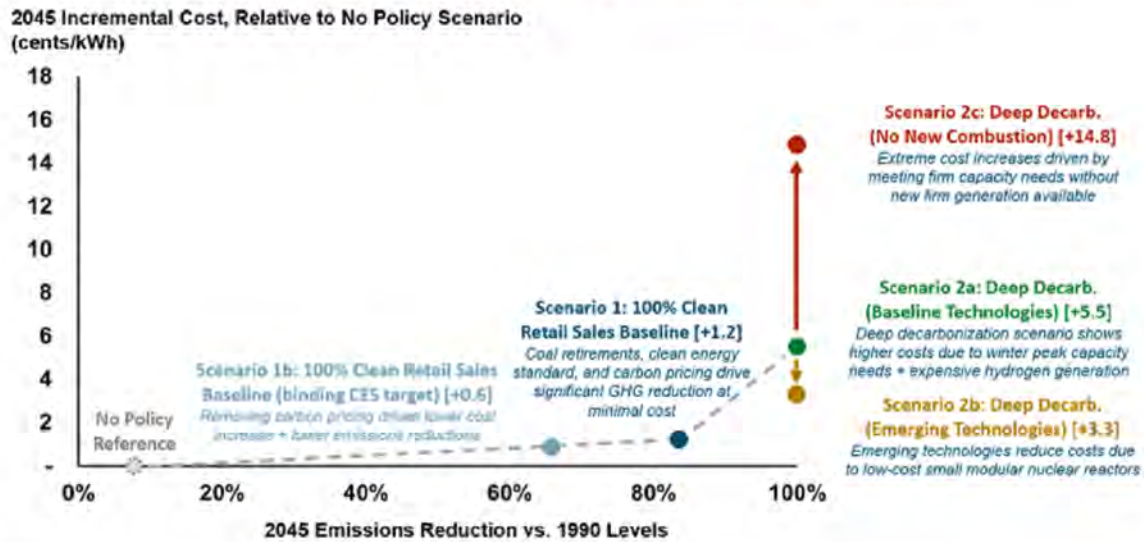


To put cost impacts in context, a “No Policy Reference” case uses the baseline load forecast and removes all electric clean energy policies, retaining the region’s coal power with little emissions decline. The four clean energy futures modeled are compared against this Reference Case on A) their cost impacts, measured in incremental cents/kWh relative to the Reference, and B) their carbon emissions reductions, relative to 1990 levels. By 2045, as shown in Figure 16, with the region’s aggressive carbon policies in place, emissions can be reduced by over 80% with a relatively small cost impact (+1.2 cents/kWh relative to the region’s current average retail rate of 8-9 cents/kWh). Without a carbon price (scenario 1b), emissions are reduced ~65% with a cost impact of 0.6 cents/kWh. Reaching a zero-carbon grid with increasing electric loads requires significantly more investment, increasing carbon reductions to 100% of 1990 levels, but also increasing costs by 3.3-14.8 cents/kWh. This range is highly dependent upon the availability of emerging technologies and their assumed costs. The low end assumes that low-cost small modular nuclear reactors become commercialized by 2035. The high end assumes no new combustion resources (such as green hydrogen)²⁷ or other emerging technologies are available²⁸, showing that relying only on non-firm resource additions (renewable energy, demand side resources, and short- to medium-duration storage) leads to much higher costs.

²⁷ The authors recognize that hydrogen can be used to generate electricity by fuel cells instead of combustion turbines. That scenario would look similar to Scenario 2a, where the combustion plant additions are replaced with many GW of fuel cells for firm capacity needs.

²⁸ Floating offshore wind was allowed in the no new combustion case since it was required to allow a feasible solution without making any other firm capacity additions available in the model.

Figure 16. Cost Impacts Compared to Emissions Reduction Impacts



NOTES:

- 2020 average retail rates for OR and WA were 8-9 cents/kWh; 1990 electric emissions were ~33 MMT
- High electrification scenarios would avoid natural gas infrastructure costs, which would offset some of the electric peaking infrastructure cost increase

LSR Dams Replacement

The resource replacement portfolios and costs of replacing the LSR dams are reported in this section.

Capacity and energy replacement

In the midterm, given the expectations of load growth and coal capacity retirements resource adequacy needs are a primary driver of LSR dam replacement needs, with around 2 GW of additional firm dual fuel natural gas and hydrogen combustion plants selected to replace the LSR dams' capacity in Scenarios 1, 1b, 2a, and 2b (see Table 10). (Note that, these turbines may initially burn natural gas when needed during reliability challenged periods but would transition to hydrogen by 2045 to reach zero-emissions.) If advanced nuclear is available as assumed in Scenario 2b, it replaces renewables and some of the combustion resource builds. In addition to firm resources, some of the LSR capacity is replaced by renewables in Scenarios 1 and 2a, mostly by wind, solar, and a small amount of battery storage. In Scenario 2c, with no combustion or advanced nuclear available, a very large buildout of renewable capacity (in the order of 12 GW) is required to replace the capacity of LSR dams, due to resource availability and the fast decline in solar and wind ELCCs as early as 2035. Small amount of geothermal capacity is also part of the portfolio in 2035.

In the long term, the dam's carbon-free energy is replaced by a combination of wind power and another "clean firm" resource when available. Scenario 2a shows additional hydrogen generation, as well as small levels of energy efficiency and battery storage. In Scenario 2b, the LSR dams are entirely replaced by clean firm capacity of hydrogen combustion plants and nuclear SMRs, whereas in Scenario 2c, a large capacity of wind and solar is relied upon to replace both the carbon-free energy and firm capacity of the LSR dams.

Overall, the magnitude of replacement portfolio capacities is close in both snapshot years (2035 and 2045) meaning that immediate capacity additions are necessary to replace LSR dams given the retirement year of 2032 while the capacity needs sustain throughout the modeling period. The early removal of LSR dams (i.e., by 2024) moves up the timing of the replacement portfolio to 2025 instead of 2035 in S1 with 2024 removal, but the replacement portfolio remains similar.

Table 10. Optimal portfolios to replace the LSR dams

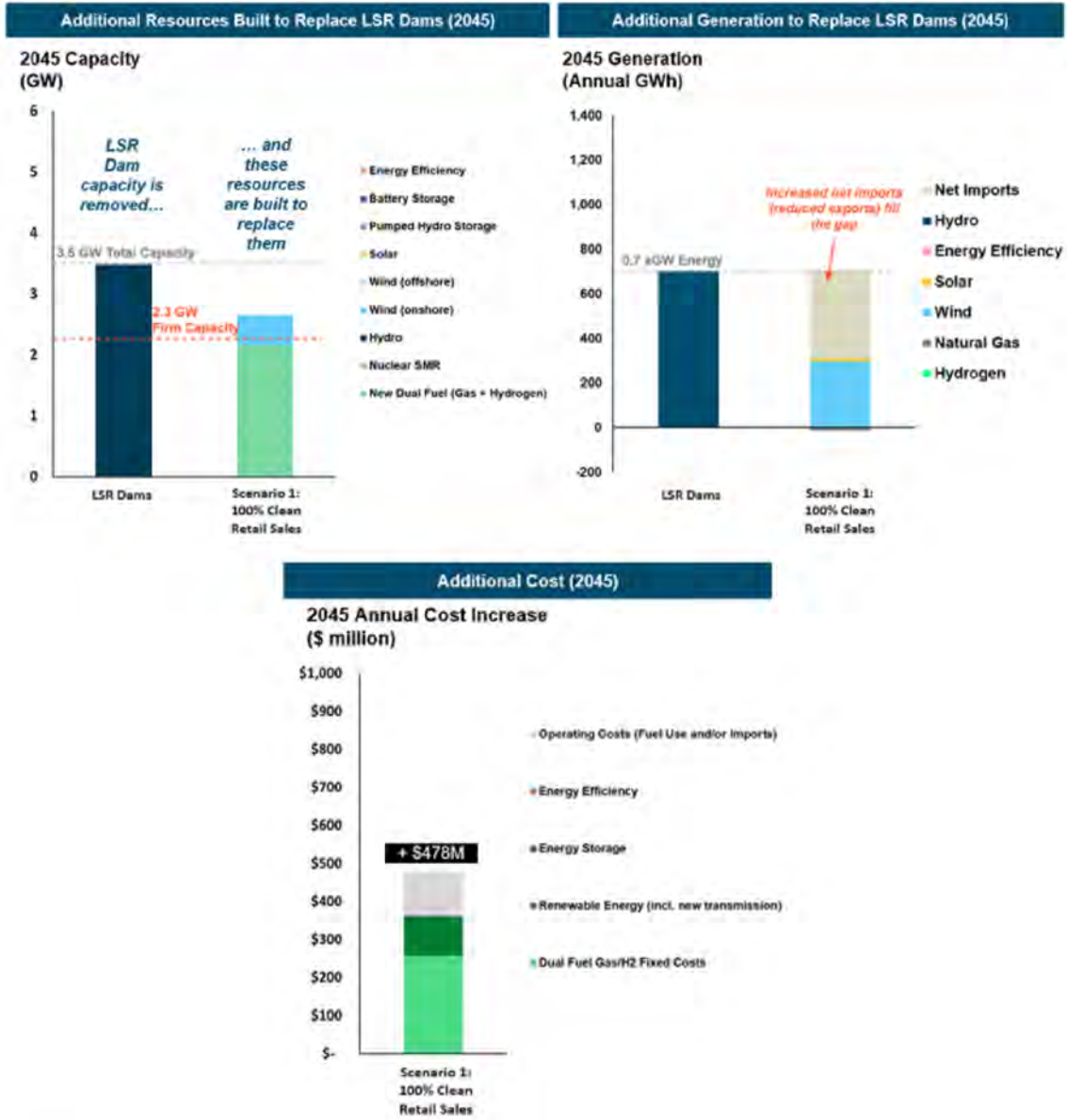
Scenario	Replacement Resources Selected, Cumulative by 2035 ²⁹ (GW)	Replacement Resources Selected, Cumulative by 2045 (GW)
Scenario 1: 100% Clean Retail Sales	+ 1.8 GW dual fuel NG/H2 CCGT - 0.5 GW solar + 1.3 GW wind + 0.1 GW li-ion battery	+ 2.1 GW dual fuel NG/H2 CCGT + 0.5 GW wind
Scenario 1: 100% Clean Retail Sales (2024 dam removal)	+ 1.8 GW dual fuel NG/H2 CCGT - 0.5 GW solar + 1.4 GW wind + 0.1 GW li-ion battery	+ 2.1 GW dual fuel NG/H2 CCGT + 0.5 GW wind
Scenario 1b: 100% Clean Retail Sales (binding CES target)	+ 2.2 GW dual fuel NG/H2 CCGT + 0.1 GW li-ion battery	+ 1.8 GW dual fuel NG/H2 CCGT + 1.3 GW solar + 1.2 GW wind
Scenario 2a: Deep Decarbonization (Baseline Technologies)	+ 2.0 GW dual fuel NG/H2 CCGT + 0.6 GW wind + 0.1 GW li-ion battery	+ 2.0 GW dual fuel NG/H2 CCGT + 0.3 GW li-ion battery + 0.4 GW wind + 0.05 GW advanced EE + 1.2 TWh H2-fueled generation
Scenario 2b: Deep Decarbonization (Emerging Technologies)	+ 1.7 GW dual fuel NG/H2 CCGT + 0.6 GW nuclear SMR	+ 1.5 GW dual fuel NG/H2 CCGT + 0.7 GW nuclear SMR
Scenario 2c: Deep Decarbonization (No New Combustion)	+ 9.1 GW wind + 0.1 GW wind + 1.0 GW solar + 0.3 GW geothermal + 1.5 GW li-ion battery	+ 10.6 GW wind + 1.4 GW solar

Figure 17 through Figure 21 show details of the capacity replacement, energy replacement, and cost breakdown for Scenarios 1, 1b, 2a, 2b, and 2c. LSR dams energy in these scenarios is replaced with wind, solar, net imports (i.e. reduced exports of hydropower outside the Core NW), and – in Scenario 2a – additional hydrogen generation, which is necessary in 2045 to meet the zero-carbon goal without the flexible LSR dam winter generation. The cost charts show that the dual fuel gas plants make up

²⁹ Replacement resources are calculated by comparing the “with LSR dams” RESOLVE portfolio to the “without LSR dams” RESOLVE portfolio. This means some resources may be built in 2035, such as 0.3 GW of geothermal in scenario 2c, that are not built when the dams are included. However, those resources may have already been selected in the “with LSR dams” case by 2045, hence do not show up as additional resource replacement needs in 2045. This explains the different resource changes between 2035 and 2045.

approximately half of the 2045 annual costs in Scenario 1 and approximately a quarter of the 2045 annual costs in Scenario 2a, which includes additional costs for energy efficiency and hydrogen generation.

Figure 17. Scenario 1: Capacity Replacement, Energy Replacement, and Costs³⁰



³⁰ Regarding the “net imports” component of the energy replacement, this refers to either increased imports, decreased exports (generally of carbon-free energy), or a combination of both, such that RESOLVE does not need to build enough new generation to fully replace the LSR dams output. For instance, the region could export less hydropower to California and other neighbors to replace the LSR dams output without necessarily increasing Northwest carbon emissions in Scenario 1.

Figure 18. Scenario 1b Capacity Replacement, Energy Replacement, and Costs

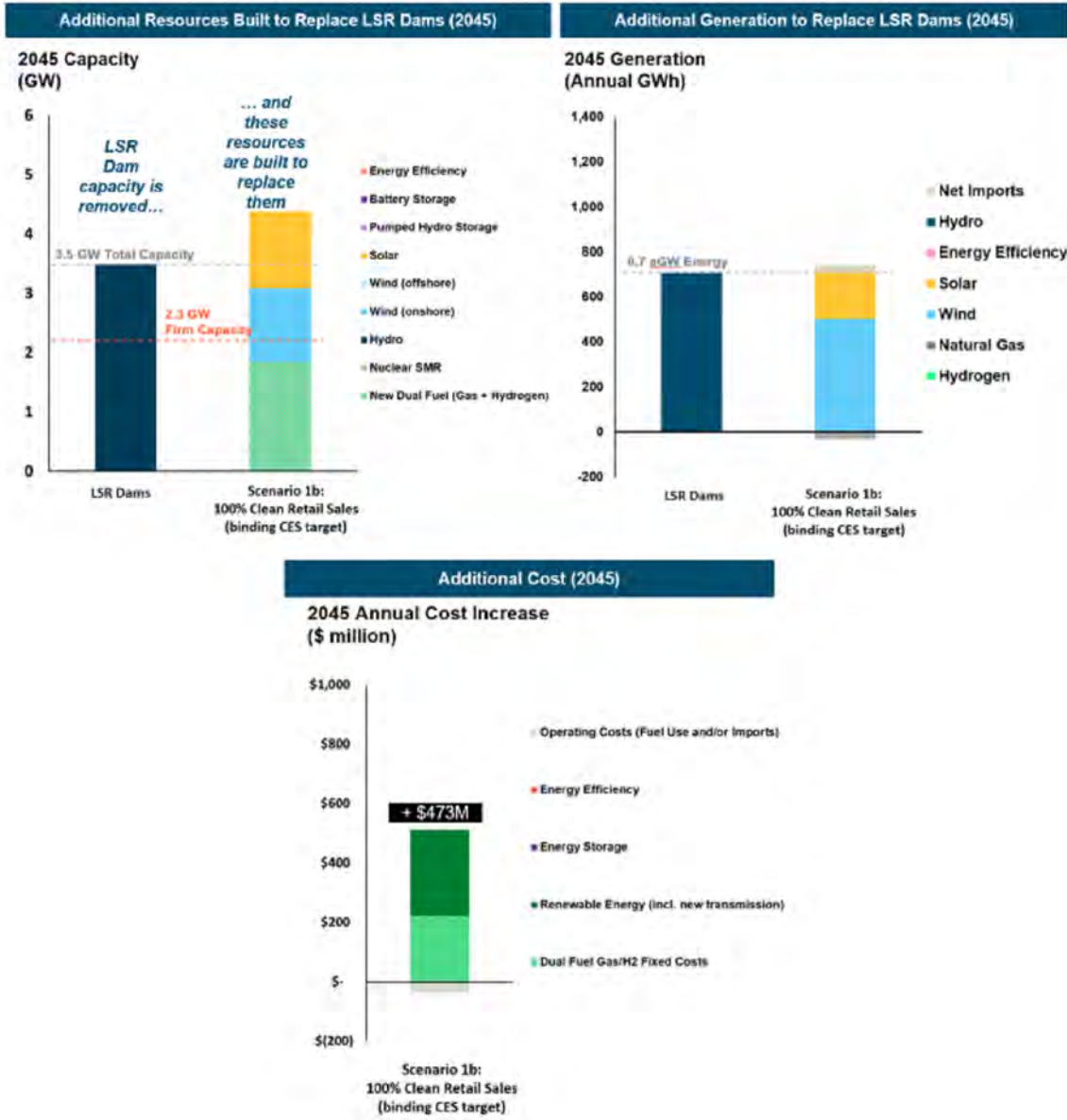
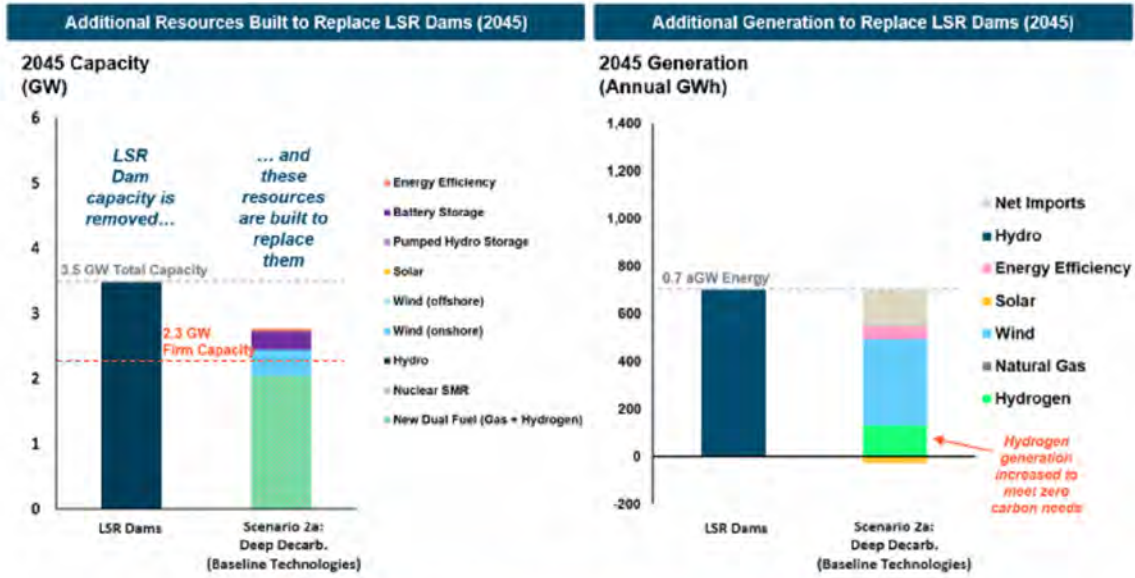


Figure 19. Scenario 2a Capacity Replacement, Energy Replacement, and Costs



Additional Cost (2045)

2045 Annual Cost Increase (\$ million)

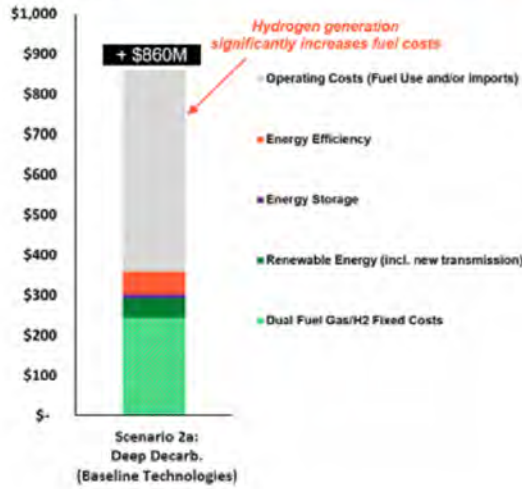


Figure 20. Scenario 2b Capacity Replacement, Energy Replacement, and Costs

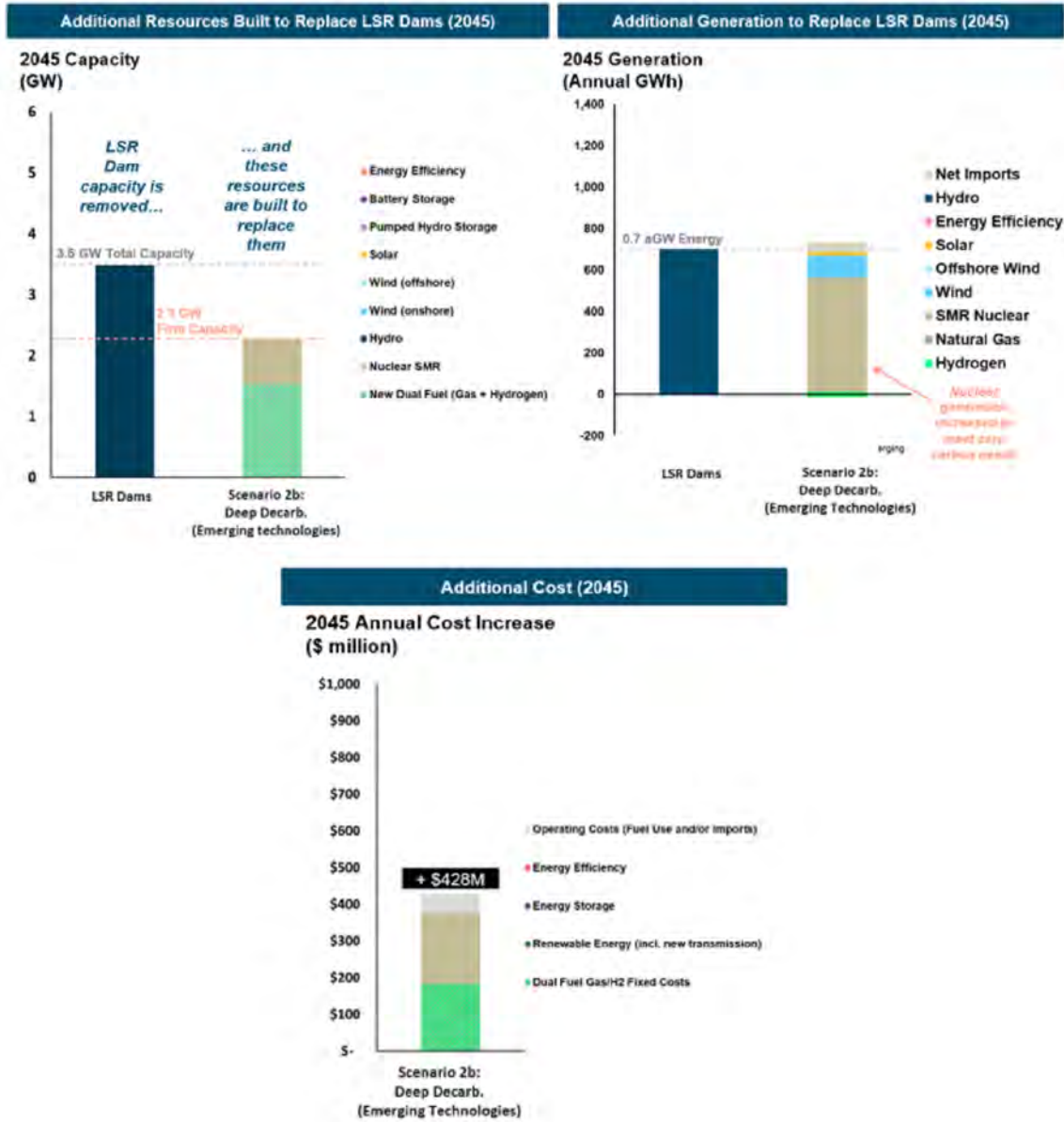
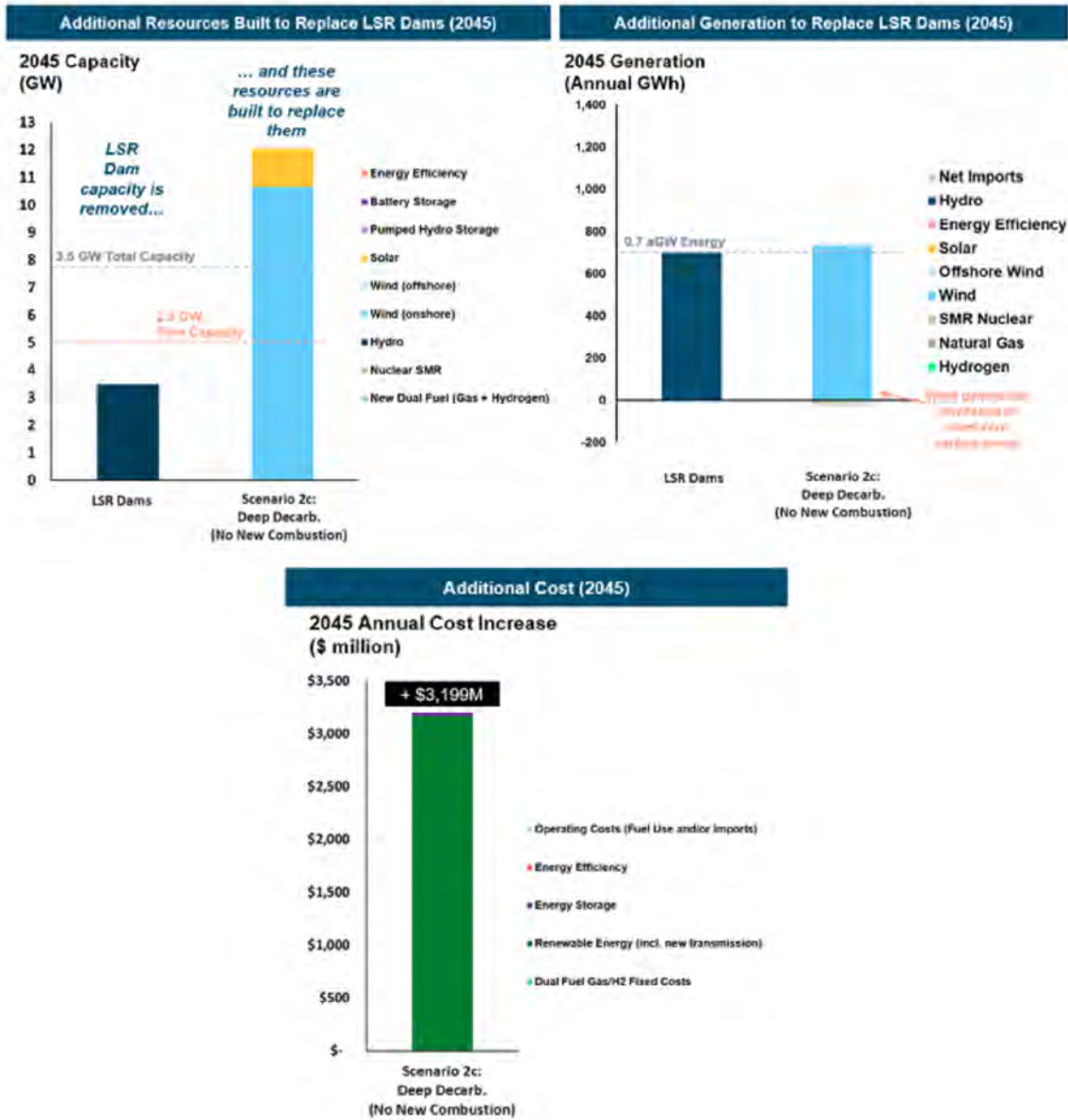


Figure 21. Scenario 2c Capacity Replacement, Energy Replacement, and Costs³¹



Replacement costs

The LSR dams provide a relatively low-cost source of GHG-free energy and firm capacity. Incremental costs for replacement resources are summarized in this section. All costs are shown in real 2022 dollars.

³¹ NOTE: the energy replacement does not show the total potential energy output of the wind built to replace the dams, because much of the potential energy output is curtailed due to oversupply of wind built for resource adequacy needs.

Incremental costs to replace the power services of the LSR dams ranges from \$69-139/MWh across most scenarios. Scenario 2c, however, shows a much higher replacement power cost of \$277-517/MWh. These incremental costs are much higher than costs of maintaining the LSR dams (i.e., \$13-17 per MWh³²); they are calculated by taking the incremental fixed and variable investment costs for the no LSR RESOLVE runs and dividing them by the LSR annual generation being replaced. See the details in Table 11.

Table 11. Incremental costs to replace LSR generation in 2045

Scenario	Incremental net costs in 2045 ³³ , including avoided LSR dam costs (Real 2022 \$/MWh)	Incremental gross costs in 2045 ³⁴ , excluding \$17/MWh avoided LSR dam costs (Real 2022 \$/MWh)
Scenario 1: 100% Clean Retail Sales	\$77/MWh	\$94/MWh
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$82/MWh	\$99/MWh
Scenario 1b: 100% Clean Retail Sales (binding CES target)	\$77/MWh	\$94/MWh
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$139/MWh	\$156/MWh
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$69/MWh	\$86/MWh
Scenario 2c: Deep Decarb. (No New Combustion)	\$277-517/MWh	\$294-534/MWh

The LSR dams' total replacement costs (in net present value) and annual replacement costs for 2025, 2035, and 2045 are shown in Table 12. NPV replacement costs are calculated based on discounting at a 3% discount rate, representative of the approximate public power cost of capital, over a 50-year time horizon following the date of breaching. Scenario 1 (100% clean retail sales) replacement costs are approximately \$12-12.4 billion in net present value (NPV) in the year of breaching (in 2032); costs increase to \$12.8 billion NPV if breached in 2024. Total replacement costs are similar in the economy-wide deep decarbonization scenario when emerging technology is available (scenario 2b), showing \$11.2 billion NPV. Replacement costs are significantly higher in scenario 2c where no new combustion resources are allowed (\$42-77 billion NPV). The economy-wide deep decarbonization (baseline technology scenario), 2a, shows more costly replacement (\$19.6 billion NPV) than when nuclear SMRs are available, but lower costs than scenario 2c, due to the availability of hydrogen-enabled gas plants.

³² BPA directly funds the annual operations and maintenance of the Lower Snake River Compensation Plan (LSRCP) facilities. The cost of generation at the lower Snake River dams is in the range of \$13/MWh without LSRCP and \$17/MWh with LSRCP. Congress authorized the LSRCP as part of the Water Resources Development Act of 1976 (90 Stat.2917) to offset fish and wildlife losses caused by construction and operation of the four lower Snake River projects.

³³ The generation replacement costs are calculated using the incremental RESOLVE's Core Northwest revenue requirement increase with LSR dams breached divided by the annual MWh of the LSR dams assuming 706 average MW generation.

³⁴ The generation replacement costs are calculated using the incremental RESOLVE's Core Northwest revenue requirement increase with LSR dams breached divided by the annual MWh of the LSR dams assuming 706 average MW generation.

Annual costs increase by \$415-860 million after LSR dams' removal in scenarios 1, 2a, and 2b. In Scenario 2c, the cost increase is in the order of \$1.9-3.2 billion per year. Replacement costs generally increase over time due to increasingly stringent clean energy standards and electrification-driven load growth. The 2045 cost increases translate to 8-18% growth in BPA's public power customers costs in scenarios 1, 1b, 2a and 2b (assuming current retail rates are about 8.5 ¢/kWh based on OR and WA average retail rates). In these scenarios, public power households would see an increase in annual electricity costs of \$100-230/yr in 2045. In Scenario 2c, rate impacts could be as high as 34-65%, which is equivalent to annual residential electricity bills raising by up to \$450-850 per year.³⁵ Note that these incremental cost increases include the ongoing LSR dams costs, such as operations and maintenance costs, avoided by breaching the dams, but do not include the costs of breaching. The rate impacts shown are only for the LSR dams' replacement, they do not include the additional rate increases driven by higher loads or clean energy needs (that are covered in the section *Electricity Generation Portfolios with the Lower Snake River Dams Intact* above), which apply even without removing generation from the LSR dams.

Table 12. Total LSR Dams replacement costs

	NPV Total Costs (Real 2022 \$) ³⁶	Annual Costs Increase (Real 2022 \$)			Incremental Public Power Costs ³⁷
	In the year of breaching (2032 or 2024)	2025	2035	2045	2045
Scenario 1: 100% Clean Retail Sales	\$12.4 billion	n/a	\$434 million	\$478 million	0.8 ¢/kWh [+9%]
Scenario 1: 100% Clean Retail Sales (2024 dam breaching)	\$12.8 billion	\$495 million	\$466 million	\$509 million	0.8 ¢/kWh [+9%]
Scenario 1b: 100% Clean Retail Sales (binding CES target)	\$12.0 billion	n/a	\$445 million/yr	\$473 million/yr	0.8 ¢/kWh [+9%]
Scenario 2a: Deep Decarb. (Baseline Technologies)	\$19.6 billion	n/a	\$496 million	\$860 million	1.5 ¢/kWh [+18%]
Scenario 2b: Deep Decarb. (Emerging Technologies)	\$11.2 billion	n/a	\$415 million	\$428 million	0.7 ¢/kWh [+8%]
Scenario 2c: Deep Decarb. (No New Combustion)	\$42 – 77 billion ³⁸	-	\$ 1,045 – 1,953 million/yr	\$1,711 – 3,199 million/yr	2.9 – 5.5 ¢/kWh [+ 34 – 65%]

³⁵ Annual residential customer cost impact assumes 1,000 kWh per month for average residential customers in Oregon and Washington in scenario 1 and 1,280 kWh per month for scenario 2, per the 28% retail sales increase due to electrification load growth.

³⁶ NPV replacement costs are based on discounting at a 3% discount rate, representative of the approximate public power cost of capital, over a 50-year time horizon following the date of breaching.

³⁷ Incremental public power costs are calculated assuming that all the replacement costs are paid by BPA Tier I customer, using the assumed 2022 Tier I annual sales of 58,686 GWh.

³⁸ A range of costs was developed for this scenario based on the assumed transmission needs for renewable additions. High end assumes 100% of nameplate, low end assumes 25% of nameplate (approx. marginal ELCC of renewable additions). Low end represents a higher ratio of renewable capacity to transmission capacity, recognizing that much of the additional energy added by 2045 would be curtailed due to over-supply.

Carbon emissions impacts

LSR dams provide emissions-free generation for Northwest and depending on what these dams are replaced with, may impact the emissions associated with the electricity systems. The removal of LSR dams may potentially cause an increase in emissions over the near- or mid-term horizon. In Scenario 1, the 2024 LSR dam breaching scenario results in substantial increases to carbon emissions through 2030, in the range of 1-2.8 MMT/yr or 15-25% of the annual Northwest emissions. This scenario does not have a binding GHG constraint, and the region meets its clean energy goals in the near term without the dams. RESOLVE therefore does not replace all the LSR dam energy with clean resources.

Under 2032 breaching scenarios, carbon emissions increases are observed in the mid-term (0.7-1.5 MMT/yr. or ~10% of the region's carbon emissions in 2035). Scenario 1b, when the CES target binds in 2045, shows to GHG increases in 2045, since the GHG-free energy of the LSR dams is replaced by solar and wind power. The economy-wide deep decarbonization cases all reach zero carbon emissions by 2045, so breaching the dams does not increase emissions in that year; RESOLVE instead builds the resources needed to replace all of the GHG-free energy to meet the zero-carbon constraint.

Additional considerations

Depending on how the future of the electric grid evolves, there might be significant land-use associated with renewables expansion, more so if LSR dams are removed in conditions similar to Scenario 2c where significant capacity additions from solar and wind resources would be necessary.

Key Uncertainties for the Value of the Lower Snake River Dams

This study explicitly captures the following key drivers of the LSR dams power service replacement needs:

- + Replacing the **GHG-free energy, firm capacity, operating reserves, and operational flexibility** of the dams

Uncertainty of the LSR dam value is considered under scenarios of:

- + **Clean energy policy:** replacement of carbon-free power becomes increasingly critical to reach a zero-emissions electricity grid
- + **Load growth:** replacement energy and capacity needs may change with increased electrification and peak higher winter space heating needs
- + **Technology availability:** replacement is more expensive with fewer emerging technology resource options
- + **Timing:** replacement was focused on breaching in 2032, but a 2024 sensitivity was also considered
- + **Carbon pricing:** a sensitivity scenario was considered for scenario 1 that considered no carbon pricing, which causes the 100% CES target to bind

Additional uncertainties regarding the value of the dams are:

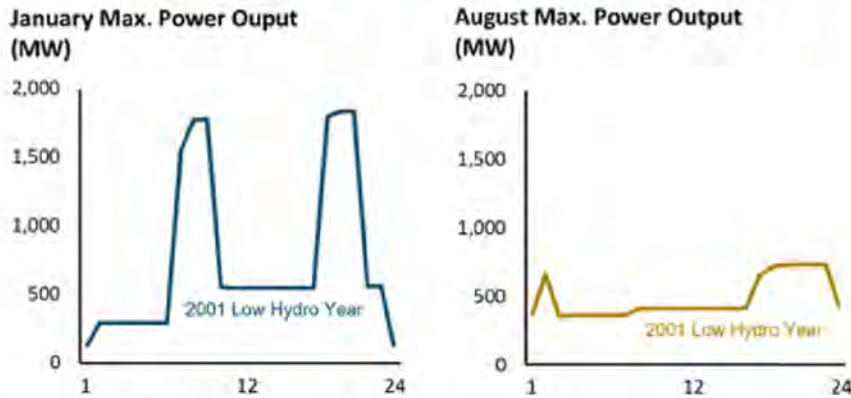
- + **LSR dams annual energy output:** E3's existing RESOLVE model data uses historical hydro years 2001, 2005, and 2011 as representative of the regional long-term average low/mid/high hydro year conditions. The data for the Columbia River System dams was adjusted to reflect the Preferred Alternative operations defined in the CRSO EIS. However, for the LSR dams, these selected historical hydro years resulted in a relatively low output of ~700 average MW, whereas the dams may generate ~900 average MW on average across the full historical range of hydro conditions. Therefore, E3's analysis likely underestimates the energy value of the dams and costs for replacing that extra GHG-free energy.
- + **LSR dams firm capacity counting:** as resource adequacy is found to be a key driver of future resource needs, the firm capacity contributions of the LSR dams is a key driver of their value. See below for further discussion of this uncertainty.
- + **Replacement resource capacity contributions:** if Northwest reliability challenges dramatically shift into the summer, this would also impact the capacity value of replacement resources. Directionally, this would likely increase the capacity value of energy storage, and change the relative value of solar and wind. It is expected that additional battery storage would be part of the regional capacity additions in lieu of dual fuel natural gas + hydrogen plants. See below for further discussion of this uncertainty.
- + **Replacement of transmission grid services:** this study does not focus on the transmission grid reliability services provided by the LSR dams. These services likely can be replaced by a combination of the new resources selected by RESOLVE and additional local transmission system investments. A qualitative summary of the transmission grid reliability services of the dams is summarized in the appendix of this report.

LSR Dams Firm Capacity Counting

Since resource adequacy is found to be a key driver of future resource needs, the firm capacity contribution of the LSR dams is a key driver of their value. E3 uses a regional hydro capacity value estimate for the LSR dams in this study, based on the PNUCC regional hydro capacity value assumption. More detailed follow-on ELCC studies could be done to confirm the LSR dams' capacity value, though proper and coordinated dispatch of the Northwest hydro fleet would be necessary to develop an accurate and fair value of the LSR dams within the context of the overall hydro fleet.

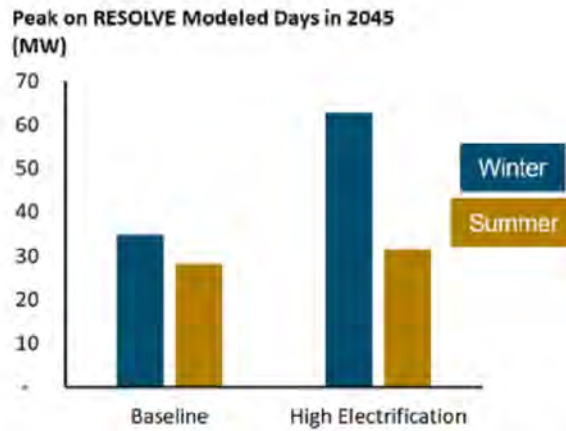
This study validated the assumed 2.28 GW of firm capacity from the LSR dams by considering BPA modeled LSR dams dispatch under 2001 dry hydro year conditions using the CRSO EIS spill constraint adjusted hourly modeling provided by BPA. Maximum January output (plus 100-250 MW of operating reserves) was 1.9-2.1 GW (~56-60% of total capacity), slightly less but close to the 65% regional hydro value the study assumes.

Figure 22. BPA-Modeled LSR Dam Output During the 2001 Low Hydro Year with CRSO EIS Preferred Alternative operations



The other capacity value uncertainty is whether the Northwest will remain winter reliability challenged or whether reliability events will shift to the summer due to climate impacts on load patterns and hydro output. If reliability challenges did shift to the summer, the LSR dam firm capacity contribution would be significantly lower than assumed. However, E3 believes it is reasonable to assume under high electrification scenarios that the region will remain winter challenged due to peak space heating needs, as shown in figure below.

Figure 23. Winter vs. Summer Peak Loads

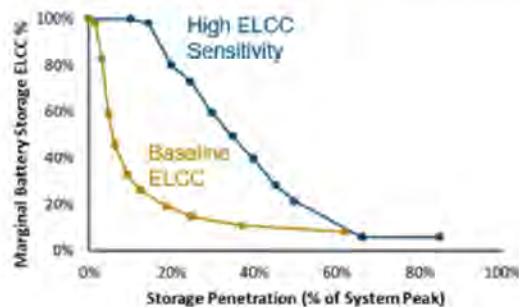


To address the capacity value uncertainty, a post-processing analysis was performed based on the replacement resources selected for firm capacity replacement. Based on this analysis performed on scenarios 1 and 2a, relative to the 2.28 GW assumption used in this study, it is estimated that a 1.5 GW firm capacity value (43%) for the dams would lower the NPV replacement costs by 9-20% and a 1.0 GW firm capacity value (29%) would lower the NPV replacement costs by 14-33%.

Replacement Resources Firm Capacity Counting

If Northwest reliability challenges dramatically shift into the summer, this would also impact the capacity value of replacement resources. One key input assumption this would change is the capacity value of battery storage additions, which were previously limited due to the Northwest wintertime energy-constrained reliability events causing charging sufficiency challenges for energy storage resources. To test whether higher energy storage ELCCs would impact the LSR dams replacement resources and replacement costs, a high storage ELCC sensitivity scenario was analyzed, per the ELCC inputs shown in Figure 24 below. This analysis was performed on scenarios 1 and 2a.

Figure 24. Inputs for High Battery Storage ELCC Sensitivity



In Scenario 1, with the LSR dams intact, higher battery ELCCs cause another 1.5 GW of batteries to be selected and 1.4 GW less dual fuel natural gas and hydrogen plants. In Scenario 2a, with the LSR dams intact, higher battery ELCCs cause another 2.4 GW of batteries and another 0.3 GW of wind to be selected, with 3.6 GW less dual fuel natural gas and hydrogen plants.

When the LSR dams are assumed to be breached, the differences in replacement resources are relatively small. In Scenario 1, an additional ~0.2 GW of battery storage, an additional 0.2 GW of wind, and 0.2 GW less dual fuel natural gas and hydrogen plants are selected to replace the dams. In Scenario 2a, an 0.3 GW less battery storage, 0.3 GW less wind, and an additional 0.1 GW of dual fuel natural gas and hydrogen plants are selected to replace the dams. This is because scenario 2a builds more wind and batteries in the base case already with the dams not breached, so the model prefers to select fewer of those resources for LSR dams replacement. Annual replacement costs in 2045 are 2% lower in scenario 1 and the same in scenario 2a. These results indicate that higher storage ELCCs would allow the region to build less dual fuel natural gas and hydrogen plants, but because energy storage ELCCs eventually saturate in either case, the replacement resources for the dam are not significantly changed and there is little impact on the replacement costs.

Conclusions and Key Findings

This study uses E3’s Northwest RESOLVE model to study optimal capacity expansion scenarios with and without the lower Snake River dams, to determine the replacement resources and cost impacts to replace the dams’ power output. RESOLVE is an optimal capacity expansion and dispatch model that determines a least-cost set of investment and operational strategies to enable the “Core Northwest” region – consisting of Washington, Oregon, Northern Idaho, and Western Montana – to achieve its long-term clean energy policy goals at least-cost, while ensuring resource adequacy and operational reliability. RESOLVE has been used in several prior studies of electricity sector decarbonization in the Pacific Northwest³⁹. Using RESOLVE allows for a dynamic optimization that considers replacement resource needs in the context of long-term system load and policy drivers, not just the near-term resource mix and needs of the system today. The dams are assumed to be breached in 2032, except for one sensitivity that considered 2024 breaching.

This study’s scenario design focuses on three key variables – clean energy policy, load growth, and emerging technology availability – that impact the cost to replace the dams.

Even with the dams in place, the region’s clean energy goals and potential electrification load growth drive a significant need for new resources. In all scenarios, significant energy efficiency and customer solar is embedded into the load forecast, based on the NWPCC’s 8th Power Plan. Additionally, 6 gigawatts (“GW” or 6,000 MW) of coal capacity is retired by 2030, while increasing carbon prices incent further clean energy resource additions. In Scenario 1, the regional power system is required to meet a goal of generating enough clean energy to provide 100% of retail electricity sales, on an average basis over a calendar year. This requires an additional 5.5-7 GW of solar and 4.6-6 GW of wind by 2045 to achieve the clean energy goal; 0.6 GW of battery storage, 2 GW of demand response, and 9 GW of dual fuel natural gas + hydrogen combustion plants are also added to meet the region’s resource adequacy needs.⁴⁰

Though all scenarios require more “firm” resources – resources that can generate when needed and operate for as long as needed – to meet peak loads, these resources are in higher demand in Scenario 2, in which all greenhouse gas emissions are eliminated from the regional power system by 2045. This scenario also assumes that electrification results in much higher electric loads, particularly in wintertime due to electrification of natural gas space heating in buildings. The baseline scenario (2a) selects additional wind, solar, and geothermal to meet clean energy needs as well as demand response, some battery storage, and 27 GW natural gas and hydrogen dual fuel combustion plants to meet reliability needs. An alternative “emerging technology” scenario selects 17 GW of advanced nuclear technology (small modular reactors or “SMRs”) by 2045, in place of the firm capacity provided by natural gas generators

³⁹ Pacific Northwest Low Carbon Scenario Analysis, December 2017, <https://www.ethree.com/projects/study-policies-decarbonize-electric-sector-northwest-public-generating-pool-2017-present/>; Pacific Northwest Zero-Emitting Resources Study, January 2020, <https://www.ethree.com/e3-examines-role-of-nuclear-power-in-a-deeply-decarbonized-pacific-northwest/>

⁴⁰ E3 ran two versions of scenario 1. In scenario 1, the high carbon price assumed drives the region higher than the 100% CES target, making it a non-binding constraint in the model. In scenario 1b, the 100% CES target is binding in 2045, causing the need to fully replace the GHG-free energy output of the LSR dams. The values shown here represent the range of additions across both scenarios.

while reducing the required quantities of wind, solar and batteries that are needed. The “no new combustion” scenario does not allow emerging clean firm technologies such as hydrogen combustion turbines, gas generation with carbon capture and sequestration (CCS) or SMRs. As a result, it requires impractically high levels of additional onshore wind, offshore wind, and battery storage to meet firm capacity and carbon reduction needs, quadrupling the total installed MW of the Northwest grid by 2045.

When the power services provided by the dams are removed from the regional power system, RESOLVE selects an optimal, i.e., least-cost portfolio of replacement resources that meets the Northwest’s clean energy and system reliability needs. These replacement resources require a large investment and come at a substantial cost that increase over time as the region’s clean energy goals become more stringent. In the latter years, the replacement costs are highly dependent on scenario-specific assumptions about the availability of emerging technologies. RESOLVE primarily replaces the carbon-free energy from the dams with additional wind and solar power and the firm capacity with dual fuel natural gas and hydrogen combustion plants. Small amounts of additional energy efficiency and battery storage are also selected in some scenarios. By 2045, the dual fuel plants added burn additional hydrogen on low wind days to replace the carbon-free energy provided by the dams. Scenario 2b selects additional nuclear SMRs in lieu of some of the wind and gas resources. Scenario 2c disallows the new combustion plants, even those that would burn green hydrogen, and other emerging technologies, requiring a very large buildout of wind and solar power to replace both the firm capacity and the carbon-free energy of the dams.

The long-term emissions impact of removing the generation of the lower Snake River dams will depend on the implementation of the Oregon and Washington electric clean energy policies. Both a 100% clean retail sales and a zero-carbon emissions target require replacement of most or all of the LSR dams’ GHG-free energy. However, without additional earlier carbon-free resource investments beyond those modeled in this study to meet clean energy policy trajectories, carbon emissions may increase initially when the dams are breached, before declining by 2045 as the carbon policy becomes more stringent.

KEY FINDINGS:

- + **Replacing the four lower Snake River dams while meeting clean energy goals and system reliability is possible but comes at a substantial cost**, even assuming emerging technologies are available:
 - Requires 2,300 – 4,300 MW of replacement resources
 - An annual cost of \$415 million – \$860 million by 2045
 - Total net present value cost of \$11.2-19.6 billion based on 3% discounting over a 50-year time horizon following the date of breaching
 - Increase in costs for public power customers of \$100 – 230 per household per year (an 8 – 18% increase) by 2045
- + The biggest cost drivers for replacement resources are the need to replace the lost **firm capacity for regional resource adequacy** and the need to replace the lost **zero-carbon energy**
- + Replacement becomes **more costly over time** due to increasingly stringent clean energy standards and electrification-driven load growth
- + **Emerging technologies** such as hydrogen, advanced nuclear, and carbon capture **can limit the cost of replacement resources** to meet a zero emissions electric system, but the pace of their commercialization is highly uncertain

- In economy-wide deep decarbonization scenarios, ***replacement without any emerging technologies requires very large renewable resource additions at a very high cost*** (12 GW of wind and solar at \$42-77 billion NPV cost)

Appendix

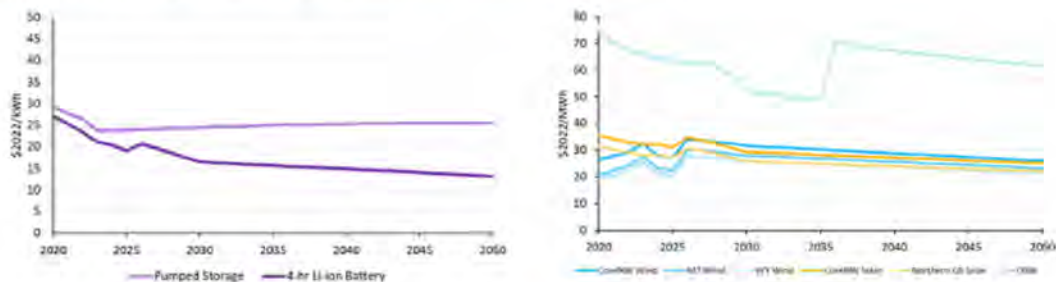
Additional Inputs Assumptions and Data Sources

Candidate resource costs

The technology fixed costs trajectories for candidate resource options are shown in Figure 25 and use the following data sources:

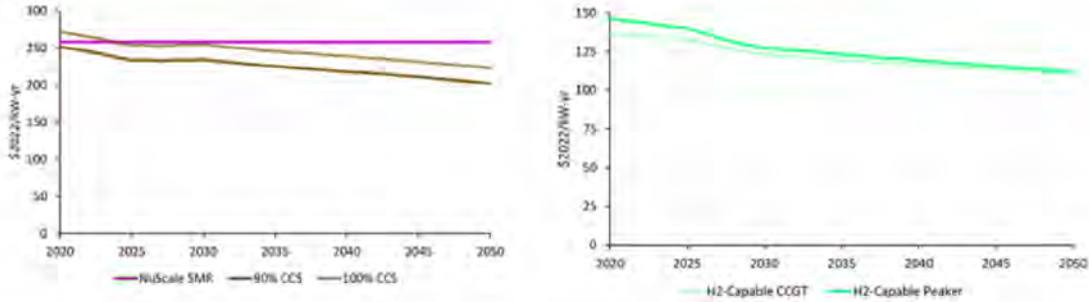
- + **Battery Storage:** Costs derived from Lazard LCOS 7.0 and E3 modeling
- + **Pumped Storage:** Costs derived from Lazard’s last published PHS costs (LCOS 4.0)
- + **Renewables (solar, onshore, and offshore wind):** Costs derived from E3’s inhouse Pro Forma which integrates the NREL 2021 Annual Technology Baseline
- + **Geothermal:** Costs derived from E3’s inhouse Pro Forma which integrates the NREL 2021 Annual Technology Baseline
- + **Energy Efficiency and Demand Response:** Costs supply curve adjusted for cost effective energy efficiency and DR potential from the 2021 Northwest Power Plan
- + **Carbon Capture and Storage (CCS):** Costs derived from E3’s inhouse “Emerging Tech” Pro Forma using the NREL 2021 Annual Technology Baseline and Feron et al., 2019.⁴¹
- + **Nuclear Small Modular Reactor (SMR):** Costs are derived from the vendor NuScale, for an “nth of a kind” installation of the technology they are developing
- + **Gas and Hydrogen-Capable Technologies:** CCGT and peaker costs are derived from E3’s inhouse ProForma which integrates NREL 2021 Annual Technology Baseline. New Hydrogen or natural gas to hydrogen upgrades include a ~10% additional cost that converges with standard CCGT and peaker costs by 2050

Figure 25. All-in fixed costs for candidate resource options⁴²



⁴¹ Feron, P., Cousins, A., Jiang, K., Zhai, R., Thiruvenkatachari, R., & Burnard, K. (2019). Towards zero emissions from fossil fuel power stations. *International Journal of Greenhouse Gas Control*, 87, 188–202.

⁴² Storage costs are shown in \$/kWh of energy storage. Renewable costs are shown in \$/MWh. Clean firm resources (nuclear, CCS, hydrogen CCGT or peakers) are shown in \$/kW-yr, since their \$/MWh costs are a function of their runtime that RESOLVE would determine endogenously.

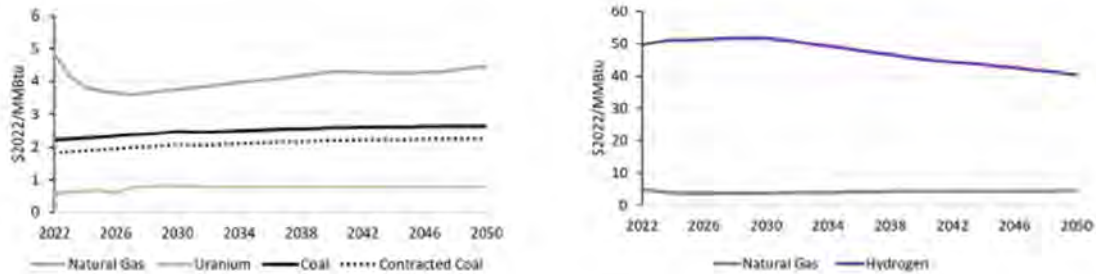


Fuel prices

The fuel price forecasts used in this study are derived from a combination of market data and fundamentals-based modeling of natural gas supply and demand. Wholesale gas prices are pulled from forward contracts from NYMEX (Henry Hub) and Amerex and MI Forwards (all other hubs) for the next five years, after which the Henry Hub forecast trends towards EIA’s AEO natural gas price by 2040. All other hubs forecast after the first five years are based on the average 5-year relationship between their near-term forward contracts and that of Henry Hub. Data sources used for fuel price forecasts used in modeling are as follows and the trajectories are presented in Figure 26:

- + **Natural gas prices:** In near term, SNL NG price forecasts (i.e., for 2022-2026); and in long term, the EIA’s AEO 2040 forecasts are used. Recent fuel cost increases due to market disruptions are excluded from the price trajectory.
- + **Coal prices:** EIA’s AEO forecast are used
- + **Uranium prices:** E3’s in-house analysis
- + **Hydrogen prices:** Conservative prices are used assuming no large-scale hydrogen economy, and thus electrolyzer capital costs and efficiencies are assumed to improve over time only slightly. Other assumptions include above ground hydrogen storage tanks and delivery via trucks from about 225 miles distance. Electrolyzers use dedicated off-grid Core NW wind power to produce hydrogen.

Figure 26. Fuel price forecasts for natural gas, coal, uranium, and hydrogen

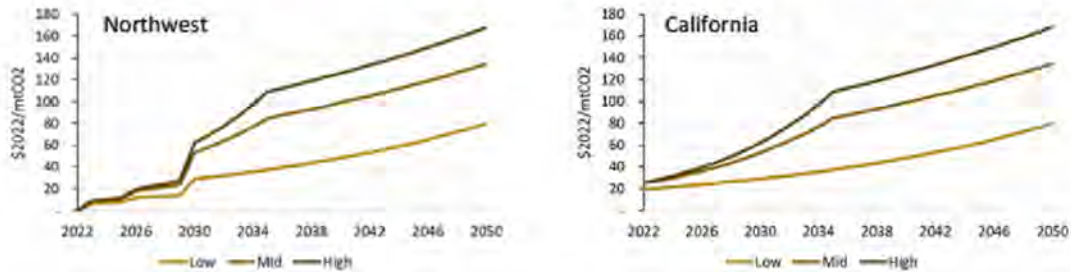


Annual average gas prices are further shaped according to a monthly profile to capture seasonal trends in the demand for natural gas and the consequent impact on pricing.

Carbon prices

For carbon pricing, it is assumed that Washington’s cap-and-trade program starts in 2023 at around 50% of California carbon prices. For Oregon, it is assumed that a carbon price policy will be effective by 2026 for the electric sector. Prior to 2026, the Northwest carbon price is a load weighted share of carbon prices in WA and OR. Additionally, it is assumed that both states will converge to California’s floor price by 2030. California’s carbon prices are adopted from the Final 2021 IEPR GHG Allowance Price Projections (December 2021). Mid carbon prices presented in Figure 27 are used in modeled cases.

Figure 27. Carbon price forecasts for Northwest and California



Scenario 1b assumes no carbon price in the CoreNW zone.

Operating Reserves

It is assumed that all coal, gas, hydro, and storage resources within the Northwest zone can provide operating reserves. Additionally, RESOLVE allows renewable generation to contribute to meeting the needs for load following down; to allow for variable renewable generation curtailment to balance forecast error and sub-hourly variability. The following three types of operating reserve requirements are considered within the Core Northwest to ensure that in the event of a contingency, sufficient resources are available to respond and stabilize the electric grid:

- + **Spinning reserves:** Modeled as 3% of hourly load in agreement with WECC and NWPP operating standards
- + **Regulation up and down:** Modeled as 1% of hourly load
- + **Load following up and down:** Modeled as 3% of hourly load

Modeling of Imports and Exports

The Northwest RESOLVE model includes a zonal representation of the WECC. In modeling hourly dispatch during representative days, it considers the least-cost dispatch solution across the WECC, based on resource economics, resource operational limits, fuel and carbon prices, operating reserve requirements, and zonal transmission transfer limits. Imports to the CoreNW zone can occur from other neighboring

zones; when they do a carbon adder is included for unspecified imports, while specified imports do not receive a carbon adder. Exports from the CoreNW zone may occur as deemed economic by RESOLVE, subject to other model constraints.

Minimum and maximum capacity limits are applied to the zonal representation of transmission between connected zones. These zonal transfer limits are shown in Table 13. Transmission hurdle rates as well as carbon hurdle rates (with regional carbon price adders) are applied to imports and exports.

Table 13. Transmission Capacity Limits between the CoreNW and other Zones

Transmission Constraint	Transmission from	Transmission to	Min Flow (MW)	Max Flow (MW)
CoreNW to OtherNW	CoreNW	OtherNW	-6,036	2,550
CoreNW to CA	CoreNW	CA	-6,820	5,433
CoreNW to SW	CoreNW	SW	0	0
CoreNW to NV	CoreNW	NV	-300	300
CoreNW to RM	CoreNW	RM	0	0

Contracted imports (such as imported coal and/or wind power) are included in the resource adequacy accounting captured in the planning reserve margin constraint. New remote resources include transmission cost adders to deliver them into the CoreNW zone. Additional unspecified imports are not assumed in RESOLVE’s resource adequacy accounting.

Additional LSR Dam Power System Benefits (not modeled)

As described in this report, RESOLVE covers replacement of most power services provided by the LSR dams. However, RESOLVE does not model transmission grid operations (power flow, voltage and frequency, dynamic stability, etc.). Therefore, E3 notes that the LSR dams may provide the following additional essential reliability services to the transmission grid. In general, E3 expects that the replacement of these services can be achieved either through siting and operations of the incremental replacement capacity selected or by additional local transmission investments. The scale of these transmission investments requires more detailed study.

- **Reactive power and voltage control:** the LSR dams, like hydropower resources generally in the Northwest, provide significant reactive power capabilities that supports reliable power flow by optimally controlling voltage levels. Replacing this function likely requires siting additional resources with reactive power capabilities in a similar section of the transmission grid as the LSR dams.
- **Frequency response and inertia:** the LSR dams provide both primary and secondary frequency response capabilities. As synchronous generators they also provide system inertia that would be lost if the LSR dams are removed and as other synchronous generators retire. New efforts are underway to allow renewable generators or battery storage to provide “synthetic inertia” (or equivalent fast frequency response services), but this provision has not yet been proven to date at scale. The LSR dams are also highly tolerant of operating during high and low frequency events without sustaining blade damage.

- **Blackstart:** Large hydro resources have the capability to provide black start services when required, though not all hydro plants are chosen to provide this capability.
 - **Participation in remedial action schemes:** Hydropower is a robust resource for participation in remedial action schemes because it can withstand being suddenly tripped off-line as part of a RAS action.
 - **Short circuit and grounding contribution:** Synchronous generators (like hydropower) provide a large short circuit current that is important for the proper operation of protective relaying schemes.
-

Earlier this year, BPA engaged electric industry research firm Energy and Environmental Economics (E3) to build on the analysis performed in the Columbia River System Operations (CRSO) Environmental Impact Statement (EIS) regarding replacement resources and costs associated with a scenario where the four lower Snake River dams may be breached in the future. As states move forward with clean energy policies, fossil fuel-generated power is being removed from the grid and E3 will include a resource portfolio optimizer model using their data sets and their criteria and objectives to create least cost replacement portfolios in the new policy landscape. The E3 study information will be important to include as at least two of the studies cited in the Draft Report include more generation on the grid than current state laws permit.

The Draft Report acknowledges the decarbonization goals of Oregon and Washington, which include shifting greater demand from high fossil-fuel sectors (e.g. transportation and heating) to the decarbonizing electricity sector. The E3 analysis included scenarios evaluating a replacement in light of future needs.

From: Koehler,Birgit G (BPA) - PG-5
Sent: Tuesday, July 12, 2022 1:03 PM
To: Godwin,Mary E (BPA) - LN-7; James,Eve A L (BPA) - PG-5
Subject: RE: E3 to Inslee/Murray cover page

Correct, heat pumps become less efficient as the temperature goes down. And even without that effect, just more heat pumps and old-fashioned electric heat will increase electric load

From: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Sent: Tuesday, July 12, 2022 1:01 PM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: E3 to Inslee/Murray cover page

Great. I'll update this and send to DOE for review.

Thanks,
Mary

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, July 12, 2022 11:40 AM
To: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: E3 to Inslee/Murray cover page

Thanks Mary- I think for buildings it is mostly heating since that is what is replacing the natural gas furnaces. Birgit correct me if I'm wrong but replacing gas furnaces with heat pumps (which provide cooling in the summer) are very inefficient at heating buildings during cold temperatures.

From: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Sent: Tuesday, July 12, 2022 11:35 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: RE: E3 to Inslee/Murray cover page

Thanks ladies. I made a few edits and I have one questions on "buildings" at the end.

Thanks,
Mary

From: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Sent: Tuesday, July 12, 2022 10:06 AM
To: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Subject: E3 to Inslee/Murray cover page

I'm making a go of having email subject lines be clearer about what the topic is. Makes it easier to find later.

I've added some edits as suggestions

From: James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Sent: Tuesday, July 12, 2022 9:43 AM
To: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>
Subject: RE: Draft LSRD Benefit Replacement Report

How about this as a first cut- I put it in a word document so you can edit as needed:

From: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Sent: Tuesday, July 12, 2022 7:27 AM
To: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>
Subject: FW: Draft LSRD Benefit Replacement Report

Hi Birgit and Eve,
Could you two take a stab at putting together a few points for a very short cover letter on the E3 study to supplement our comments on the draft Inslee-Murray Report? Now that the E3 study is public, we can send it in to the contractors working on the final report. We can use existing talking points and tie it to our comments on the studies that the Draft Report references.

Thanks,
Mary

From: Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>
Sent: Tuesday, July 12, 2022 7:18 AM
To: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Cc: Renner,Marcella P (BPA) - E-4 <mprenner@bpa.gov>
Subject: RE: Draft LSRD Benefit Replacement Report

Do we want to cut a cover letter today and mail the E3 study in? Scott

SCOTT G ARMENTROUT
Executive Vice President, Environment, Fish & Wildlife, SES | E-4
BONNEVILLE POWER ADMINISTRATION
bpa.gov | P 503-230-3076 | c(b)(6)



From: Godwin,Mary E (BPA) - LN-7 <megodwin@bpa.gov>
Sent: Monday, July 11, 2022 4:47 PM
To: Hairston,John L (BPA) - A-7 <jlhairston@bpa.gov>; Armentrout,Scott G (BPA) - E-4 <sgarmentrout@bpa.gov>; Cook,Joel D (BPA) - K-7 <jdcook@bpa.gov>; Cooper,Suzanne B (BPA) - P-6 <sbcooper@bpa.gov>; Cathcart,Michelle M (BPA) - TO-DITT-2 <mmcathcart@bpa.gov>; Baskerville,Sonya L (BPA) - AIN-WASH <slbaskerville@bpa.gov>
Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Sullivan,Leah S (BPA) - EWP-4 <lsullivan@bpa.gov>; Sweet,Jason C (BPA) - EW-4 <jcsweet@bpa.gov>; Zelinsky,Benjamin D (BPA) - E-4 <bdzelinsky@bpa.gov>; Leary,Jill C (BPA) - LN-7 <jcleary@bpa.gov>; Senters,Anne E (BPA) - LN-7 <aesenters@bpa.gov>; Chong Tim,Marcus H (BPA) - L-7 <mhchongtim@bpa.gov>; Chan,Allen C (BPA) - LT-7 <acchan@bpa.gov>; Anasis,John G (TFE)(BPA) - TOOP-DITT-2 <jganasis@bpa.gov>; Klumpp,Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>
Subject: FW: Draft LSRD Benefit Replacement Report

Hi All,

Bonneville submitted its comments on the draft Inslee-Murray Lower Snake River Dams Benefit Replacement Report this afternoon. Comments were due today. The Draft Report is located here: [Lower Snake River Dams: Benefit Replacement Draft Report \(lsrdoptions.org\)](#)

Thanks,
Mary

From: Renner, Marcella P (BPA) - E-4 <mprenner@bpa.gov> On Behalf Of Armentrout, Scott G (BPA) - E-4
Sent: Monday, July 11, 2022 4:38 PM
To: info@lsrdoptions.org
Cc: Godwin, Mary E (BPA) - LN-7 <megodwin@bpa.gov>; Klumpp, Elizabeth C (BPA) - AIR-WSGL <ecklumpp@bpa.gov>
Subject: Draft LSRD Benefit Replacement Report

To whom it may concern,

This serves as Bonneville Power Administration (Bonneville) comments to Senator Murray and Governor Inslee on the draft *Lower Snake River Dams: Benefits Replacement Study* report (Draft Report). Bonneville provided input into the draft report on the power replacement analysis completed in the 2020 Columbia River System Operations (CRSO) Environmental Impact Statement (EIS) and Bonneville's comments focus on key technical points contained in the Draft Report and for inclusion in the Final Report.

Bonneville markets and transmits the hydropower generated at thirty-one Federal Columbia River Power System (FCRPS) projects, including the four lower Snake River dams.^[1] Bonneville, is one of four Power Marketing Administration's and is part of the U.S. Department of Energy. Bonneville operates as a not-for-profit federal entity, selling cost-based electrical power and transmission services to benefit the Pacific Northwest, including the public bodies and cooperatives that serve domestic and rural consumers. In providing these services, Bonneville balances multiple public duties and purposes, including: assuring the Pacific Northwest has an adequate, efficient, economical and reliable power supply; promoting energy conservation and the use of renewable resources; respecting and upholding its relationship with Tribal Nations; and, acting in a manner consistent with the program developed by the Northwest Power and Conservation Council by protecting, mitigating, and enhancing fish and wildlife in the Columbia River basin that are affected by the development and operations of the federal facilities from which Bonneville markets power.^[2]

The U.S. Army Corps of Engineers (Corps) operates and maintains these four projects for multiple congressionally authorized purposes including flood risk management, navigation, hydropower generation, fish and wildlife conservation, irrigation, recreation, water quality, and municipal and industrial water supply though not every facility is authorized for every one of these purposes. While the Corps is congressionally authorized to operate these four projects for multiple purposes, Bonneville is the federal agency Congress authorized to market and transmit the power generated at these facilities. In return, Bonneville is required to pay, either directly to the Corps, or as a reimbursement to the U.S. Treasury, (1) all costs associated with power-specific operations and assets (e.g., turbines); and (2) a share of "joint costs," which benefit or mitigate, for all purposes of the facility (e.g., fish mitigation, water quality).

Bonneville's comments are separated into six sections: 1) General comments on the Executive Summary and Context and Purpose; 2) Technical comments on the Power Information; 3) Technical comments on Transmission Analysis; 4) Technical comments on Fish Information; 5) Technical comments on Water Quality Information and 6) Clerical Error Correction.

SCOTT G ARMENTROUT

Executive Vice President, Environment, Fish & Wildlife, SES | E-4

BONNEVILLE POWER ADMINISTRATION

bpa.gov | P 503-230-3076 | C (b)(6)



Question: need a few Q&As on the energy price impacts that are summarized in the report? Specifically, timing considerations about how the impacts are estimates that would not be actualized in the near-term / the Admin is not endorsing a policy that will increase energy prices for households.

1. What is the projected rate impact and timing impact to BPA customers?

By 2045, scenarios 1, 2a and 2b, the rate impact would be between 8% and 18% or ~\$100 to \$230 per ratepayer/per year. By 2045, in a deep economy-wide decarbonization scenario (2c) with no emerging technologies, the cost would be approximately a 65% increase or \$850 per year per ratepayer/per year.

E3 estimates that adding additional renewable energy and firm capacity additions would take approximately five to seven years after Congressional approval to breach the dams and possibly up to 10 to 20 years assuming additional new large-scale transmission was required. There would be no immediate impact to BPA's ratepayers.

2. Could these cost increases be offset?

Yes, new federal tax credits for hydrogen plants/fuels or Investor Tax Credit/Production Tax Credit extension for renewables would provide a cost reduction be considered taxpayer contributions that would reduce upward rate pressure to public power customers from taxpayers.

Alternatively, using taxpayer funding to acquire the new generating resources through Congressional appropriations in lieu of utility financing would largely offset the rate increase.

3. How much would it cost to replace the power benefits of the four LSR dams?

The total net present value of replacement would be \$11.87.5B. In a deep carbonization scenario with higher loads and zero emissions by 2045, the net present value ranges from \$10.7 – \$ 14.59.0B.

4. What net present rate was used to calculate financial impacts?

These net present value costs were calculated using a 3% discount rate, consistent with the discount rate used in the Inslee/Murray draft report which is a reasonable rate for public financing of large utility projects.)

5. What scenarios did the E3 Study analyze?

E3's scenarios analyzed emerging technologies, such as small modular nuclear reactors (SMRs) and gas plants with carbon capture or hydrogen-burning capability, which are not yet commercially available. In all scenarios, E3's model includes use of traditional renewable resources, such as wind, solar, storage and demand response.

Comment [KG(-P1): If the wrote a big check, that would cover construction. After that, O&M might still fall on us, and some resources (e.g. SMR, hydrogen) would have fuel costs. That would go for TX build and TX O&M too.

Comment [KG(-P2): These numbers are too small. Can't find them in the PPT. #5 has different numbers. Maybe I'm missing where these are being pulled from?

Comment [KG(-P3): This is all without scenario 2c, deep decarbonization at \$75B

In scenarios in which one or more new technology becomes commercially viable, new resources to replace the existing lower Snake River dams' energy and capacity would cost between \$10.7 to \$19.0 Billion.

Map idea, Seattle --

Consider cropping. I left the scale from Google maps on the bottom, but can crop that too



Deliberative, FOIA Exempt 1

Map idea, Seattle --

Not cropped



Deliberative, FOIA Exempt 2

Map idea, showing wind is way bigger than area for two reservoirs. Could redo with 4 reservoirs and skinnier boxes



Conversion factors from

[Land Use by System Technology | Energy Analysis | NREL](#)

0.001563 sq miles/acre

solar, 1 to 10 MW 6.1 acres/MW 0.009531 sq miles/MW

wind 1 to 10 MW 44.7 acres/MW 0.069844 sq miles/MW

[Offshore Wind Market Report: 2021 Edition \(energy.gov\)](#)

off-shore 82.36921 acres/MW 0.128702 sq miles/MW

Table 5. New York Bight Wind Energy Area Characteristics

	Fairways North WEA	Fairways South WEA	Hudson North WEA	Central Bight WEA	Hudson South WEA
Acres	88,246	23,841	43,056	84,688	567,552
Estimated Capacity (MW) ²⁰	1,072	289	523	1,028	6,890
Estimated Generation (megawatt-hour/year) ²¹	3,754,037	1,014,210	1,831,628	3,602,678	24,143,998
Average Water Depth (meters)	49	42.5	43	56.5	45.5

		area acres	area sq miles
Scenario 2c			
on-shore wind	4.6 cm on blown-up graph when 16 GW is 10.3 cm 7145.631 MW	319,410	499
solar	0.55 mm on blown-up graph 854.3689 MW	5,212	8
batteries	3.7 cm on blown-up graph 5747.573 MW		
pumped storage	0.13 cm 201.9417 MW		

From Birgit's husband:

Using Megapack, Tesla can deploy an emissions-free 250 MW, 1 GWh power plant in less than three months on a **three-acre** footprint – four times faster than a traditional fossil fuel power plant of that size.

That is 83.3 MW/Acre,

So $5700\text{MW}/83.3\text{MW/Acre} = 65\text{Acres}$

That is 22.8GWH of storage in a 4 hour format.

Using 4,385 Tesla Megabucks.

1000 megapacks cost \$1,654,927,950 installed, so 4384 megapacks would be \$7

This is a big project. Tesla has only deployed 5GWH of storage so far.

Info from:

<https://www.tesla.com/megapack/design>

for cost and number of packs

<https://www.tesla.com/blog/introducing-megapack-utility-scale-energy-storage#:~:text=Using%20Megapack>

for acreage.

Rob's ratios	MW	sq miles land	acres		acres/MW
solar	-500	-1.3	-832	0.0026	1.664
	1500	4	2560	0.002667	1.70666667
	1600	4.3	2752	0.002688	1.72
wind	200	7.8	4992	0.039	24.96
	1300	50.8	32512	0.039077	25.0092308
	600	23.4	14976	0.039	24.96

Total
807,383
9,802
34,346,551
47.3

It looks like Rob used the Std Deviation values, n

Year	S0 No Policy	S1 100% Clean Retail Sales	S1a 100% Clean Retail Sales (no carbon price)	S2 De
	2035 PRM	2035 PRM	2035 PRM	
Reliability Metric				
Gas (MW)	2300	1800	2200	
DR (MW)				
Solar (MW)		-500		
Batteries (MW)		100	100	
Wind (MW)	200	1300		
Offshore Wind (MW)				
Pumped Storage (MW)				
Conservation (MW)				
SMR (MW)				
Wind (Sq Miles)	7.8	50.8	0.0	
Offshore Wind (Sq Miles)				
Solar (Sq Miles)		-1.3	0.0	

.3B

[%2C%20Tesla%20can%20deploy,creating%20seamless%20renewable%20energy%20plants](#)

not the actual area

E3			
	S2a1 - Deep Decarb no combusti on	S2a2 - Deep Decarb no gas	S2a3 - Deep Decarb emerging tech
	2035 PRM	2035 PRM	2035 PRM
	2000		1500 (H2)
		1500	
	200	6000	300
	600	9400	600
			13000
		300	
		10	
			600
	23.4	367.2	0.0
			1204.4
	0.0	4.0	4.3
			0.0

Non-technical presentation for DOE and CEQ

Deliberative, Pre-Decisional, FOIA exempt ← this needs to be on every slide

- What are the 3-5 new things coming out of the study we didn't know before?
- What are the effects on BPA and our customers of not having the LSN gen
 - Cost, etc
- What are the regional effects?

About this study – can use E3’s slide with minor edits

- Fix footnote on what is included in LSN costs (LSRC) lower snake river comp plan

What is new in this study

- Used an optimizer to select the portfolio of resources to replace the generation of the lower Snake River Dams
- Performed multiple scenarios of the future
- Examined what resources the region would need (absent removing the LSN gen) and what the region would need to replace the LSN

- Insert before list of scenarios

What is similar to the EIS

- Not sure we want this, but maybe

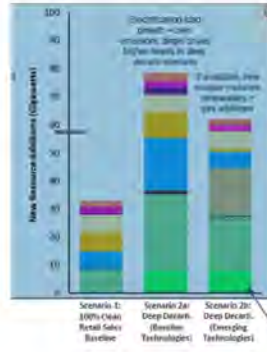
Contrast with NWECC Study (E3 may not have seen it yet, but we need to do it)

- Used 1000 MW for LSN capacity for LSN capacity and assumed 300 MW from market
 - Contrast, LSN good over 2000 MW (we have a good graphic)

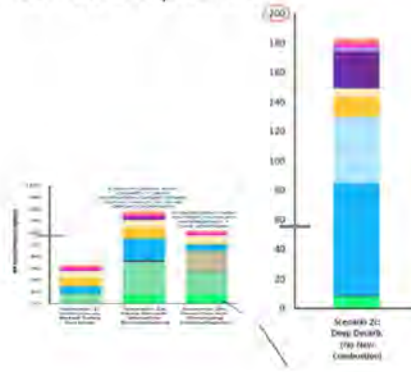
Key Take-aways

- Add the thought that Alisa Kaseweter articulated well. (As long as fossil fuel plants are on-line, any new renewables replacing the LSN means that the fossil plants are generation and thus increases GHG emissions.)

Idea for two graphs with really different scales, slide 1



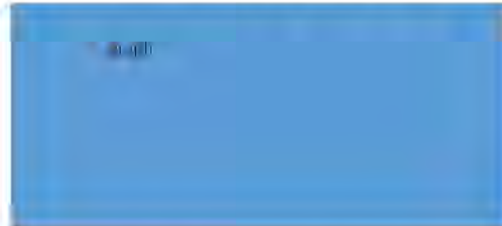
Idea for scale, slide 2



Map- like diablo canyon - shows footprint of solar and maybe wind

- [An Assessment of the Diablo Canyon Nuclear Plant for Zero-Carbon Electricity, Desalination, and Hydrogen Production | Energy \(stanford.edu\)](#)
- Rob Diffely can help you convert MW solar to land area (or google probably can too)
- Also make sure we include things like transmission takes time, supply chain for building new resources, critical minerals for batteries, etc.

Template Birgit learned in grad school for *technical presentations* let alone for lay-person



- What the audience should remember (even if they slept through what you said)

From: Aaron Burdick <aaron.burdick@ethree.com>
Sent: Friday, August 12, 2022 5:35 PM
To: Jennifer Light
Cc: John Ollis; Koehler,Birgit G (BPA) - PG-5; James,Eve A L (BPA) - PG-5; Arne Olson
Subject: [EXTERNAL] RE: Follow-Up Questions on LSRD Power Replacement Study
Attachments: NWPCC_Questions about LSRD removal study Assumptions_E3 response.docx

Hi Jennifer,

Sharing written responses to your questions. Let me know if you have any further questions.

Enjoy the weekend!

Aaron

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Thursday, August 4, 2022 5:30 PM
To: Aaron Burdick <aaron.burdick@ethree.com>
Cc: John Ollis <JOllis@NWCouncil.org>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Arne Olson <arne@ethree.com>
Subject: RE: Follow-Up Questions on LSRD Power Replacement Study

Thank you Aaron! I appreciate your willingness to help us better understand your work.

Please reach out if talking is easier or anything else we can help with.

Thanks,
Jennifer

From: Aaron Burdick <aaron.burdick@ethree.com>
Sent: Thursday, August 4, 2022 2:05 PM
To: Jennifer Light <JLight@NWCouncil.org>
Cc: John Ollis <JOllis@NWCouncil.org>; Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; James,Eve A L (BPA) - PG-5 <eajames@bpa.gov>; Arne Olson <arne@ethree.com>
Subject: RE: Follow-Up Questions on LSRD Power Replacement Study

Hi Jennifer,

Wanted to confirm we received your questions and will work to provide a response to them by next week.

All the best,
Aaron

From: Jennifer Light <JLight@NWCouncil.org>
Sent: Monday, August 1, 2022 2:28 PM
To: Arne Olson <arne@ethree.com>; Aaron Burdick <aaron.burdick@ethree.com>

Cc: John Ollis <JOllis@NWCouncil.org>

Subject: Follow-Up Questions on LSRD Power Replacement Study

Hello Arne and Aaron,

Thank you for presenting your study at the July Council meeting. I think it was a great discussion. The fact that the Council members were able to ask so many good questions is a testament to the good presentation.

I am reaching out with a few follow up questions (see attached). My team had some questions about the analysis and assumptions that we were not able to fully answer through reading the report or listening to the presentation. As you can see, these get more into the weeds, as you might expect from the staff/analytical level. Our goal is to just make sure we understand the analysis, as we have been getting some questions from our members. I reached out to Bonneville to confirm that they were okay with us following up, and they asked that we just contact you directly. Hopefully you can take some time to respond.

Thank you in advance for your time, and please let me know if a call might be easier to talk through any of these.

Jennifer Light (she/her)

Interim Director of Power Planning

Office: 503-222-5161 | Direct (b)(6)

www.nwcouncil.org | [LinkedIn](#)



Subject: Natural Gas Resources in LSRD Removal Study
Location: Webex (BPA Invite, Information Attached to Event)

Start: Mon 8/21/2023 9:30 AM
End: Mon 8/21/2023 10:00 AM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Dombeck,Brian J (BPA) - PGPR-5
Required Attendees: Aaron Burdick; Egerdahl,Ryan J (BPA) - PGPR-5
Optional Attendees: Arne Olson

Great, thank you Aaron! I'm sending the invitation back to all 4 on this message thread, but that's mostly just for Ryan/Arne's information. Webex information below.

You can forward this invitation to others.

BPA Resource Program changed the Webex meeting information.

When it's time, join the Webex meeting here.

Monday, August 21, 2023

10:00 AM | (UTC-07:00) Pacific Time (US & Canada) | 30 mins

[Join meeting](#)

More ways to join:

Join from the meeting link

<https://mybpa.webex.com/mybpa/j.php?MTID=m759ca79089b03a47150e8a084c4cc573>

Join by meeting number

Meeting number (access code): (b)(6)

Meeting password: pgDxjJ3x\$46

Tap to join from a mobile device (attendees only)

[\(b\)\(6\)##](tel:+1-415-527-5035) US Toll

Join by phone

+1-415-527-5035 US Toll

[Global call-in numbers](#)

Join from a video system or application

Dial (b)(6) @mybpa.webex.com

Need help? Go to <https://help.webex.com>

You can forward this invitation to others.

BPA Resource Program changed the Webex meeting information.

When it's time, join the Webex meeting here.

Monday, August 21, 2023

10:00 AM | (UTC-07:00) Pacific Time (US & Canada) | 30 mins

[Join meeting](#)

More ways to join:

Join from the meeting link

<https://mybpa.webex.com/mybpa/j.php?MTID=m759ca79089b03a47150e8a084c4cc573>

Join by meeting number

Meeting number (access code): (b)(6)

Meeting password: pgDxjJ3x\$46

Tap to join from a mobile device (attendees only)

[\(b\)\(6\)##](tel:+1-415-527-5035) US Toll

Join by phone

+1-415-527-5035 US Toll

[Global call-in numbers](#)

Join from a video system or application

Dial (b)(6) @mybpa.webex.com

Need help? Go to <https://help.webex.com>

From: Aaron Burdick <aaron.burdick@ethree.com>

Sent: Thursday, August 17, 2023 9:55 AM

To: Dombeck, Brian J (BPA) - PGPR-5 <bjdombeck@bpa.gov>; Egerdahl, Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>

Cc: Arne Olson <arne@ethree.com>

Subject: Re: [EXTERNAL] RE: Lower Snake study

Hi Brian,

Happy to have a discussion. I'm free 9:30-10:30 on Monday.

Regarding your questions:

1. We didn't do much calibration in the near-term on resource potential limits. The 2025 builds looked generally reasonable in most cases - the 2024 dam removal had the most aggressive buildout, but also seemed the least likely scenario for that reason.
2. In general, RESOLVE sees those plants as natural gas capacity resources that don't operate frequently either on gas or hydrogen. They are primarily built to replace the PRM contributions of the LSR dams and would mostly operate on extreme load days and/or low hydro years. Of course, if they're CCs that are more efficient than the regional fleet, then they'd operate to displace those less efficient units, with a corresponding emissions reduction benefit. Beyond the RESOLVE modeling, there is the political reality that may force some of those units to operate on a zero-carbon fuel like biogas or hydrogen, but that would require securing biogas or additional hydrogen infrastructure to do so.

All the best,

Aaron

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From: Dombeck, Brian J (BPA) - PGPR-5 <bjdombeck@bpa.gov>
Sent: Thursday, August 17, 2023 7:37 AM
To: Aaron Burdick <aaron.burdick@ethree.com>; Egerdahl, Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: RE: [EXTERNAL] RE: Lower Snake study

Thank you Aaron for the data and additional information. I wonder if we could find a time for a ~30 minute call to close out my questions? For starters, I'm open 1-3pm PST tomorrow Friday August 18th or 9am-12pm Monday August 21st.

In case a meeting doesn't work (and maybe even if it does J), here are my new questions:

For sake of concreteness lets focus on the "1 (2024 removal)" results, which I think says the least-cost solution to replacing the dams *if* they were removed in 2024 would be, in part, to build 3.9 GW of new thermal plants which can run on NG or H2 by 2025, with that amount rising to 7.9 GW by 2035. Two questions:

How did you arrive at your calibration for what the "earliest installed date" would be for these resources? And maybe other new installed capacity as well. Trying to think about time to build and resource availability.

In the 2025-2035 time frame, is that new installed capacity operating mostly using the emitting NG fuel? Trying to think about whether/how these dual fuel plants are different than a traditional NG plant.

cid:image011.jpg@01D9D1A1.C159FBE0

Brian Dombeck (he/him/his)

Public Utilities Specialist | Resource Program Coordinator

Long Term Power Planning – PGPR

Bonneville Power Administration

bjdombeck@bpa.gov | O: 503-230-3544

cid:image001.jpg@01D52C3E.DF0B9390cid:image008.jpg@01D52C3E.09FCE1E0cid:image009.jpg@01D52C3E.09FCE1E0cid:image010.jpg@01D52C3E.09FCE1E0cid:image011.jpg@01D52C3E.09FCE1E0cid:image012.jpg@01D52C3E.09FCE1E0

From: Aaron Burdick <aaron.burdick@ethree.com>

Sent: Wednesday, August 16, 2023 12:32 PM

To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Dombeck,Brian J (BPA) - PGPR-5 <bjdombeck@bpa.gov>

Cc: Koehler,Birgit G (BPA) - PG-5 <bgkoehler@bpa.gov>; Arne Olson <arne@ethree.com>

Subject: RE: [EXTERNAL] RE: Lower Snake study

Hi Ryan,

Attached are the annual build results from the three studies you noted (1, 1 2024 removal, and 1b). Note that 1 and 1b include the LSR dams, whereas the 1 2024 removal case does not after 2024. Let me know if you need any data beyond this.

Note that scenario 1 allows some emitting generation to remain, so the "dual fuel" capable plants we model burn natural gas only on days with low renewables and hydro available. In scenario 2, we model a zero-carbon grid, whereby the dual fuel plants must ultimately burn hydrogen only by 2045 to reach zero emissions. In RESOLVE we see they typically only burn hydrogen when emissions must reach zero or very close to zero.

The idea of a dual fuel plant provides a useful bridge to construct firm capacity that is needed now, while decreasing the risk the plants could not operate in a zero-carbon grid. But there would be a large need for additional infrastructure (pipelines, storage, etc.) to transition multiple GWs (or 10s of GWs) from natural gas to hydrogen fuel. This is why we characterize the burning of hydrogen in those plants as an “emerging technology”. (We’ve been doing some modeling in CA to explore how to integrate this full H2 infrastructure build need into capacity expansion models for resource planning.) The Intermountain Power Plant replacement in Utah is the first good example of a dual fuel plant providing this function, though we’re starting to hear more of others popping up.

All the best,

Aaron

From: Aaron Burdick
Sent: Tuesday, August 8, 2023 9:37 PM
To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>; Arne Olson <arne@ethree.com>; Dombeck,Brian J (BPA) - PGPR-5 <bjdombeck@bpa.gov>
Subject: RE: [EXTERNAL] RE: Lower Snake study

Hi Ryan,

I'll need a bit of time to track down the annual build case results. I'll follow up in the next couple days.

All the best,

Aaron

From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Tuesday, August 8, 2023 8:59 AM
To: Arne Olson <arne@ethree.com>; Dombeck,Brian J (BPA) - PGPR-5 <bjdombeck@bpa.gov>
Cc: Aaron Burdick <aaron.burdick@ethree.com>
Subject: RE: [EXTERNAL] RE: Lower Snake study

Hi Arne. Now I'm back from vacation. J Thanks for the great follow up. We appreciate that. Aaron, we appreciate your future pointing too. J

Ryan

From: Arne Olson <arne@ethree.com>
Sent: Monday, August 7, 2023 11:34 PM
To: Dombeck,Brian J (BPA) - PGPR-5 <bjdombeck@bpa.gov>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Cc: Aaron Burdick <aaron.burdick@ethree.com>
Subject: RE: [EXTERNAL] RE: Lower Snake study

Hi Brian,

Yes, the plants burn gas in the near term and switch to H2 later. Cc'ing Aaron Burdick who will be able to point you to the information that shows the timing of the switchover from CH4 to H2 and the buildout of other resources.

Arne

From: Dombeck,Brian J (BPA) - PGPR-5 <bjdombeck@bpa.gov>
Sent: Monday, August 7, 2023 7:14 AM
To: Arne Olson <arne@ethree.com>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: RE: [EXTERNAL] RE: Lower Snake study

Hi Arne,

Ryan and I are trying to better understand how natural gas turbines are modeled in regional long-term power planning studies as well as how the planning requirements (like the CES target vs the carbon price in the E3 LSRDR study) influence the model results.

If the plants start switching to hydrogen in the late 2030s then presumably they are selected and burning gas prior to that point, especially in the 2024 LSRDR scenario when the need would be higher and the carbon price lower earlier in the study period. Do I have that right?

Is there a way to see the timing of the buildout for Scenario 1, Scenario 1 (2024 removal), and Scenario 1b? The tables in the report that I have access to give information on cumulative build by 2045. Also wondering if information on the “earliest operational date” for candidate resources is handy?

Best,

Brian

Brian Dombeck (he/him/his)

Public Utilities Specialist | Resource Program Coordinator

Long Term Power Planning – PGPR

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From: Arne Olson <arne@ethree.com>

Sent: Friday, August 4, 2023 4:55 PM

To: Dombeck, Brian J (BPA) - PGPR-5 <bjdombeck@bpa.gov>; Egerdahl, Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>

Subject: RE: [EXTERNAL] RE: Lower Snake study

Yes, the turbines would burn natural gas in the early years and hydrogen fuel later on when the carbon price gets high enough. We ran the model with a carbon constraint so the carbon price is endogenous and a function of the stringency of the emissions cap and the various cost components. The model starts to blend in hydrogen in the late 2030s.

From: Dombeck,Brian J (BPA) - PGPR-5 <bjdombeck@bpa.gov>
Sent: Thursday, August 3, 2023 6:52 AM
To: Arne Olson <arne@ethree.com>; Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Subject: RE: [EXTERNAL] RE: Lower Snake study

Hi Arne,

Thanks for the information! I noticed a line in the report speaking to the possibility of the dual fuel resource burning NG if needed:

[cid:image007.jpg@01D9D0D9.EEC133A0](#)

How should we be thinking about this in a modeling perspective? If these resources are selected, do they have some kind of transition path to 100% H2 over some amount of years (or some other exogenous determinant of the fuel being used), or is it something endogenous dealing with differences in peak capacity perhaps?

All the best,

Brian

Brian Dombeck (he/him/his)

Public Utilities Specialist | Resource Program Coordinator

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bjdombeck@bpa.gov | O: 503-230-3544

[cid:image001.jpg@01D9D0D9.EEC133A0cid:image002.jpg@01D9D0D9.EEC133A0cid:image003.jpg@01D9D0D9.EEC133A0cid:image004.jpg@01D9D0D9.EEC133A0cid:image005.jpg@01D9D0D9.EEC133A0cid:image006.jpg@01D9D0D9.EEC133A0](#)

From: Arne Olson <arne@ethree.com>
Sent: Wednesday, August 2, 2023 5:42 PM

To: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Cc: Dombeck,Brian J (BPA) - PGPR-5 <bjdombeck@bpa.gov>
Subject: [EXTERNAL] RE: Lower Snake study

Hi Ryan,

Apologies for the late reply, I was on vacation last week and am still digging out.

We did not allow conventional gas generation to be added to the model. We only allowed the dual fuel peaking plants. With that said, natural gas combustion was allowed in 2035 in all scenarios and all the way through 2045 in Scenario 1 (only H2 was allowed in 2045 in the other scenarios).

Hope this helps, please feel free to follow up if you need any additional information.

Thanks,

Arne

From: Egerdahl,Ryan J (BPA) - PGPR-5 <rjegerdahl@bpa.gov>
Sent: Friday, July 28, 2023 8:58 AM
To: Arne Olson <arne@ethree.com>
Cc: Dombeck,Brian J (BPA) - PGPR-5 <bjdombeck@bpa.gov>
Subject: Lower Snake study

Hi Arne. Hope you are doing well. I was hoping you could remind me of what natural gas technologies were included as candidate resources for LSN replacement in the E3 study. Really, I am looking for clarity if traditional baseload or gas peakers were included as candidates by themselves, or only natural gas that would be knowingly converted to a cleaner output than traditional gas.

Thanks in advance.

Ryan

Ryan Egerdahl

Manager, Long Term Power Planning

Bonneville Power Administration

rjeerdahl@bpa.gov

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cid:image009.jpg@01D9D0D9.EEC133A0

<https://www.bpa.gov/-/media/Aep/power/hydropower-data-studies/e3-bpa-lower-snake-river-dams-power-replacement-study.pdf>

1. Can you please provide more clarity on how you treated energy efficiency in this study? Our understanding is that you removed the expected energy efficiency from the load forecast. For the energy efficiency you subtracted from loads, did you only look at the energy efficiency that was cost-effective in the 2021 Plan? (pg 45). Or did you remove all of the energy efficiency in the Council (or other) supply curve? If the former, did you allow the model to consider energy efficiency that was not cost-effective under the 2021 Plan but was otherwise available in your supply curve?
 - a. We based our analysis on the achievable technical energy efficiency potential from 2021 Power Plan (5,144 average MW), assumed that the cost-effective energy efficiency was embedded in the load forecast; thus, we made the difference between total achievable energy efficiency and total cost-effective energy efficiency available for RESOLVE as candidate resource. Also, note that we scaled down the Power Plan EE potential to 87% to consider the geographic differences in the modeled CoreNW zone in RESOLVE vs the Power Plan. In most of the Deep Decarbonization scenarios, most of the remaining EE was selected in the baseline scenario, i.e., the scenario with the dams in place. In those cases, the only EE that would have been available to replace the dams would have been a small amount that was *not* cost-effective with the dams in place but that became cost-effective once the dams were removed. Because the size of the dams is small relative to the entire NW power system, we would not expect dam removal to have much, if any, impact on EE cost-effectiveness.
2. Similar question for demand response. It appears from pg 45 that you looked at the demand response that was considered cost-effective in the plan, which I am assuming is the ~720 MW we identified in the resource program. What additional DR did you consider in the study?
 - a. Based on the 2021 Power Plan total achievable technical DR potential in winter (2.7 GW), we allowed 2.4 GW DR available in RESOLVE under a supply curve by scaling the total Power Plan potential capacity down to 87% to adjust for the geographic area modeled in RESOLVE. Across all scenarios, all the DR that was available was selected in the baseline case, leaving none to replace the dams. Again, dam removal has a very small impact, if any, on DR cost-effectiveness.
3. Are the hourly load shapes used for the High Electrification case the same as in the baseline? Or do they change due to different sectoral usage patterns? (p. 17)
 - a. They are not the same as the base case. E3 added GWh of additional electrification load with sector + end use specific load shapes associated with that load (e.g., light duty EVs, residential space heating, etc.).
4. (a) Is three years of sampling historical data enough to extrapolate hydro ramps? (b) How is the 5% day to day shift of non-LSRD hydro energy shifting calculated? (c) Does the PNUCC estimate of hydro capacity being 65% of nameplate apply to every dam individually or the NW system as a whole? (d) Is there any assumed change in peaking capability of the non-LSRD hydropower after removal? (e) From what years is the historical hydro dispatch data for the rest of the northwest fleet based? (f) In general, do these shaping numbers change as the system and portfolio changes? (page 22-26)
 - a. We relied on hourly historical data in three years including one dry year (2001), one wet year (2011) and one average year (2005) to calculate hydro availability and ramp rates. E3 believes ramp rates based on three different hydrological years are generally sufficient to characterize a range of ramping capabilities of hydro resources for capacity expansion modeling. Hydro ramping capability is a function of available water in the model. In this sense, RESOLVE is sophisticated in its treatment of hydro availability than most production cost models, which rely on a single water year.

- b. Additional flexibility in hydro operations is modeled as 5% of the hydro energy in each day to be shifted. For example, if hydro operators know that tomorrow will be a peak day, they can save some hydro energy today and use it the next day to meet the system needs. The flexibility of hydro operations is complex and challenging to comprehensively model in a capacity expansion model like RESOLVE. The day-to-day shift modeled provides additional flexibility to the model to adjust hydro to support optimal dispatch and renewable integration. We did not include day to day shiftable energy budgets for the LSR dams given their more limited storage capacity.
 - c. The PNUCC 65% estimate is applied to the two categories of hydro modeled in RESOLVE: the aggregated LSR dams resource and the aggregated non-LSR dams large hydro resource. Our benchmarking suggests 65% is a reasonable assumption for the effective capacity value of the LSR dams in the wintertime, however summertime capability is notably lower. We included sensitivities on this parameter in the final report.
 - d. No, the peaking capability of the non-LSR dams hydro fleet is not adjusted in the LSR dams breaching scenarios.
 - e. All hydro in RESOLVE is based on three historical hydro years: 2001, 2005, and 2011.
 - f. The physical parameters representing the hydro system's capabilities -- monthly energy availability in the three hydro years modeled, Pmin, Pmax, and ramp rate values are static inputs into the model. Subject to these physical constraints, the hydro fleet is modeled dynamically in the sense that it can dispatch optimally around changing portfolio needs as wind and solar power grow.
5. When considering the ELCC of each resource type, the previous 2019 RA study seemed to use a larger NW footprint and portfolio when calculating ELCC. Since ELCC is generally sensitive to the portfolio makeup in which it is tested and unless we are mistaken this study seems to leverage the results from the previous study, how much do you suspect the different ELCC of new resources might be with the revised footprint for the NW used in this study? Did the removal of the LSR dams capability influence the ELCC calculations? Are there any intra-regional transmission limitations in the ELCC analysis? Is the ELCC analysis using historical hydro conditions from 1929 to 2008? Or a more limited set of hydro conditions? If reliability challenges shift to the summer ELCC of other resources might change other than storage, were any of these potential changes considered? (p. 24)
- a. Based on the LSR dams replacement analysis study scope and timeline, existing ELCC analyses were leveraged. This meant using RECAP runs from E3's 2019 RA study, as the most comprehensive regional level forecast of ELCC values for various non-firm technologies across a decarbonizing Northwest region. As noted in the question, these RECAP runs used a larger load and resource area than the Northwest zone modeled in RESOLVE (47 GW peak in 2030 vs. the 35-37 GW peak in the "Core Northwest"). This would have some impact on the ELCCs (relative to a smaller "Core Northwest" zone) – E3 has not analyzed the extent of this impact. The RECAP study did not include intra-regional transmission limits and modeled the LSR dams as intact (not breached). Details of the hydro conditions modeled in the RECAP study can be found [here](#) in section 4.2.2; water years 1928-2008 were utilized. We did include ELCC sensitivities for the LSR dams and battery storage.
6. What is the data source or methodology to extract the deemed market emissions rate of 0.43 tons/MWh? (pg 30)
- a. This deemed emissions rate is based on the California Air Resources Board unspecified import emissions rate used in California's cap and trade program. See slide 14 of [this CARB deck](#) and the link on that slide for more information. It is based on the expected

marginal generation for imported electricity to California and is broadly aligned with the emissions rate of a less-efficient gas plant.

7. Can you provide some information as to why you used 2001 sustained peaking as a sample year (pg 33)? We understand that 2001 is a low hydro year, especially in the summer, but are wondering how this connects with the 15% planning reserve margin?
 - a. RESOLVE has two separate and distinct modules for considering A) energy generation + dispatch economics, and B) resource adequacy. In the hourly load + resource balance module, historical representative days are modeled using three historical hydro years. Uses of this module include 1) ensuring generation is balanced against hourly loads + operating reserve requirements by optimally dispatching resources across the WECC, 2) calculating dispatch costs, 3) calculating annual GHG emissions. In the resource adequacy module, the resource adequacy load and resource balance is calculated based on annual resource capacity contributions versus a requirement based on median peak demand plus a 15% PRM. In the PRM module, a 65% firm contribution from hydro is modeled, which is derived from the PNUCC resource adequacy study. This value is ultimately based on sustained peaking capability during critical water years conditions. To summarize, the dispatch module uses 2001 hydro as one of the three years included, but the critical water year criteria is used (per PNUCC's accounting) in the PRM constraint.
8. Can you provide more information why the model picked more wind in the no combustion case? We were seeing a different picture in our modeling of the amount of solar vs wind to replace peak needs, and are trying to understand your model better from that perspective.
 - a. There are a few reasons for this:
 - i. **GHG REDUCTION:** Significant solar and storage is also built in this case. However, wind is able to output during the winter to support GHG reduction needs during low winter hydro years.
 - ii. **RESOURCE ADEQUACY:** In the no combustion case, the model goes well beyond the energy needed to reduce emissions and most of the resource addition dynamics are driven by the least cost solution to meet resource adequacy needs. Though wind's capacity value does saturate, it ultimately provides a lower net marginal cost of RA capacity than solar.
 - iii. **EXTERNAL ZONE ASSUMPTIONS GROWTH:** a more secondary reason may be that the external zone modeling (outside the NW) already includes significant solar growth across the WECC, which may limit the economics of building additional solar in the Northwest. However, the GHG reduction and RA attributes of this external solar is assumed to remain with the external zones, not available for the CoreNW to access.
 - iv. **RESOURCE POTENTIAL:** E3 assumed that higher renewable potential could be accessed outside the region via A) offshore wind + transmission, and B) WY + MT wind on new transmission. These are the primary additional resources RESOLVE builds in the no new combustion scenario. RESOLVE does not built out all the solar potential made available in the no new combustion case for the reasons noted in the other bullets.
9. Our understanding is that for outside the region you used policy targets and a planning reserve margin to develop the build trajectory. In this analysis, what kind of out of region natural gas additions do you assume (where? How much?).
 - a. E3's WECC-wide build out includes natural gas plant additions, particularly in regions with retiring coal units. These include

- i. CCGT
 - 1. ~4 GW in the Other Northwest zone
 - 2. ~3.5 GW in the Rocky Mountain zone,
 - 3. ~2 GW in the Southwest zone.
 - ii. Peaker units
 - 1. ~2 GW peaker in Other NW zones
 - 2. ~6 GW in Southwest zone
- 10. In your high electrification scenario, did the potential of EE and DR increase from the baseline potential?
 - a. The high electrification load scenarios were based on the Washington State Energy Strategy analysis and additional EE assumed in that scenario was included in that scenario (including efficient building appliances and a 1%/yr industrial EE). DR potential was kept as 6% of system peak in the base load scenario in early years until it reaches the full technical potential by 2041, after which it was kept constant. No additional DR potential was modeled for high electrification load scenario. Based on other E3 studies, shifting of building or vehicle loads, if made available, would likely offset some of the short-duration battery storage selected, but would likely have a generally limited impact on the need for firm capacity resources. No additional candidate EE potential was assumed for RESOLVE to choose from in the high electrification scenario compared to the baseline scenario. As noted above, dam removal has a minimal impact on EE and DR cost effectiveness at the margin.
- 11. What is the underlying source or thought behind the Load following up and down assumptions of 3% of hourly load? Does that change with renewable buildout size? (P.55)
 - a. The 3% load following reserve value is a general standard assumption used by E3. E3 has additional modeling tools (RESERVE) for analyzing this question, but that question was not in scope for analysis in this study. The load following reserves could increase with renewable buildout, but we have not seen such an increase change resource buildout in past E3 testing.

From: Hairston,John L (BPA) - A-7
Sent: Friday, July 15, 2022 10:46 AM
To: ALLBPA
Subject: Becoming the Provider of Choice; continuing the conversation on lower Snake River dams

We reached a significant milestone this week in our effort to remain the region's low-cost power provider beyond 2028. As part of the Provider of Choice process to establish long-term power sales contracts that will go into effect in 2028, we released a [concept paper](#) yesterday that serves as a starting point for policy development.

This represents more than a year of work analyzing our existing policies and potential changes suggested by customers and staff, but we really began looking ahead to these future contracts back in 2016. In this time, BPA has engaged with and listened to customers to understand their needs and interests. We heard that the product offerings and rate methodology for our current contracts generally work well. But we also know the industry landscape has changed considerably since these contracts went into effect in 2008. For those reasons, the Provider of Choice Concept Paper proposals maintain key elements of the current contracts while offering additional flexibilities and options to address current and emerging issues, including resource adequacy, capacity and carbon.

I am proud of what is included in the proposal and I am proud of the cross-agency team that is responsible for this body of work. We will host an all-day public meeting with customers on July 21 to discuss the proposal, and there will be many more opportunities to engage on the issues over the next year. I look forward to hearing from our customers and seeing how the concepts evolve. We know we will need to be nimble to craft solutions that uniquely fit the needs of the future and reflect the evolving demands and urgencies of the day.

Congratulations to the team on this important milestone.

Analysis of replacing the lower Snake River dams' services and costs

Also this week, we saw the results of an independent analysis BPA commissioned on various scenarios describing replacement resources and costs that would be necessary if the four lower Snake River dams were breached. The [study](#), completed by Energy and Environmental Economics, known as E3, builds on the analysis performed for the [Columbia River System Operations Environmental Impact Statement](#).

Multiple reviews are being completed in the region regarding the future of the LSR dams. Just this week, the Council on Environmental Quality announced the release of a draft assessment on the state of the science and large scale actions to make progress toward healthy and harvestable abundances of key fish stocks in the basin. The assessment includes a recommendation to breach these dams, a step that would require an act of Congress. While the Biden Administration has not endorsed the actions identified in the draft science report, it is carefully considering this information and ongoing regional efforts as it assesses long-term pathways for the Columbia River Basin.

BPA's role is to contribute to the regional dialogue about the future of these publicly owned assets, and to help elevate regional understanding of the complexities and costs involved in exploring replacement resources. As the E3 study concludes, replacing the carbon-free energy and capacity of the LSR dams would require a combination of renewable generation (like wind and solar), "clean firm" resources (such as dual fuel natural gas and hydrogen plants, advanced nuclear, or gas with carbon capture and storage), and energy efficiency. It's important to note that some of these technologies are not developed or aren't available at a large scale. The study also takes into account system reliability needs, state and federal decarbonization requirements and goals, and affordability of those replacement resources to the public.

The cost of new resources to replace the existing lower Snake River dams' energy and capacity, using a mix of existing and emerging technologies, could range between \$11.2 billion and \$19.6 billion. The cost rises to between \$42 billion and \$77 billion if only renewable energy is used.

While BPA does not support breaching these dams, we respect and appreciate the commitment of so many groups and leaders in the regional dialogue about long-term strategies that prioritize the protection and enhancement of salmon and steelhead. Ultimately, the region as a whole must continue to advance collaborative solutions in balance with the other critical and essential services the system provides.

Stay safe,

John