BPA's Public Engagement for Establishing a Policy Direction on Potential Day Ahead Market (DAM) Participation - Workshop 7

June 3, 2024

Agenda

- Review of BPA's Comments on West-Wide Governance Pathways Initiative (WWGPI) April 10 Proposal and Legal Analysis
- High-Level Congestion Rent Scenario
- Congestion Rent Design
- Congestion Revenue Scenario with Congestion Rights

BPA's Comments on West-Wide Governance Pathways Initiative (Pathways) April 10 Proposal and Legal Analysis

West-Wide Governance Pathways Initiative Summary

"The July 14, 2023, letter from several Western state regulators to the Western Interstate Energy Board and the Committee on Regional Electric Power Cooperation, advanced a proposal "for ensuring that the benefits of wholesale electricity markets are maximized for customers across the entire Western U.S."…In late 2023 the West-Wide Governance Pathways Initiative Launch Committee was formed, comprising a diverse set of utilities, consumer advocates, public power, generators and power marketers, public interest organizations, and others. The Launch Committee developed a range of potential market design options along with evaluation criteria and associated legal and technical questions."

The Launch Committee has proposed a stepwise approach:

- **"Step 1: Early success.** This step demonstrates early commitment to the regulators' vision through substantive changes within the scope of existing law, while continuing to develop more ambitious pathways to independent governance.
- **Step 2: Durable, independent governance of markets and other potential services.** This step aims to implement the regulators' vision of a regional energy market with a large and inclusive footprint, maximizing independence while leveraging the existing market infrastructure to minimize costs. Step 2 is designed to be able to evolve and accommodate the addition of new, voluntary services as the framework matures.
- **Step 3: Toward an RTO.** As Step 2 matures, the Launch Committee contemplates further evolution toward services of an RTO for balancing authorities (BA) and other market participants to join voluntarily. Proposing a particular design for these subsequent incremental stages goes beyond the scope of the Launch Committee's work, but Steps 1 and 2 have been developed with a clear line of sight to those potential voluntary future services beyond the energy markets. The Launch Committee refers to this later evolution of additional services, inclusive of a full suite of RTO services, as Step 3."

Source: Pathways Phase One Straw Proposal https://www.westernenergyboard.org/wp-content/uploads/Phase-1-Straw-Proposal.pdf

BPA's Comments on West-Wide Governance Pathways Initiative

- BPA is appreciative of the Pathways efforts to further the independence of CAISO and EDAM Governance.
  - Comments were submitted in response to the April 10th Proposal and Legal Analysis
  - Pathways progress will be considered in BPA's DAM decision process
  - BPA staff will continue analysis as Pathways progresses.
  - BPA approaches its involvement in the Pathways initiative as both a current WEIM participant and to inform its November Day Ahead Market decision.

BPA's Comments on West-Wide Governance Pathways Initiative

- For BPA and its customers, there is risk inherent in a future dependent on California legislation with unknown outcomes at this time.
- BPA will consider how legislation modifies CAISO corporate scope and CA Utilities Code Section 345.5 which prioritizes the interests of the people of CA.
- BPA will consider the legislation's reserved authorities for CAISO Board of Governors (BoG).
- Balancing Authority Areas in the Regional Organization-administered market should have equal influence within the decision framework.

BPA's Comments on West-Wide Governance Pathways Initiative

- Step 1: Transition from Joint Authority to Primary Authority
  - BPA recognizes that Step 1 aims to make progress towards independent governance.
  - Bonneville is not confident that there are added benefits to Primary Authority without going to Sole Authority and agrees with the Governance Review Committee perspective in its January 2023 final proposal regarding the benefits of the current Joint Authority structure.
  - Bonneville is concerned that the proposed Primary Authority decision structure creates distance between the Governing Body and the BoG such that the BoG may be less engaged with the market decisions.

BPA's Comments on West-Wide Governance Pathways Initiative

- Step 1: BPA submitted questions and suggestions
  - Step 1 of the final proposal needs to clearly define the proposed dispute resolution process and any required changes from the status quo process.
  - Define where assertion of control for Exigent Circumstances would occur and if there is consideration of checks and balances on the discretion of the CAISO BoG in these situations.
  - WWGPI should consider what changes could be made to stakeholder engagement on market initiatives during Step 1 rather than waiting for Step 2.
  - WWGPI should define the "elevated role" for participating States in Step 1.
  - Directly engage with CA regulatory agencies to confirm the agencies' scope of reserved authorities over WEIM and EDAM market design & market operations.

BPA's Comments on West-Wide Governance Pathways Initiative

- Step 2: Full Governance Independence
  - Step 2 proposes a significant step towards independence; however BPA feels the proposed approach sacrifices ultimate independence to achieve cost efficiencies.
  - In Step 2, California will retain the CAISO BA and continued control over state policy requirements such as resource adequacy and GHG accounting. CAISO maintaining these roles and operating the market is inequitable.

BPA's Comments on West-Wide Governance Pathways Initiative

- Step 2: BPA Recommendations
  - If Option 2 or 2.5 moves forward, tariff scope will need to be reassessed to determine which elements will be under Sole Authority of the Regional Organization.
  - Step 2 and future legislation should address CAISO and its Board of Directors' obligations under Section 345.5, which requires the BoG to base decisions on the interests of the people of CA.
  - The RO's Sole Authority and independence would be illusory if the CAISO has contractual provisions to force certain tariff filings and prohibit others.
  - The current EDAM tariff was developed and approved through the current CAISO policy and decision structure. Stakeholders joining the RO should be afforded an opportunity to reconsider tariff elements under the new independent governance structure that is independent of the CAISO processes.

BPA's Comments on West-Wide Governance Pathways Initiative

- Step 2: Institutional Independence
  - The proposed tradeoffs for administrative efficiency may create a structure of reduced institutional independence.
  - Under Options 2, 2.5 and 3, CAISO would continue to maintain control over tariff administration which creates potential of advancing CA interests over other considerations. These potential conflicts may be addressed through contractual restrictions but would continue to be a concern.
  - Under Options 2 and 2.5, CAISO would continue to manage market rules and operate the market. BPA is concerned about 1) CAISO staff reporting up a chain of command to a Board w/unique obligations to a single participating BA, and 2) the CAISO would be both the market operator and a market participant.

BPA's Comments on West-Wide Governance Pathways Initiative

- Step 2: Institutional Independence
  - The proposal references a potential ongoing role for the CAISO Board to make unilateral decisions without or over the objection of the Regional Organization (RO) in emergency situations. This would give one BA (CAISO) the power to make unilateral decisions in emergency situations.
  - BPA recognizes that transferring authority to the RO could result in liability to the RO. Today, market participants are exposed to liability through CAISO. This would most likely not be an incremental liability for participants.

BPA's Comments on West-Wide Governance Pathways Initiative

- Other Considerations:
  - Define a path in the proposal for the RO to be launched prior to legislative changes to address funding, staffing and contingencies regarding the future of the RO if 2025 legislation is not successful.
  - Engage in, and share, a detailed examination (and explanation) of how decision-making authority would be split in a hypothetical RO future.
  - Pathways should consider the structure of stakeholder engagement earlier in its process, beginning with Step 1.

BPA's Comments on West-Wide Governance Pathways Initiative

Questions?

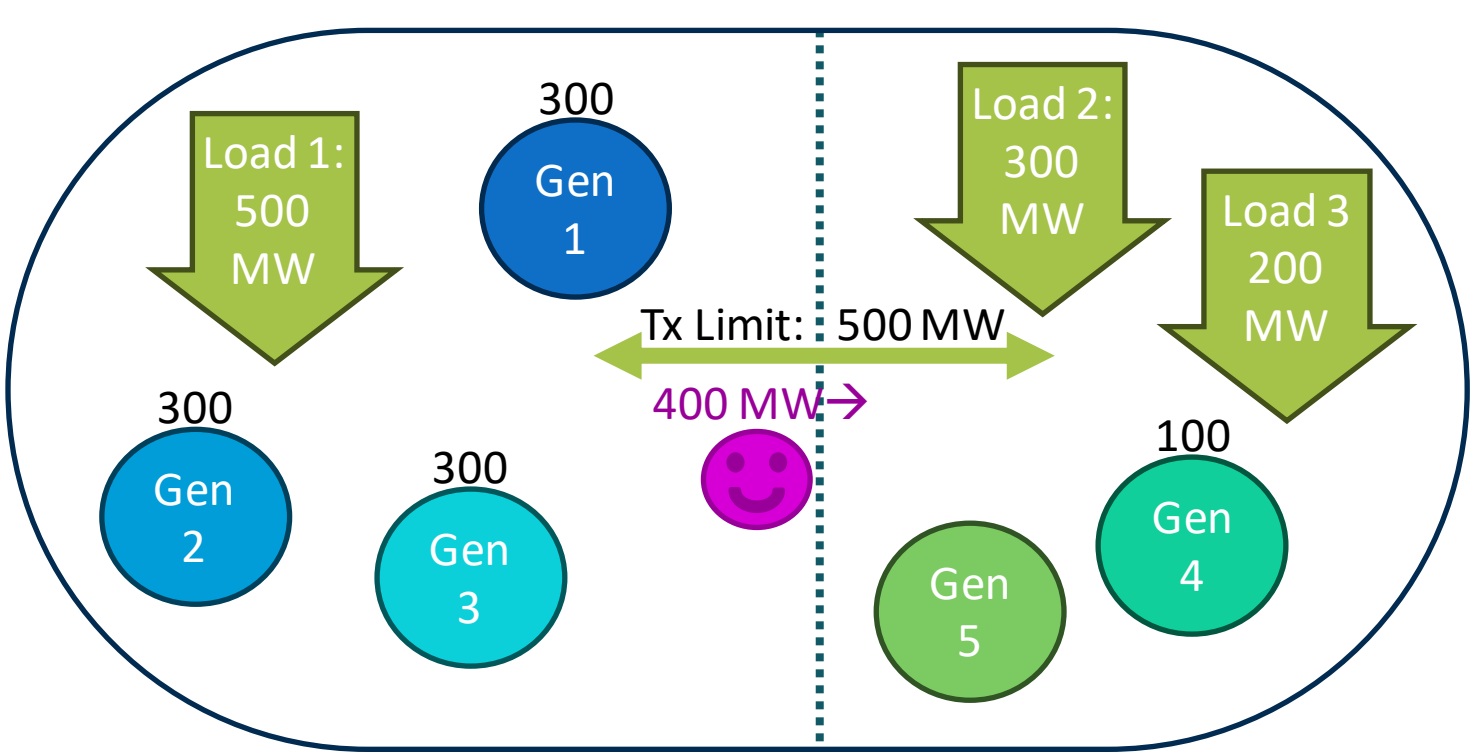
High-Level Congestion Rent Scenario

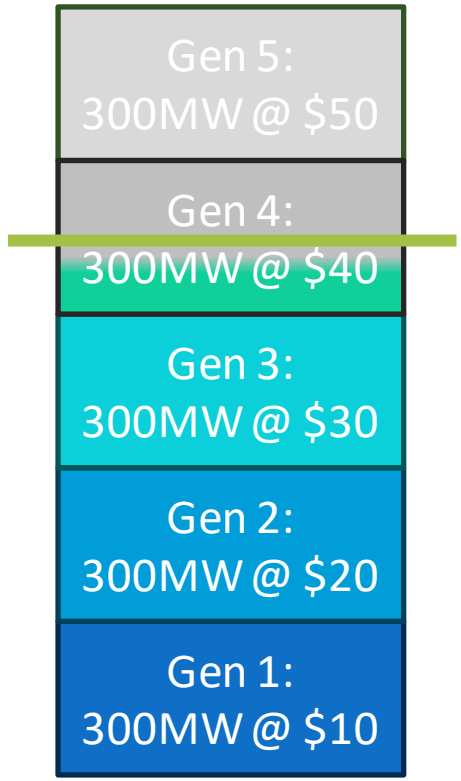
What is Congestion Rent?

- When elements on the transmission grid are fully utilized, they can no longer support additional flow in power. In a DAM this is reflected by transmission limits that inform the market optimization.
- When this happens in an energy market, more expensive generation must be dispatched to provide displacement power to relieve this physical constraint and serve load. This creates price separation.
- This price separation results in differences between settlements for total generation payments and total load.
  - This separation occurs on either side of a congested path.
- Allocation of congestion rent ensures that the Market Operator remains revenue neutral.
  - Unlike an RTO/ISO, EDAM/M+ will not have FTRs (Financial Transmission Rights) or CRRs (Congestion Revenue Rights)

Market Optimization Illustration (Uncongested)

- Let's find the least cost to serve 1000MW of load (within single BAA), with a transmission constraint:

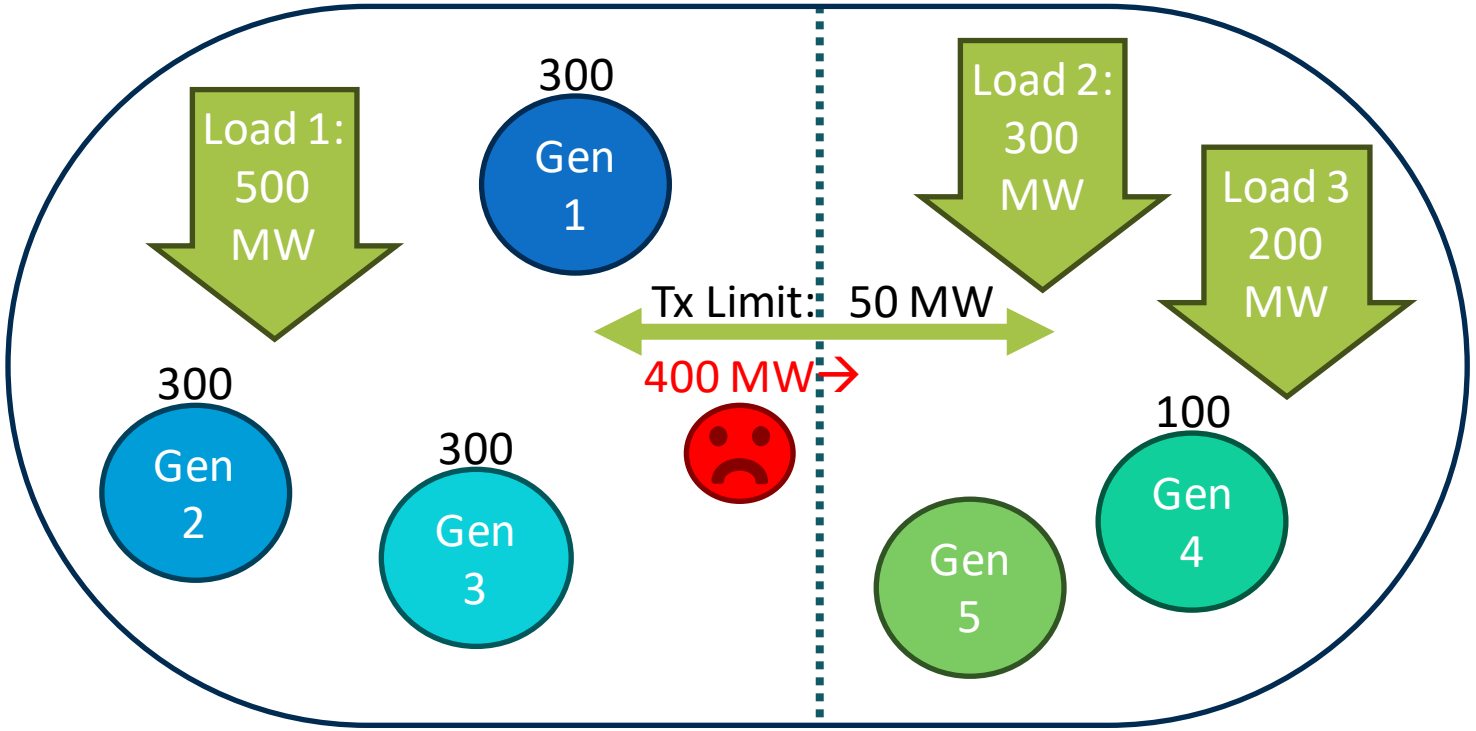




No binding tx constraints!
1000 MW load
LMP = $40

Market Optimization Illustration (Congested)

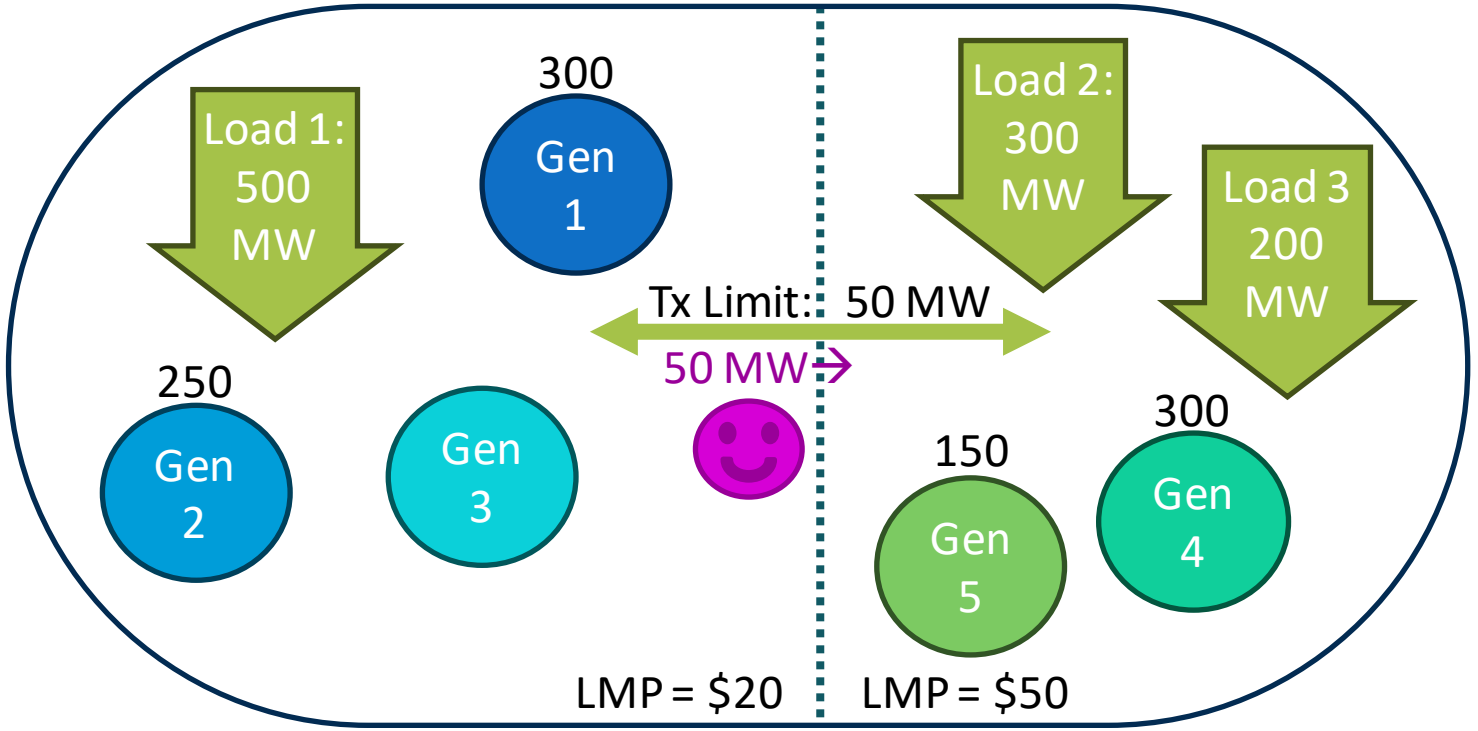
- Transmission limit between the two load zones is reduced from 500MW to 50MW due to an outage:

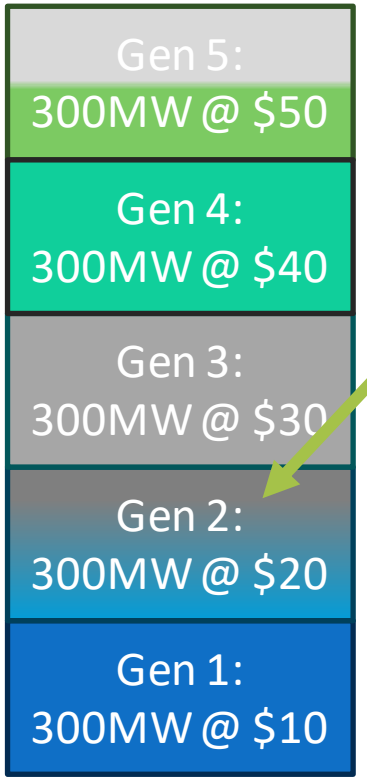


Using the same dispatch results in a transmission constraint violation!

Market Optimization Illustration (Congested) Continued

- Let's find the least cost to serve 1000MW of load, without violating the new transmission constraint of 50MW:

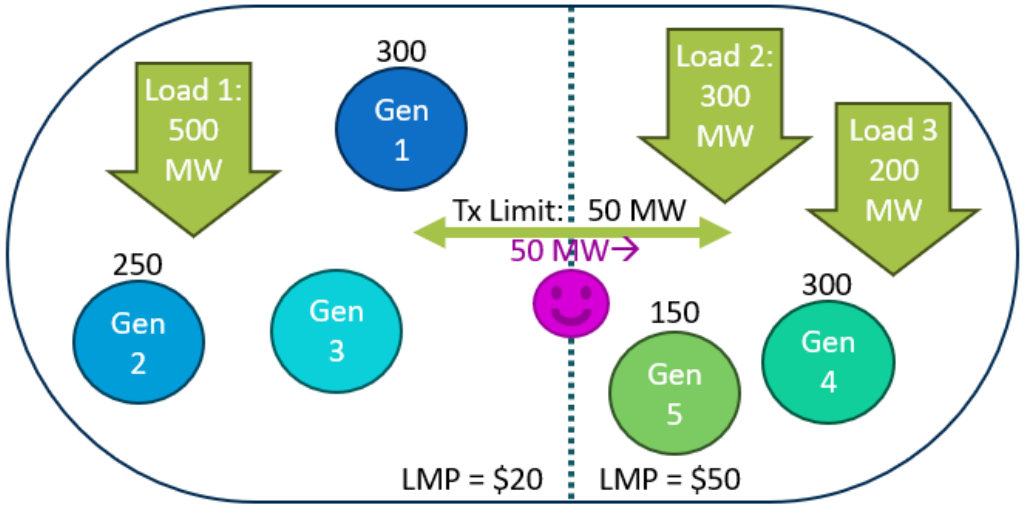




Constraint binds! Now, find the next least cost gen that doesn't violate the constraint to serve the rest of the load on the right side

Congestion and DAM Settlements

- Congestion: Money In ≠ Money Out
  - Caused by price separation between settlement locations (excluding losses)



MP	Settled	Total
Gen 1	$20 * -300 MW	$6,000
Gen 2	$20* -250 MW	$5,000
Gen 3	$20 * 0 MW	$0
Gen 4	$50* -300 MW	$15,000
Gen 5	$50 * -150 MW	$7,500
Load 1	$20* 500 MW	-$10,000
Load 2	$50 * 300 MW	-$15,000
Load 3	$50* 200 MW	-$10,000
Total (Over-Collection from MO)		**$1,500**

The Market Operator must remain revenue neutral. $1,500 of collected congestion rent must be allocated to market participants. How the rent is allocated depends on the market design

Congestion Rent Design

EDAM Congestion Revenue Design

- EDAM design differentiates between Congestion Revenue and Transfer Revenue. For EDAM entities, these will be payments to distribute (not charges)
- The last example would be congestion revenue, because the binding constraint was internal to the BA. The accrued incremental revenue would be allocated to the BA where the binding constraint was modeled.
  - The distribution of the congestion revenue would be defined by the EDAM entity's OATT.

- In EDAM, if the binding constraint occurs across an interface between BAs at a transfer location, this is called transfer revenue.
  - Transfer revenue is allocated 50/50 between the two BAs that made the transmission available to facilitate the energy transfer (baring a different commercial arrangement at the interface).
  - If a transmission customer has released its transmission rights to the market, the customer is eligible to receive an allocation of transfer revenues if the constraint binds

Commercial Model for Congestion Rent

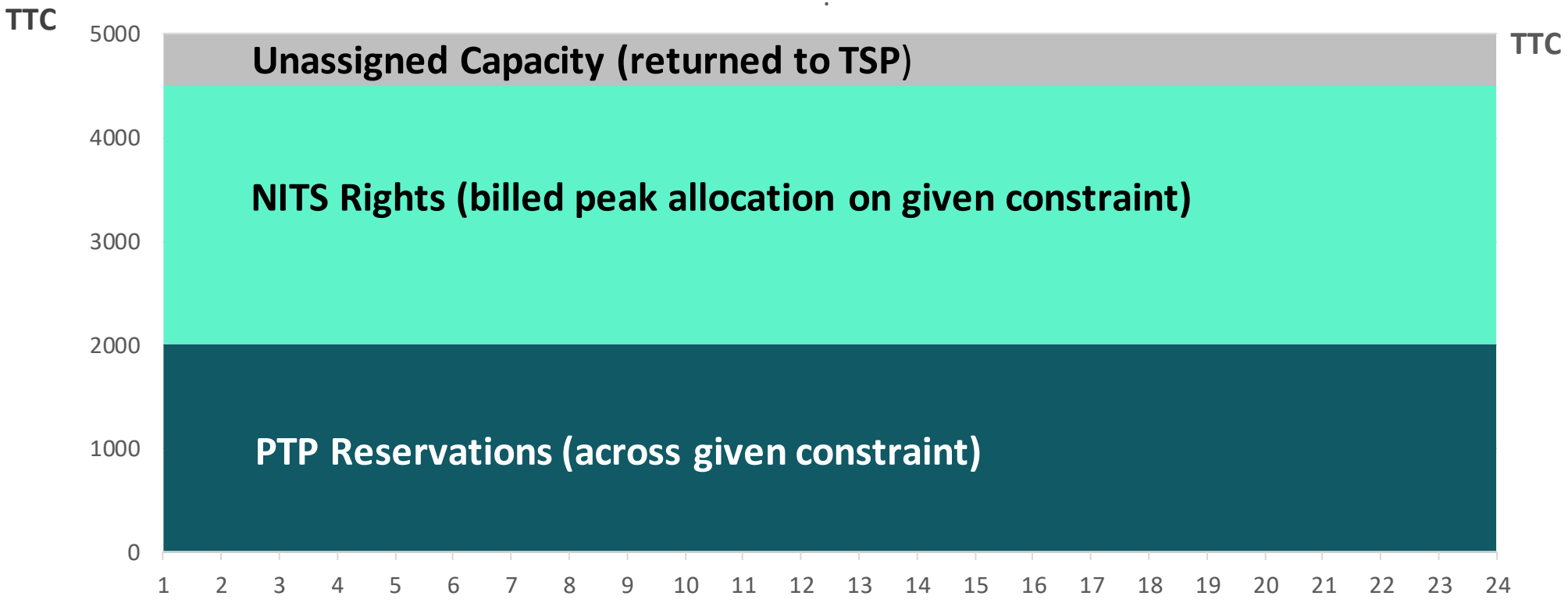
- The Market Operator will build the network and commercial models, working with the TSP and Transmission Contributors to map all the essential information to enable congestion rent rights and ensure they are accurately reflected and appropriately settled
- For PTP mapping of all the applicable source/sink and POR/POD to a Pricing Node (PNode) or an Aggregated Pricing Nodes (APnode) within the commercial model
- For NITS all the Designated Network Resources (DNRs) and Network Loads will be mapped to a PNode or an APnode within the commercial model

M+ Congestion Rent Design

- Based on prevailing flows only (same as for EDAM entities, CR design will not charge for congestion)
- Leverages OATT framework and LT rights holders' investment in tx system
- TSR CR payoff-ratio is calculated for each constraint separately, instead of zonally or market-wide.
  - Note: the constraint-based methodology was discussed at the 7/20/23 M+ Congestion Rent Task force meeting around the 2 hour and 11-minute mark.
  - The public recording can be found at the following link. Password: YgQsZM4F
  - The approach was developed by a sub-team and received unanimous approval at the 8/14/23 M+ Congestion Rent task force meeting
- Includes Firm and Conditional Firm Point-To-Point Transmission Service, Network Integration Transmission Service, and Legacy Transmission that has not been opted out, and is available for use by Markets+
- Includes service increments that are either monthly, yearly, or longer, and the service increment spans the full applicable calendar month
  - Not directly eligible: TSR for August 10th through September 10th
- Monthly snapshot taken of OASIS rights to determine eligible TSRs
  - Snapshot taken 15 days prior to the start of the month, for the upcoming operational month
  - Example: monthly snapshot taken on July 16th for August 1st through 31st
- Includes original, redirects and resales
  - For rights that are redirected or resold for a partial month, the congestion will be allocated using the last valid path and/or customer that covered the full month.

Visualization of Eligible Rights

- Each modeled constraint will stack up eligible TSRs from PTP Reservations and NITS Rights (monthly cap allocated across constraints to ceiling: *see next slide*)
- Stacking of rights creates a ratio for payment if the constraint binds



PTP and NITS Eligibility

PTP:

- Eligible TSRs include **firm reservations** of a **month or longer**, CF transmission, and resales or redirects of eligible transmission. The redirect or resale is allocated to the new path/new owner if the transaction occurs prior to the monthly snapshot (15 days prior to the start of the month). Grandfathered rights are also eligible.

NITS:

- Eligibility is tied to a **customer's monthly MW cap**, which is determined by the TSP billing methodology. For BPA NT customers, it would be the monthly coincidental peak. The final settlement will be **trued-up to use actual coincidental peak** values for the customer's MW cap.
  - (Ex. initial settlement based on 100 MW cap, final settlement based on 102 MW cap)
- Market Operator will utilize customer source to sink paths from DNRs to NT load, leveraging a merit order stack of lowest to highest cost supply, up to the monthly cap.
  - Depending on eligible DNRs and resource offers, could see MW cap allocated across multiple constraints

"Unassigned" congestion rent will be distributed to transmission customers, per the TSP OATT.

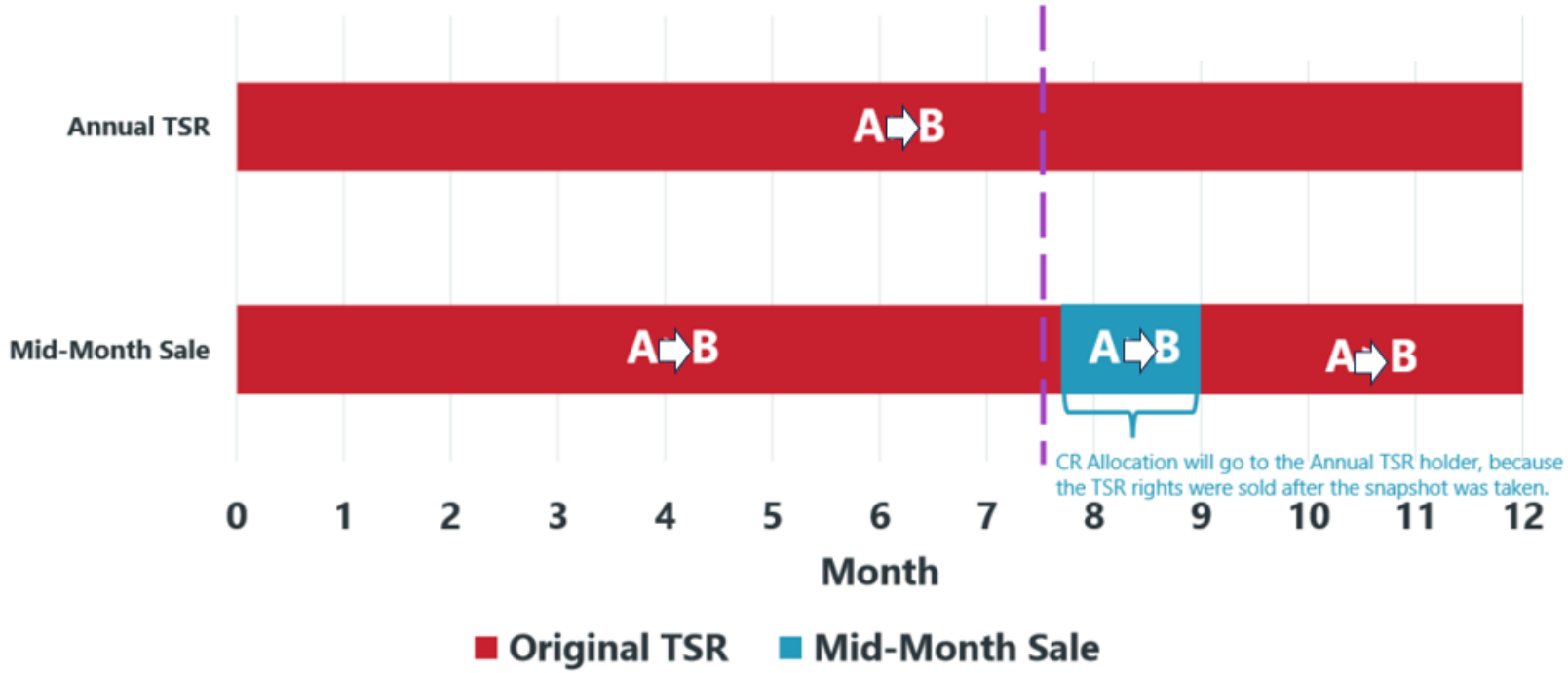
NT DNR Merit Order Stack

- This table demonstrates how DNR resource offers on a given hour would be organized into an offer stack for assigning congestion rights across the mapped constraints.
- This MPs Network Service Distribution Cap is 750 MW for this example. The distribution cap is based on their billed peak load value for the sample month.
- For all hours, the resource offers will be put into merit order stack from lowest to highest
  - *Unit 4 is on outage in this example

DNR	MW	Cost ($/MWh)	Cumulative MW
3	100	Self	100
1	50	$20	150
1	75	$24	225
2	100	$25	325
2	100	$27	425
1	75	$30	500
3	150	$34	650
2	**100**	**$35**	**750**
~~3~~	~~150~~	~~$38~~	~~900~~
~~3~~	~~100~~	~~$42~~	~~1,000~~
~~4~~	~~75~~	~~$15~~	~~1,075~~
~~4~~	~~50~~	~~$20~~	~~1,125~~
~~4~~	~~75~~	~~$25~~	~~1,200~~
Sum	**1,200**		

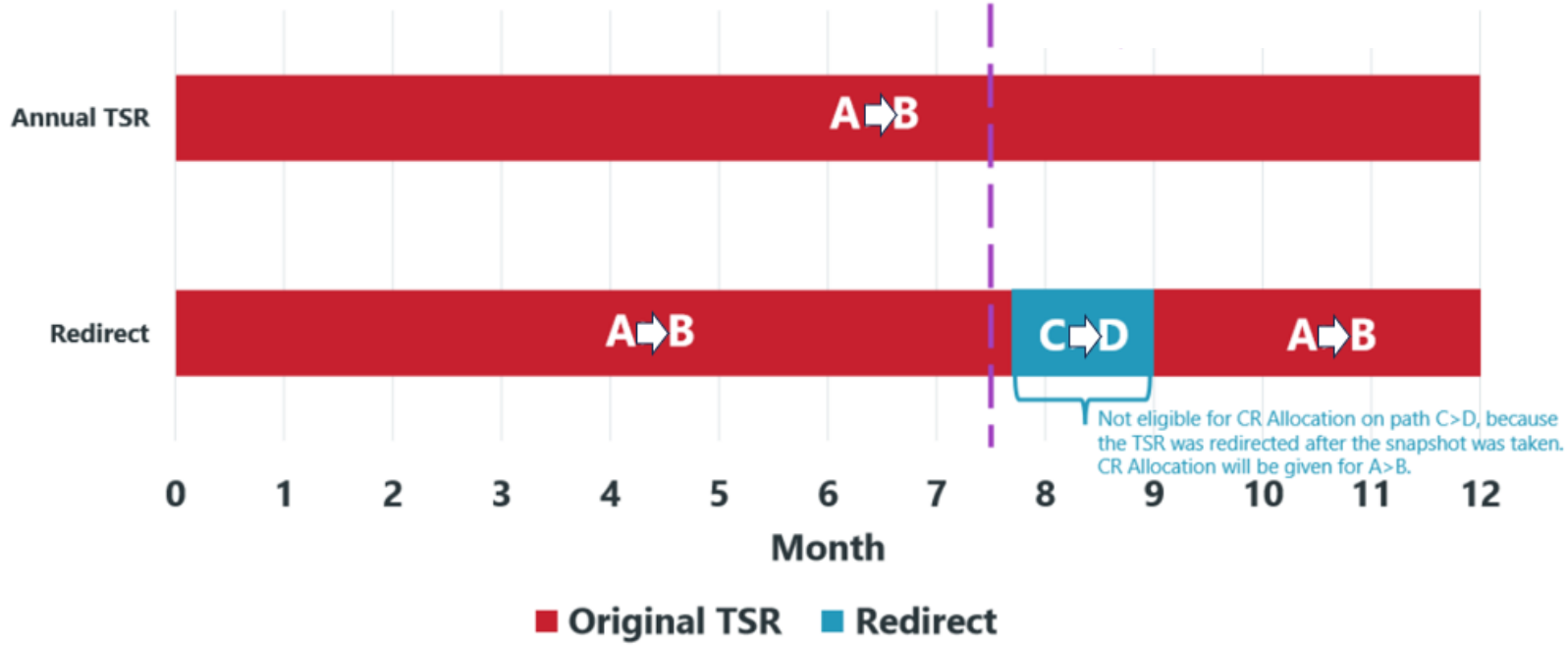
PTP TSR Resale Example

- If a TSR is resold, the rights are paid to the owner at the time of the snapshot (assuming they are an MP and can settle with the MO). If the TSR is resold after the snapshot is taken, the rights go to the original owner. It would be up to the seller and buyer to reconcile the CR allocation outside of the market



PTP TSR Redirect Example

- If a TSR is redirected, the path for the congestion rent eligibility is based on what is in OASIS at the time of the snapshot (still subject to verification). If the TSR is re-directed after the snapshot is taken, the rights will be based on the original path (A to B).
  - Example: Purple line represents the snapshot. If the blue section (the redirect) was to the left of the purple line, the CR eligibility would be for the new path (C to D).



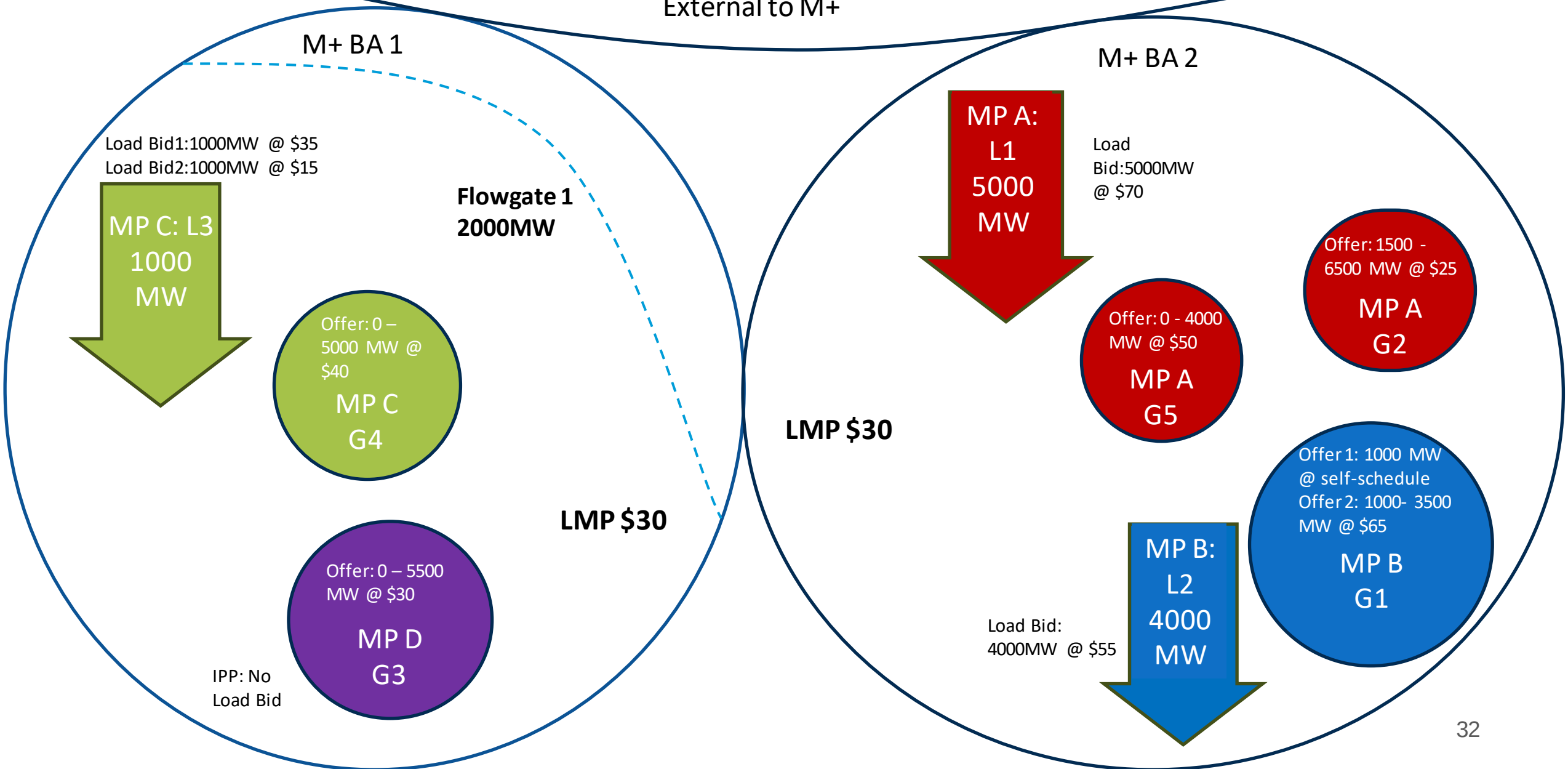
Congestion Rent Scenario with Congestion Rights

Congestion Rent Scenario Overview

- Today's scenarios present a high-level illustrative overview of how the process runs and solves for congestion rent as part of the market optimization.
  - We will be focusing on DAM awards only (no Flex Awards, RUC or RTBM)
  - CR is based on DAM clears. Any changes that occur after DAM that are attributable to congestion will fold into Revenue Neutrality Uplift (RNU).
  - Since many factors impact MCC, organized markets can't clearly identify and attribute to cost-causers or it would be prohibitively expensive to do so (standard across RTO/ISOs).
- The use of the M+ market design for the scenarios is done to demonstrate how congestion rent would be allocated per BPA's Staff Recommendation on day-ahead markets
- These scenarios build on the examples from May, showing "normal" operations, illustrating inputs/outputs, basic optimization, and basic settlement, but adding congestion components.
- BPA plans to provide further scenarios with additional layers of complexity throughout our summer workshops.

No Congestion Scenario

External to M+



DAM Inputs, Outputs and Settlements

DAM Inputs: Resource Offers & Load Bids

BA	MP	Generator	Offer	Min MW	Max MW	$
BA 2	MP B	Gen 1	Self	1000	1000	N/A
			Range	1000	3500	$65
BA 2	MP A	Gen 2	Range	1500	6500	$25
BA 1	MP D	Gen 3	Range	0	5500	$30
BA 1	MP C	Gen 4	Range	0	5000	$40
BA 2	MP A	Gen 5	Range	0	4000	$50

BA	MP	Load	MW	$
BA 2	MP A	Load 1	5000	$70
BA 2	MP B	Load 2	4000	$55
BA 1	MP C	Load 3	1000	$35
			1000	$15

DAM Outputs: Resource & Load Awards

BA	MP	Generator	Award Type	Award MW	LMP
BA 2	MP B	Gen 1	Energy	1000	$30
BA 2	MP A	Gen 2	Energy	6500	
BA 1	MP D	Gen 3	Energy	2500	
BA 1	MP C	Gen 4	Energy	0	
BA 2	MP A	Gen 5	Energy	0	
BA	**MP**	**Load**	**Award Type**	**Award MW**	**LMP**
BA 2	MP A	Load 1	Energy	5000	$30
BA 2	MP B	Load 2	Energy	4000	
BA 1	MP C	Load 3	Energy	1000	
				0	

No Congestion Scenario

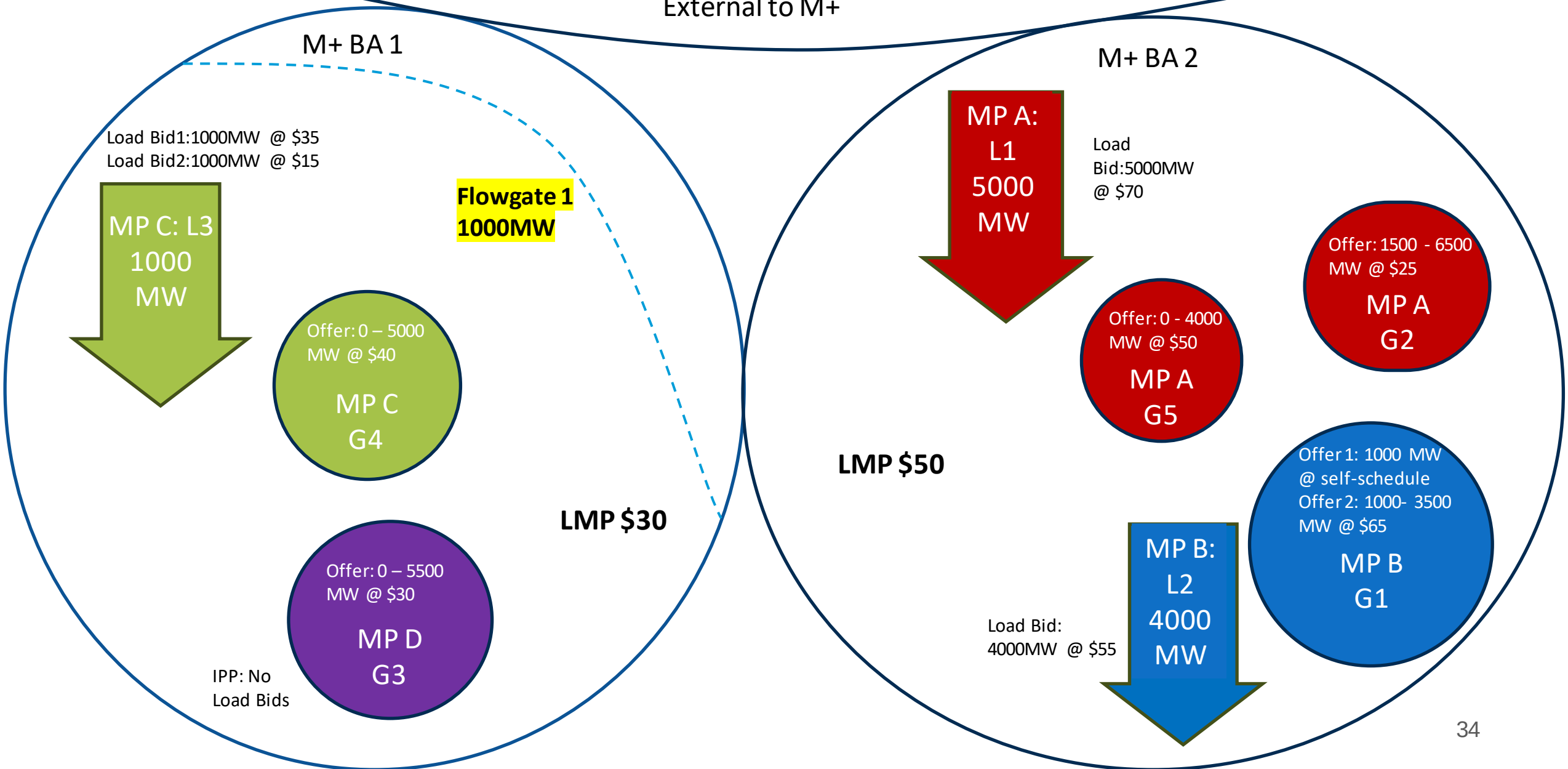
DAM Settlements by Market Participant

	MP	Price	Gen Award	Gen Settlement	Load Cleared	Load Settlement	DA Net Settlement
DA	MP A	$30	G2: 6500 G5: 0	$195,000	L1: 5000	($150,000)	$45,000
	MP B	$30	G1: 1000	$30,000	L2: 4000	($120,000)	($90,000)
	MP C	$30	G4: 0	$0	L3: 1000	($30,000)	($30,000)
	MP D	$30	G3: 2500	$75,000	-	-	$75,000
	Total*			$300,000		($300,000)	$0

*For the simplicity of the example, we are ignoring the procurement, payment and costs associated with flex reserves. In our previous example from May, Gen 3 would receive a flex award, additional $X based on flex price, and load will receive an allocation of the flex product cost

Congestion Scenario

External to M+



DAM Inputs, Outputs and Settlements

DAM Inputs: Resource Offers & Load Bids

BA	MP	Generator	Offer	Min MW	Max MW	$
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			Range	1000	3500	$65
BA 2	MP A	Gen 2	Range	1500	6500	$25
BA 1	MP D	Gen 3	Range	0	5500	$30
BA 1	MP C	Gen 4	Range	0	5000	$40
BA 2	MP A	Gen 5	Range	0	4000	$50

BA	MP	Load	MW	$
BA 2	MP A	Load 1	5000	$70
BA 2	MP B	Load 2	4000	$55
BA 1	MP C	Load 3	1000	$35
			1000	$15

DAM Outputs: Resource & Load Awards

BA	MP	Generator	Award Type	Award MW	LMP
BA 2	MP B	Gen 1	Energy	1000	$50
BA 2	MP A	Gen 2	Energy	6500	
BA 1	MP D	Gen 3	Energy	2000	$30
BA 1	MP C	Gen 4	Energy	0	
BA 2	MP A	Gen 5	Energy	500	$50

BA	MP	Load	Award Type	Award MW	LMP
BA 2	MP A	Load 1	Energy	5000	$50
BA 2	MP B	Load 2	Energy	4000	
BA 1	MP C	Load 3	Energy	1000	$30
				0	

Congestion Scenario

DAM Settlements by Market Participant

	MP	Price	Gen Award	Gen Settlement	Load Cleared	Load Settlement	DA Net Settlement
DA	MP A	$50	G2: 6500 G5: 0	$350,000	L1: 5000	($250,000)	$100,000
	MP B	$50	G1: 1000	$50,000	L2: 4000	($200,000)	($150,000)
	MP C	$30	G4: 0	$0	L3: 1000	($30,000)	($30,000)
	MP D	$30	G3: 2500	$60,000	-	-	$60,000
	Total*			$460,000		($480,000)	$20,000

$20,000 DAM Over-Collection = Congestion Rent
(MCC for G3 = $20/MW * 1000 MW = $20,000)

*For the simplicity of the example, we are ignoring the procurement, payment and costs associated with flex reserves. In our previous example from May, Gen 3 would receive a flex award, additional $X based on flex price, and load will receive an allocation of the flex product cost. Given the binding constraint, Gen 5 would also see a flex award.

Congestion Rent Allocation

- In this simplified example, say that both MP A and MP B have 1000 MW PTP TSRs from Gen 3 to L1 and L2 respectively and flowgate 1 is 1:1 (no shift factors).
- This would result in a very straightforward CR payment of $10,000 to each MP.
- Compare the initial settlement (without flowgate 1 binding) to the constrained settlement:
  - MP A receives more payment for G2 (due to the higher LMP) as well as congestion revenue. Despite the higher DA settlement for load service, MP A sees an increased incremental payment of $65,000
  - MP B, while receiving more payment for G1, faces higher costs to serve L2 and those higher costs are not offset by the congestion revenue. Therefore, MP B has incremental charge of $50,000.
    - Note: MP B had part of its resource offered to the market at $65/MWh, so despite seeing an incremental charge from a settlement standpoint, based on its reflected opportunity costs, MP B comes out ahead, despite the incremental cost vs. the initial scenario

MP	POR/POD	TSR MW	CR Ratio (1:1 Flowgate)	CR Payment
MP A	G3 to L1	1000	50%	$10,000
MP B	G3 to L2	1000	50%	$10,000

MP	Initial DA Net Settlement	Constraint DA Net Settlement	CR Payment	Settlement Difference
MP A	$45,000	$100,000	$10,000	$65,000
MP B	($90,000)	($150,000)	$10,000	($50,000)

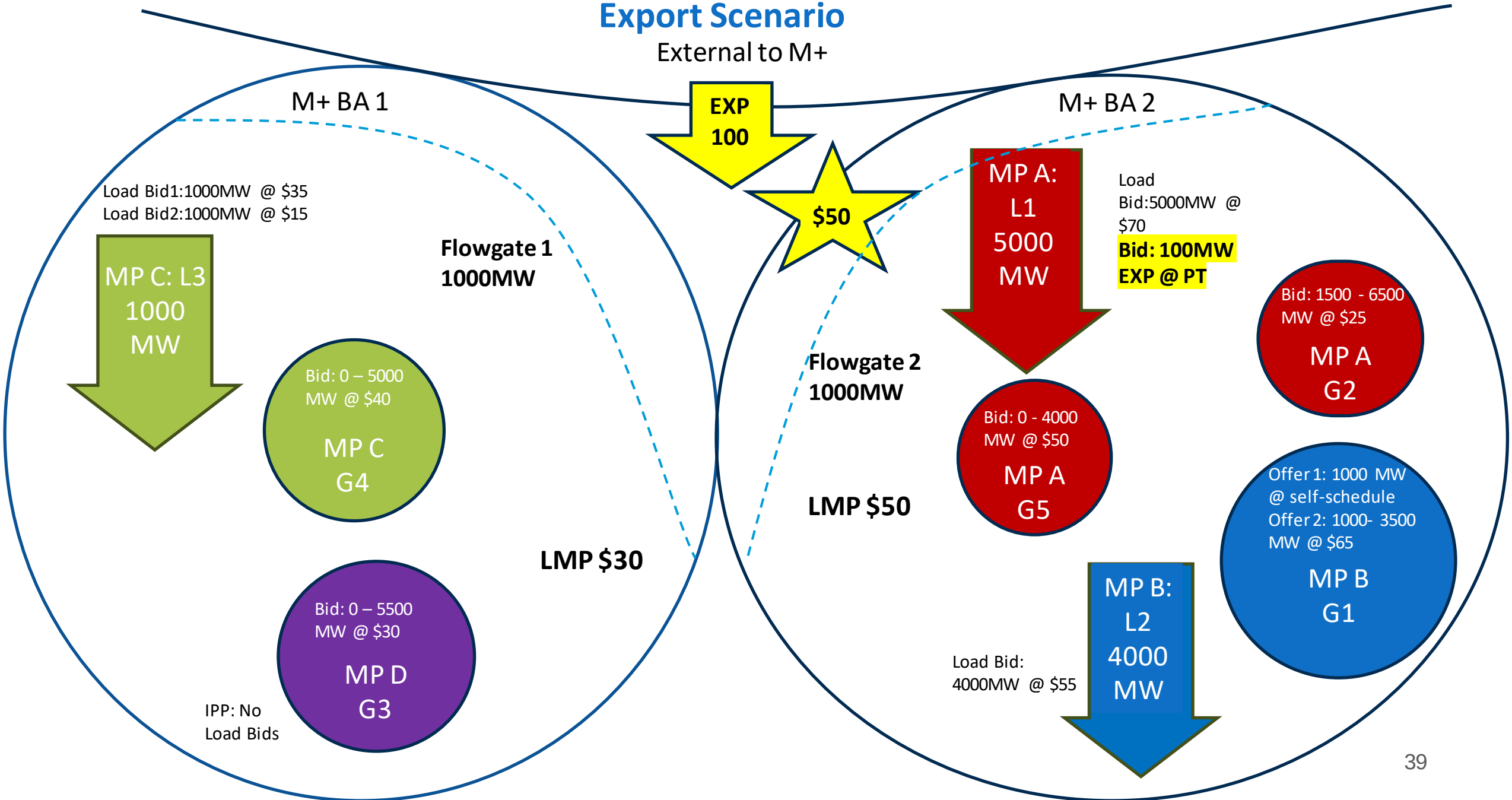
Simple Export Example

Simple Export Overview

- When an entity is exporting from the market footprint the transaction is essentially modeled as an incremental load
  - These can be price-sensitive or price-taker bids
  - Export prices are subject to the system marginal energy cost and any congestion impacting the export
  - Specific scheduling options are still under development (e.g., use of centroids)
- In this example Market Participant A has submitted a 100MW non-price sensitive export bid

Export Scenario

External to M+



DAM Inputs, Outputs and Settlements

Export Scenario

DAM Inputs: Resource Offers & Load Bids

BA	MP	Generator	Offer	Min MW	Max MW	$
BA 2	MP B	Gen 1	Self	1000	1000	N/A
			Range	1000	3500	$65
BA 2	MP A	Gen 2	Range	1500	6500	$25
BA 1	MP D	Gen 3	Range	0	5500	$30
BA 1	MP C	Gen 4	Range	0	5000	$40
BA 2	MP A	Gen 5	Range	0	4000	$50

BA	MP	Load	MW	$
BA 2	MP A	Load 1	5000	$70
		EXP	100	PT
BA 2	MP B	Load 2	4000	$55
BA 1	MP C	Load 3	1000	$35
			1000	$15

DAM Outputs: Resource & Load Awards

BA	MP	Generator	Award Type	Award MW	LMP
BA 2	MP B	Gen 1	Energy	1000	$50
BA 2	MP A	Gen 2	Energy	6500	
BA 1	MP D	Gen 3	Energy	2000	$30
BA 1	MP C	Gen 4	Energy	0	
BA 2	MP A	Gen 5	Energy	600	$50

BA	MP	Load	Award Type	Award MW	LMP
BA 2	MP A	Load 1	Energy	5000	$50
		EXP	Energy	100	
BA 2	MP B	Load 2	Energy	4000	
BA 1	MP C	Load 3	Energy	1000	$30
				0	

DAM Settlements by Market Participant

	MP	Price	Gen Award	Gen Settlement	Load Cleared	Load Settlement	DA Net Settlement
DA	MP A	$50	G2: 6500 G5: 600	$355,000	L1: 5000 EXP: 100	($255,000)	$100,000
	MP B	$50	G1: 1000	$50,000	L2: 4000	($200,000)	($150,000)
	MP C	$30	G4: 0	$0	L3: 1000	($30,000)	($30,000)
	MP D	$30	G3: 2500	$60,000	-	-	$60,000
	Total			$465,000		($485,000)	$20,000

Because there was no congestion caused in serving the export, and therefore no price separation with the interface Pnode, the congestion rent collected, and the allocation, is unchanged from the previous example. MP A sees no change in DA Net Settlement.

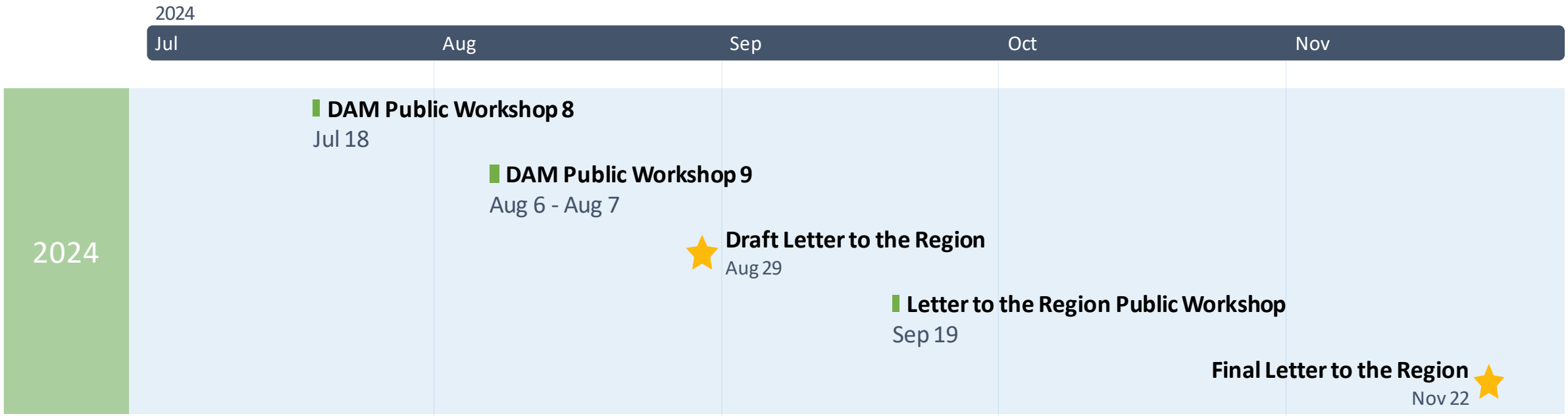
Questions?

Closeout and Q&A

Key dates for CY24

- July through September
  - Additional workshop dates:
    - July 18
    - August 6-7
    - September 19
  - The July and August workshops will continue to discuss DAM related scenarios, specifically transmission, GHG, and other topics.
  - The September workshop will walk through the Draft DAM Policy to address any requests for clarification

What is BPA's DAM Decision timeline for CY24?

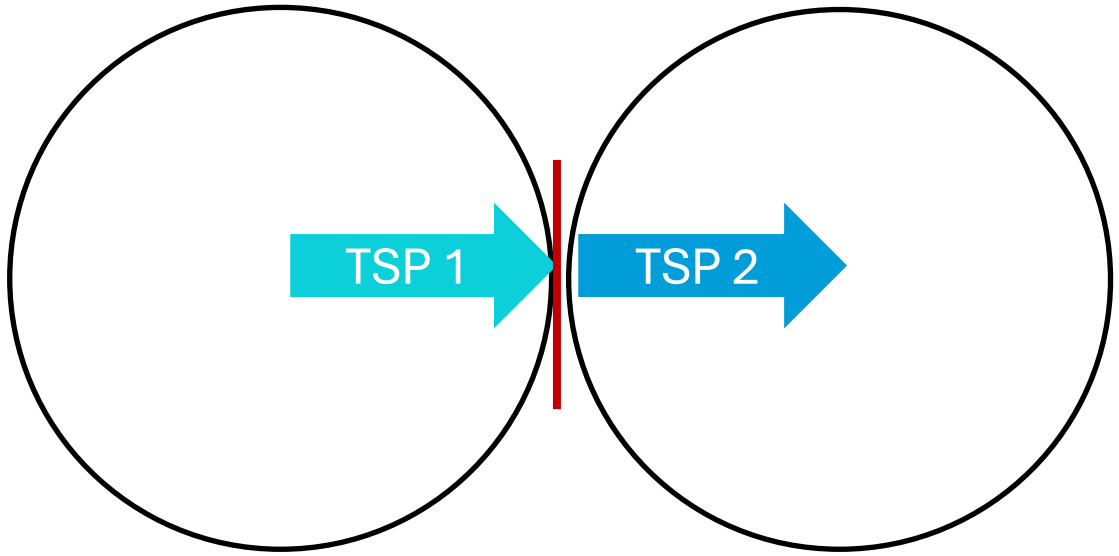


Wrap Up

- Please submit comments on this workshop by July 3rd
- Please send comments to techforum@bpa.gov (with "DAM Participation Evaluation" in the subject heading)
  - All formal feedback received will be posted to the BPA.gov page for BPA's DAM Participation Evaluation

Appendix

Coordinated Interchange Scheduling Limits (Section 7.16.1 of M+ Tariff)



- In some cases, entities may require SPP to apply a coordinated scheduling limit between two BAAs
- May result in 2 (or more) TSPs providing segments that enable a transfer of energy across a single coordinated constraint:
  - One TSP enables export capability
  - A different TSP provides import capability
  - Congestion occurs at “hand-off” point
- In these special cases, SPP will separate congestion revenue into an Export Share and Import Share
  - Default 50/50 allocation between export and import shares
  - Flexibility for TSPs to mutually agree on a different sharing ratio
- This construct is identical to EDAM design for handling transfer revenue, but is not the default for handling congestion between two BAAs

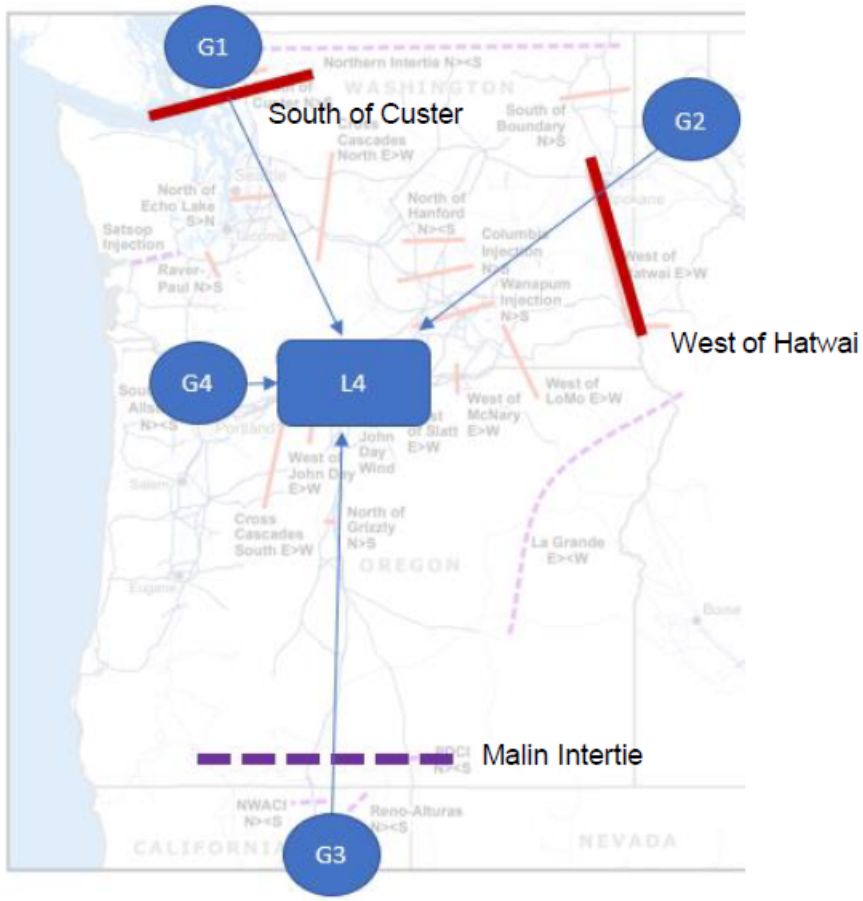
M+ Constraint-Level Congestion Allocation

- Step 1: Maintain a mapping of TSRs to Markets+ modelled constraints
  - Mapping can apply to flow-based constraints (i.e., based on shift factor impacts)
  - Mapping can apply on a 1:1 basis across a scheduling path
- Step 2: Sum the congestions rents across each binding constraint
- Step 3: For each binding constraint, allocate the congestion rents collected to rightsholders with eligibility on that constraint (based on mappings in Step 1)

TSR CR payoff-ratio is calculated for each constraint separately, instead of zonally or market-wide.

Without outages, market-wide and constraint-level financial payouts would be equal

Step 1: Map TSRs to Markets+ Constraints



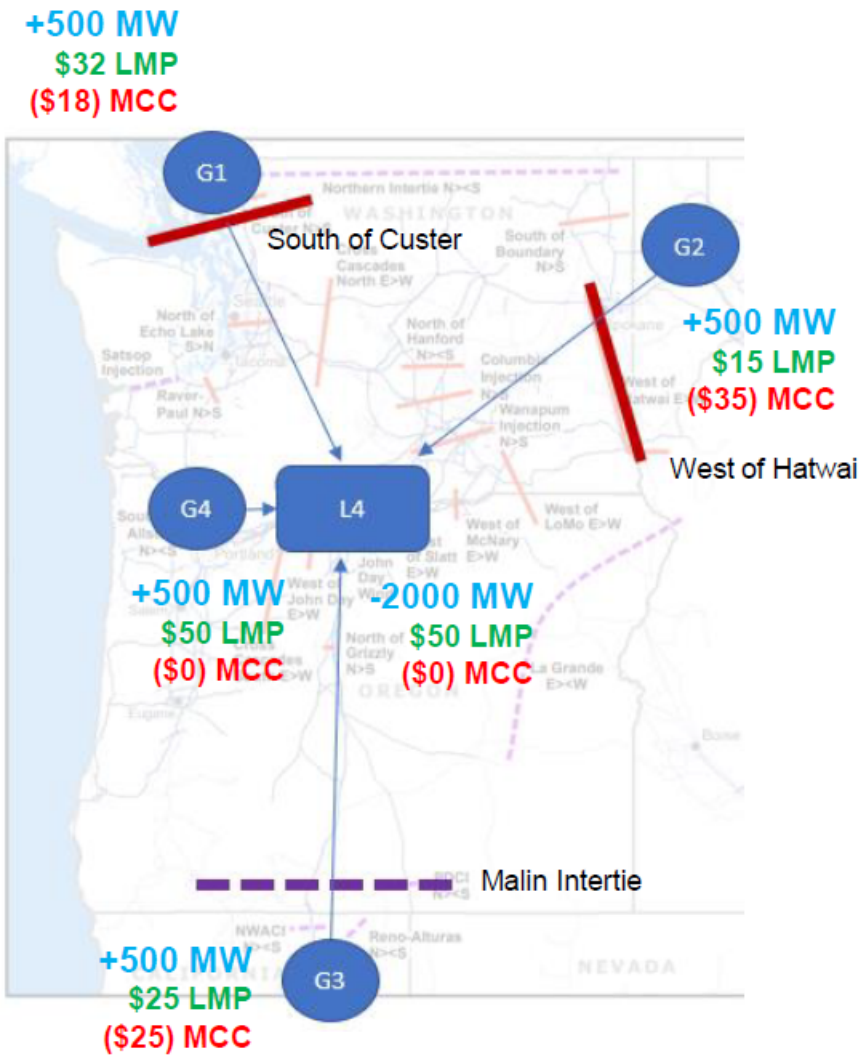
- For flow-based constraints, shift factors are used to estimated the impact on each constraint of injecting power at the POR and withdrawing power at the POD
- For scheduling/interchange limits, TSR rights are already mapped 1:1
- In this example, BPA's published "PTDF" table was used for illustrative purposes:

Shift factors based on BPA PTDFs

Customer	POR/POD	TSR MW	South of Custer	West of Hatwai	Malin Intertie (1:1)	South of Custer MW	West of Hatwai MW	Malin MW
A	G1 to L4	500	84.73%	12.59%	0%	423.65	62.95	0
B	G2 to L4	500	9.94%	73.96%	0%	49.7	369.8	0
C	G3 to L4	500	0.42%	8.65%	100%	2.1	43.25	500
D	G4 to L4	500	0%	0%	0%	0	0	0

Example:
*Customer A has a 500 MW TSR * 84.74% Shift Factor on South of Custer = 423.65 MW*

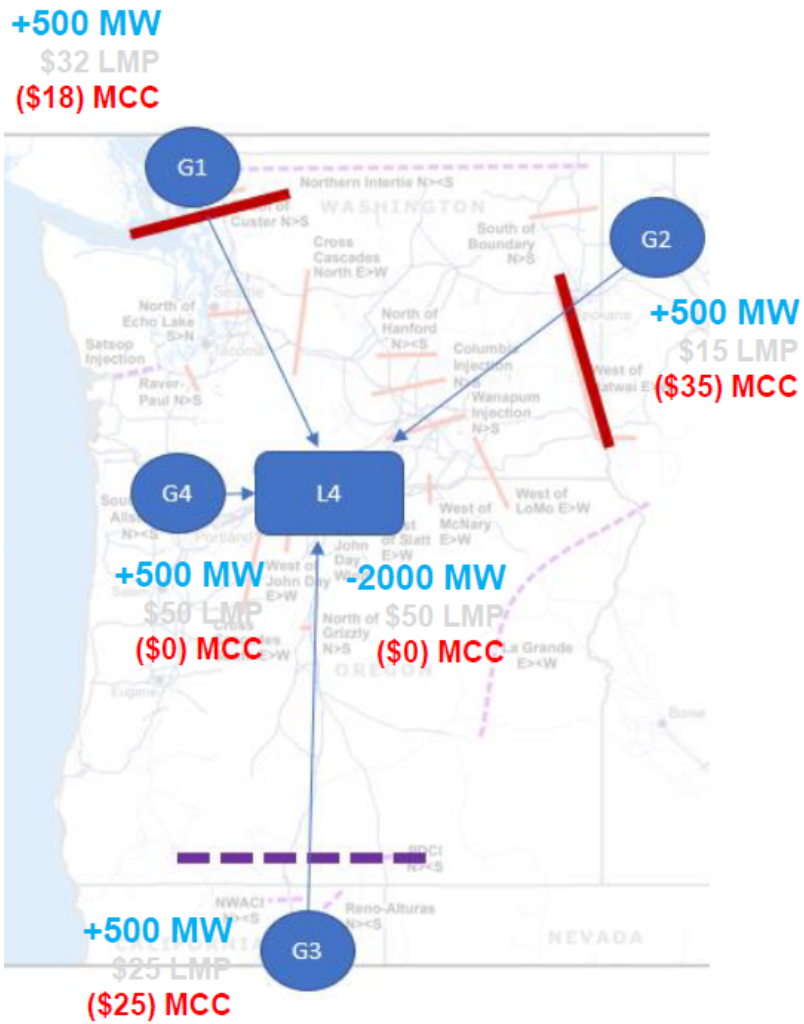
Example 1: Market Solution



Settlement Location	Pmax	Offer Price	Dispatch	LMP	MEC	MCC
G1	600	$32	500	$32	$50	($18)
G2	600	$15	500	$15	$50	($35)
G3	600	$25	500	$25	$50	($25)
G4	600	$50	500	$50	$50	($0)
L4	2000	PT	2000	$50	$50	($0)

Binding Constraints	Flow & Limit	Shadow price
South of Custer	475	-$14.50
West of Hatwai	476	-$45.37
Malin Intertie	500	$-21.01

Example 1: DA Congestion Rent **Collected**

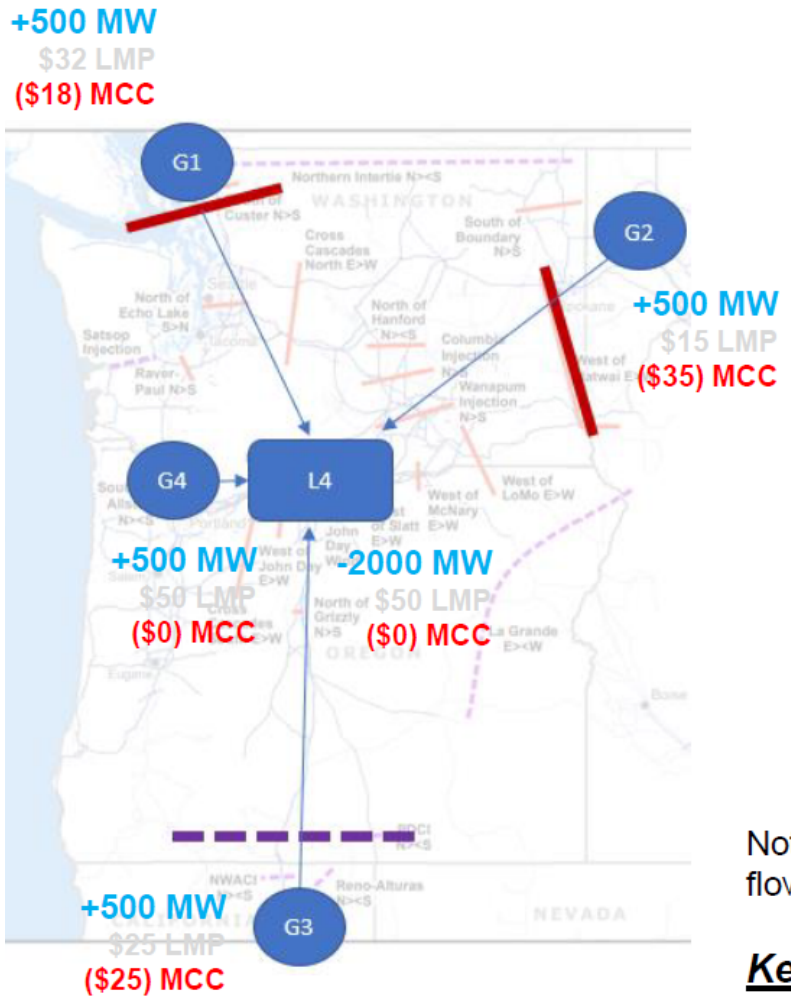


Total Congestion Rent Collected at Each Settlement Location:

Settlement Location	MCC	Cleared MW	Cleared MW * MCC	Total
G1	($18.00)	(500)	-500.0 * ($18.00) =	$ 9,000.00
G2	($35.00)	(500)	-500.0 * ($35.00) =	$ 17,500.00
G3	($25.00)	(500)	-500.0 * ($25.00) =	$ 12,500.00
G4	$0.00	(500)	-1000.0 * $0.00 =	$ -
L4	$0.00	2000	2000.0 * $0.00 =	$ -
Total				$ 39,000.00

The total DA Congestion Rent collected is based on the sum of dispatches at each settlement location, multiplied by the MCC

Example 1: DA Congestion Rent **Collected**



Total Congestion Rent Collected at Each Settlement Location:

Settlement Location	MCC	Cleared MW	Cleared MW * MCC	Total
G1	($18.00)	(500)	-500.0 * ($18.00) =	$ 9,000.00
G2	($35.00)	(500)	-500.0 * ($35.00) =	$ 17,500.00
G3	($25.00)	(500)	-500.0 * ($25.00) =	$ 12,500.00
G4	$0.00	(500)	-1000.0 * $0.00 =	$ -
L4	$0.00	2000	2000.0 * $0.00 =	$ -
Total				$ 39,000.00

But, the total Congestion Rent Collected Can Also Be Expressed By Constraint:

Constraint	Flow	Shadow Price	Congestion Rent Collected
South of Custer	475	-$14.50	$ 6,894.91
West of Hatwai	476	-$45.37	$ 21,597.96
Malin Intertie	500	-$21.01	$ 10,507.13
Total			$ 39,000.00

Note: The sum of congestion rent at each settlement is equal to the sum of [shadow price * flow] across each binding constraint

Key take-away: SPP will have the total congestion dollars collected for each constraint

Example 1: DA Congestion Rent **Allocation Comparison**

Approach 1: Global Payout Ratio

Customer	POR	POD	MWs	Source MCC	Sink MCC	(SINK MCC - SRC MCC) * MW		Ratio	$ Paid to Customer
A	G1	L4	500	-$18.00	$0.00	$0.00 - ($18.00) * 500.0 =	$9,000.00	23%	$9,000.00
B	G2	L4	500	-$35.00	$0.00	$0.00 - ($35.00) * 500.0 =	$17,500.00	45%	$17,500.00
C	G3	L4	500	-$25.00	$0.00	$0.00 - ($25.00) * 500.0 =	$12,500.00	32%	$12,500.00
Total							$39,000.00	100%	$39,000.00

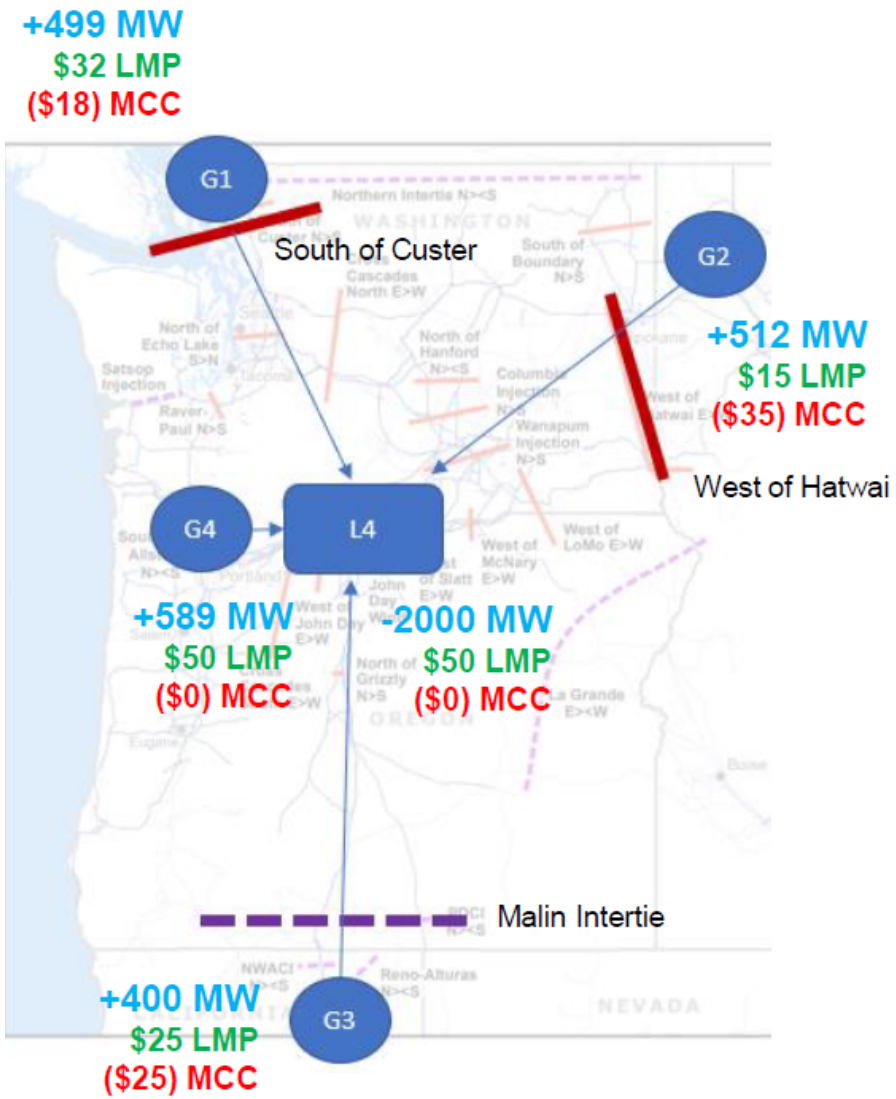
In this scenario all rights are feasible and the result between the two approaches is the same

Approach 2: Constraint-level payout ratios

Customer	POR	POD	MWs	South of Custer MW	West of Hatwai MW	Malin MW	CR Ratio SOC	CR Ratio WOH	CR Ratio Malin	South of Custer	West of Hatwai	Malin	$ Paid to Customer
A	G1	L4	500	423.7	63.0	0.0	89.1%	13.2%	0.0%	$6,143.71	$2,856.29	$0.00	$9,000.00
B	G2	L4	500	49.7	369.8	0.0	10.5%	77.7%	0.0%	$720.74	$16,779.26	$0.00	$17,500.00
C	G3	L4	500	2.1	43.3	500.0	0.4%	9.1%	100.0%	$30.45	$1,962.42	$10,507.13	$12,500.00
				475.5	476.0	500.0	100.0%	100.0%	100.0%	$6,894.91	$21,597.96	$10,507.13	$39,000.00

Example 2: 20% Malin De-Rate Scenario (from 500 MW to 400 MW)

Market Solution

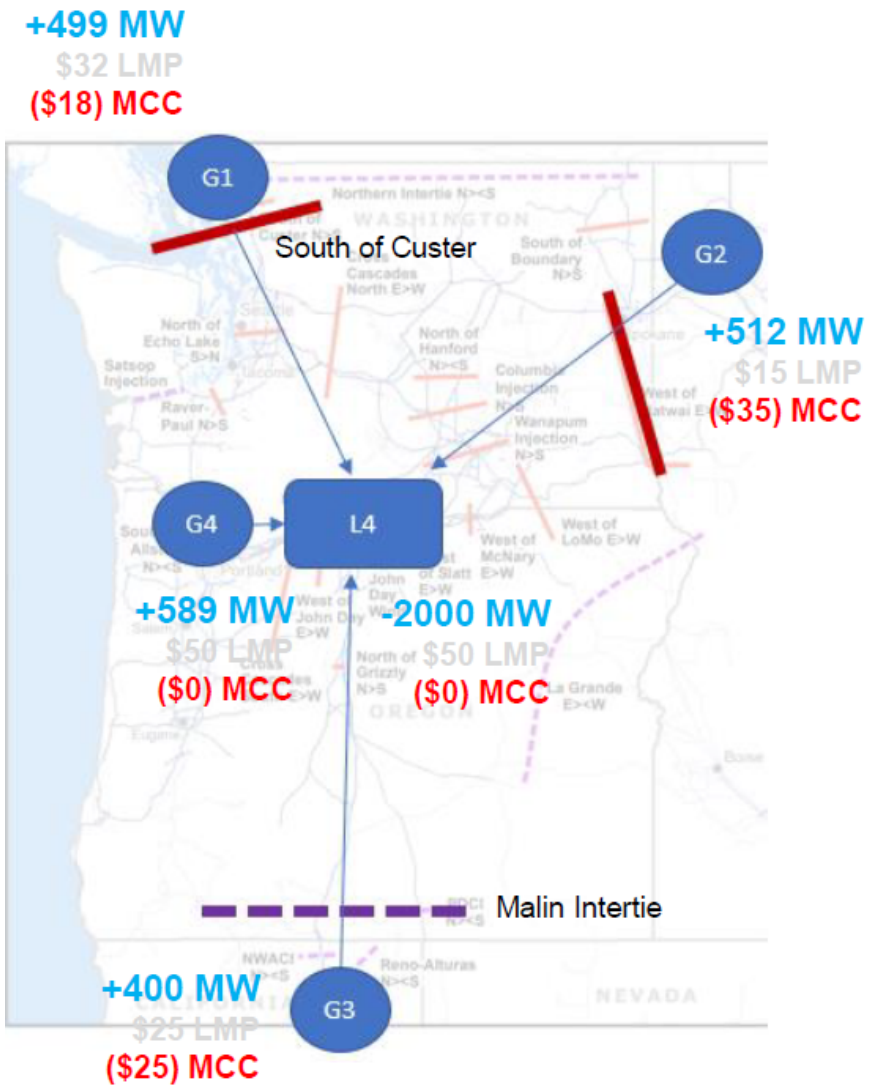


Settlement Location	Pmax	Offer Price	Dispatch	LMP	MEC	MCC
G1	600	$32	499	$32	$50	($18)
G2	600	$15	512	$15	$50	($35)
G3	600	$25	400	$25	$50	($25)
G4	600	$50	589	$50	$50	($0)
L4	2000	PT	2000	$50	$50	($0)

Binding Constraints	Flow & Limit	Shadow price
South of Custer	475	-$14.50
West of Hatwai	476	-$45.37
Malin Intertie	400	$-21.01

Example 2: 20% Malin De-Rate Scenario (from 500 MW to 400 MW)

DA Congestion Rent **Collected**



Total Congestion Rent Collected at Each Settlement Location

Settlement Location	MCC	Cleared MW	Cleared MW * MCC		Total
G1	($18.00)	(499)	-499.1 * ($18.00) =	$	8,983.90
G2	($35.00)	(512)	-511.8 * ($35.00) =	$	17,914.67
G3	($25.00)	(400)	-400.0 * ($25.00) =	$	10,000.00
G4	$0.00	(589)	-589.0 * $0.00 =	$	-
L4	$0.00	2000	2000.0 * $0.00 =	$	-
Total				**$**	**36,898.57**

Total Congestion Rent Collected By Constraint:

Constraint	Flow	Shadow Price		Congestion Rent Collected
South of Custer	475	-$14.50	$	6,894.91
West of Hatwai	476	-$45.37	$	21,597.96
Malin Intertie	400	-$21.01	$	8,405.70
Total			**$**	**36,898.57**

Note: The sum of congestion rent at each settlement is equal to the sum of [shadow price * flow] across each binding constraint

Example 2: 20% Malin De-Rate Scenario (from 500 MW to 400 MW)

DA Congestion Rent **Allocation**

Global Payout Ratio

Customer	POR	POD	MWs	Source MCC	Sink MCC	(SINK MCC - SRC MCC) * MW		Ratio	$ Paid to Customer
A	G1	L4	500	-$18.00	$0.00	$0.00 - ($18.00) * 500.0 =	$9,000.00	23%	$8,515.06
B	G2	L4	500	-$35.00	$0.00	$0.00 - ($35.00) * 500.0 =	$17,500.00	45%	$16,557.05
C	G3	L4	500	-$25.00	$0.00	$0.00 - ($25.00) * 500.0 =	$12,500.00	32%	$11,826.47
Total							$39,000.00		$36,898.57

By Constraint Payout Ratio

Customer	POR	POD	MWs	South of Custer MW	West of Hatwai MW	Malin MW	CR Ratio SOC	CR Ratio WOH	CR Ratio Malin	South of Custer	West of Hatwai	Malin	$ Paid to Customer
A	G1	L4	500	423.65	62.95	0	89.1%	13.2%	0.0%	$6,143.71	$2,856.29	$0.00	$9,000.00
B	G2	L4	500	49.7	369.8	0	10.5%	77.7%	0.0%	$720.74	$16,779.26	$0.00	$17,500.00
C	G3	L4	500	2.1	43.25	500	0.4%	9.1%	100.0%	$30.45	$1,962.42	$8,405.70	$10,398.57
				475.45	476.00	500.00	100.0%	100.0%	100.0%	$6,894.91	$21,597.96	$8,405.70	$36,898.57

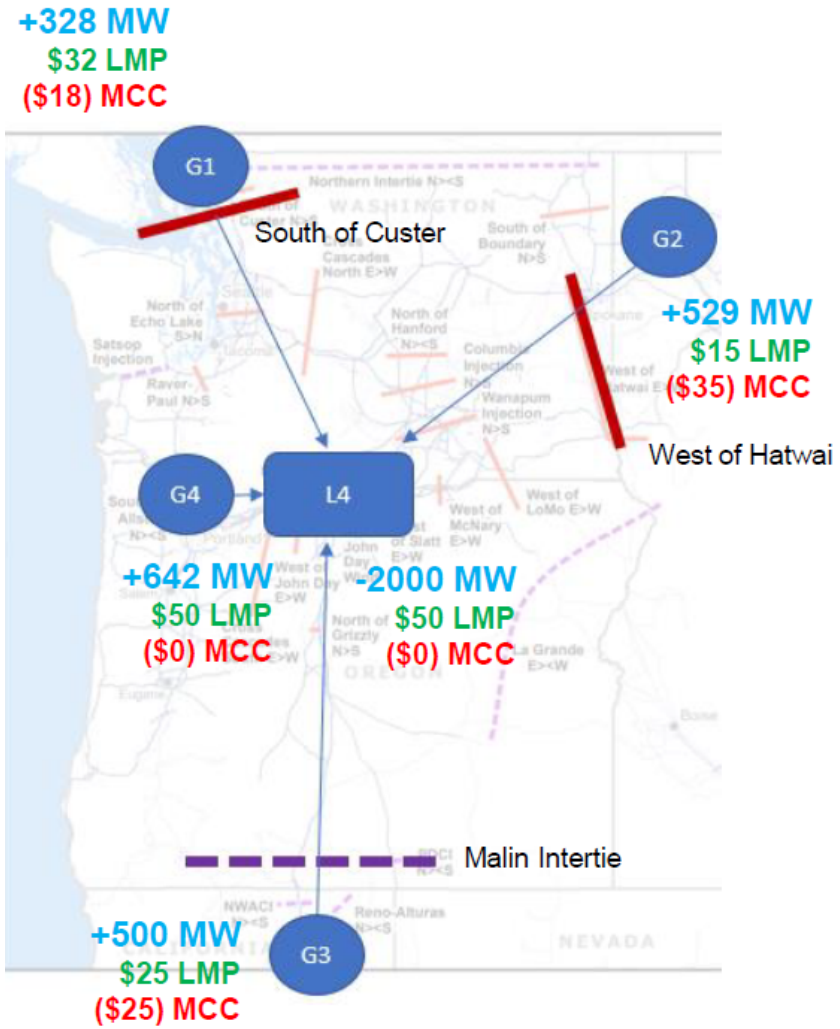
Comparison Of Final Payments for each Methodology:

Customer	POR	POD	MWs	(SINK MCC - SRC MCC) * MW	Global Payout Ratio	% of MCC Diff	By Constraint Payout Ratio	% of MCC Diff
A	G1	L4	500	$9,000.00	$8,515.06	95%	$9,000.00	100%
B	G2	L4	500	$17,500.00	$16,557.05	95%	$17,500.00	100%
C	G3	L4	500	$12,500.00	$11,826.47	95%	$10,398.57	83%
				$39,000.00	$36,898.57		$36,898.57	

Impact limited to Entity C with rights on Malin Intertie

Example 3: SoC 30% De-Rate Scenario

Market Solution

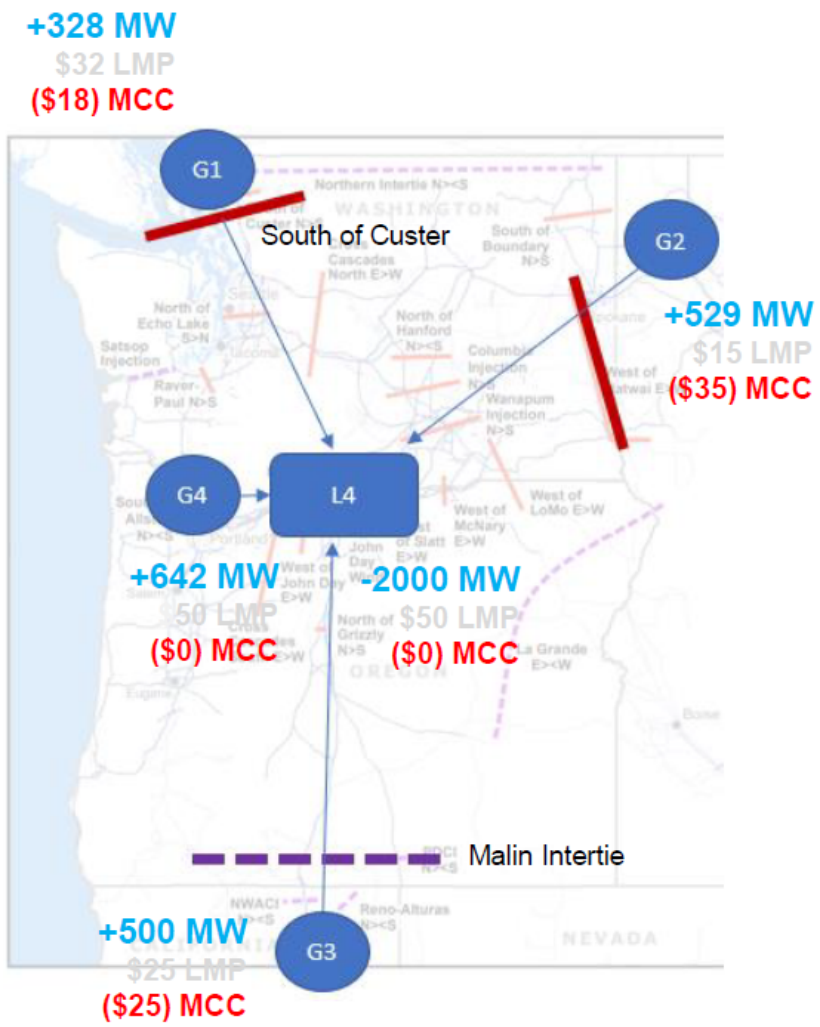


Settlement Location	Pmax	Offer Price	Dispatch	LMP	MEC	MCC
G1	600	$32	328	$32	$50	($18)
G2	600	$15	529	$15	$50	($35)
G3	600	$25	500	$25	$50	($25)
G4	600	$50	642	$50	$50	($0)
L4	2000	PT	2000	$50	$50	($0)

Binding Constraints	Flow & Limit	Shadow price
South of Custer	333	-$14.50
West of Hatwai	476	-$45.37
Malin Intertie	500	$-21.01

Example 3: SoC 30% De-Rate Scenario

DA Congestion Rent **Collected**



Total Congestion Rent Collected at Each Settlement Location

Settlement Location	MCC	Cleared MW	Cleared MW * MCC		Total
G1	($18.00)	(328)	-328.5 * ($18.00) =	$	5,912.13
G2	($35.00)	(529)	-529.2 * ($35.00) =	$	18,522.07
G3	($25.00)	(500)	-500.0 * ($25.00) =	$	12,500.00
G4	$0.00	(642)	-642.3 * $0.00 =	$	-
L4	$0.00	2000	2000.0 * $0.00 =	$	-
Total				**$**	**36,934.21**

Total Congestion Rent Collected By Constraint:

Constraint	Flow	Shadow Price		Congestion Rent Collected
South of Custer	333	-$14.50	$	4,829.12
West of Hatwai	476	-$45.37	$	21,597.96
Malin Intertie	500	-$21.01	$	10,507.13
Total			**$**	**36,934.21**

Note: The sum of congestion rent at each settlement is equal to the sum of [shadow price * flow] across each binding constraint

Example 3: SoC 30% De-Rate Scenario

DA Congestion Rent **Allocation**

Global Payout Ratio

Customer	POR	POD	MWs	Source MCC	Sink MCC	(SINK MCC - SRC MCC) * MW		Ratio	$ Paid to Customer
A	G1	L4	500	-$18.00	$0.00	$0.00 - ($18.00) * 500.0 =	$9,000.00	23%	$8,523.28
B	G2	L4	500	-$35.00	$0.00	$0.00 - ($35.00) * 500.0 =	$17,500.00	45%	$16,573.04
C	G3	L4	500	-$25.00	$0.00	$0.00 - ($25.00) * 500.0 =	$12,500.00	32%	$11,837.89
Total							$39,000.00		$36,934.21

By Constraint Payout Ratio

Customer	POR	POD	MWs	South of Custer MW	West of Hatwai MW	Malin MW	CR Ratio SOC	CR Ratio WOH	CR Ratio Malin	South of Custer	West of Hatwai	Malin	$ Paid to Customer
A	G1	L4	500	423.65	62.95	0	89.1%	13.2%	0.0%	$4,302.99	$2,856.29	$0.00	$7,159.28
B	G2	L4	500	49.7	369.8	0	10.5%	77.7%	0.0%	$504.80	$16,779.26	$0.00	$17,284.06
C	G3	L4	500	2.1	43.25	500	0.4%	9.1%	100.0%	$21.33	$1,962.42	$10,507.13	$12,490.88
				475.45	476.00	500.00	100.0%	100.0%	100.0%	$4,829.12	$21,597.96	$10,507.13	$36,934.21

Comparison Of Final Payments for each methodology

Customer	POR	POD	MWs	(SINK MCC - SRC MCC) * MW	Global Payout Ratio	% of MCC Diff	By Constraint Payout Ratio	% MCC Diff
A	G1	L4	500	$9,000.00	$8,523.28	95%	$7,159.28	80%
B	G2	L4	500	$17,500.00	$16,573.04	95%	$17,284.06	99%
C	G3	L4	500	$12,500.00	$11,837.89	95%	$12,490.88	100%
				$39,000.00	$36,934.21		$36,934.21	

Impact to customers is consistent with rights on de-rated flowgate