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

Wind Integration Team Work Plan

June 2009

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BPA Wind Integration Team Work Plan

In June 2008, BPA and its customers agreed to establish a Wind Integration Team to improve techniques to integrate large amounts of wind power and other variable power sources into the BPA transmission system. A 2009 Wind Integration Rate Case Settlement laid out specific areas for the team to address.

Over the last year, we have identified the key issues and how to address them. We have developed and are implementing short-term solutions that are sustaining the fast pace of wind power growth in the Northwest today.

At the urging of our customers and with the support of our parent organization, the U.S. Department of Energy, we are now accelerating work on long-term solutions. We are adding more staff and resources and have pushed up deadlines. We appreciate the contributions and collaborative spirit shown by our utility customers and the wind power community in development of this work plan, and their offers of assistance and participation in carrying it out. These projects will reduce the costs of wind integration to Northwest consumers and will give our utility and wind project customers a choice between buying generating reserves and other services from BPA or elsewhere on the market.

A work plan to change the way the grid works

This work plan will begin to upgrade BPA's transmission grid to meet the nation's domestic and renewable resource goals and to get our part of the Northwest ready for the Smart Grid.

To accomplish the six projects outlined in the plan, BPA estimates it will cost roughly $7 million a year more in 2010 and 2011 than the $2 million a year now allocated. We expect to add a number of full-time positions to complete these projects and to meet resulting permanent workload increases in dispatch, transmission reservations, contract administration and related areas.

For the last decade, BPA's policies, its transmission grid and the federal hydropower system have fostered growth of the Northwest wind power fleet. We have addressed transmission construction and financing issues for renewable resources and have increased available transmission capability.

This work plan is the next major push in BPA's wind integration efforts. The projects focus primarily on operational issues, including reliability protocols, wind forecasting, and the systems and business practices by which we schedule power and sell transmission services. These are complex projects that get to the heart of how the grid runs.

The projects will begin to fundamentally change the way the transmission grid is operated, from today's hourly power scheduling to a faster, more flexible grid. The work plan brings wind power needs directly into the heart of transmission system operation. Under this plan, BPA will add its own wind forecasting system. It will add a "wind desk" to its dispatch center, staffed continuously and located next to the existing hydro dispatch desk.

This work also will reach beyond BPA. Most of the projects involve joint efforts, financial investments and parallel changes in business and operating practices by other participating Northwest utilities and wind project owners. Ultimately, we expect this work may lead to new business practices across the Northwest Power Pool and the Western Interconnection.

Overview of projects

The six Wind Integration Team Work Plan projects all address aspects of transmission system operation and control.

1) **Implement Dispatcher Standing Order DSO-216**: BPA is installing equipment and working with wind power projects to implement new BPA operating protocols known as Dispatcher Standing Order 216, which will curtail wind generation or transmission tags if necessary to avoid exhausting reserves. This will keep the system reliable, lessen costs to wind projects and support fast growth of the wind fleet while long-term solutions are developed. Implementation will be complete by October 2009, when rates relying on these protocols go into effect.

2) **Wind Forecasting**. BPA is adding 16 wind measurement sites to its existing wind monitoring network by October 2009. We will develop a complete wind forecasting system by March 2010. By September 2010, BPA dispatchers will have display screens of real-time wind generation and next-hour wind forecasts by wind project, so dispatchers can better anticipate changes in wind output and adjust generation to make more efficient use of combined wind, hydro and other available resources. (BPA's Dittmer dispatch center already features a real-time display of total moment-to-moment wind generation in BPA's grid.)

The remaining WIT projects go beyond BPA.

3) **Sub-Hourly Scheduling Pilot**: This project will begin to fundamentally change BPA power scheduling. BPA will develop tools and processes to change power and transmission schedules at the half-hour as well as the hour to let customers sell power from fast changes in wind output. We will begin scheduling on power on the half-hour by December 2009 for exports of wind generation where wind power output is exceeding its existing hourly schedule and could otherwise trigger the protocols of DSO 216. Avista and PacifiCorp have launched similar pilot projects. We are working with them, the Western Electricity Coordinating Council, Portland General Electric and Puget Sound Energy to assure that the systems we develop are consistent as we begin to move from traditional hourly power and transmission scheduling to within-hour schedules for variable generation and Smart Grid technologies.

Northwest utilities need a better methodology to determine where the transmission system has enough flexibility available to let a utility use a power plant in another utility's area for reserves. This is known as dynamic transfer; scheduling such arrangements is called dynamic scheduling. ColumbiaGrid, the Northern Tier Transmission Grid (NTTG), and WestConnect are cooperating through a Joint Initiative to support broader use of dynamic scheduling.

4) **Dynamic Transfer Limits Study**: Under a study plan proposed by BPA, a ColumbiaGrid/NTTG study is developing a methodology to quickly determine whether the existing transmission system can reliably let a power plant in one balancing authority supply reserves to another balancing authority. The study will apply this methodology to four transmission paths: the Northern Intertie from BPA's grid to British Columbia, the Southern Intertie from BPA's grid to California, the transmission path from Idaho to Boardman, Ore., and the transmission path from the eastern border of BPA's grid at Garrison, Mont., to Libby Dam. This study is due Feb. 15, 2010.

5) **Self-Supply of Reserves**: Once the dynamic transfer study is done, BPA can use its results to allow wind projects to purchase reserves from suppliers other than BPA,

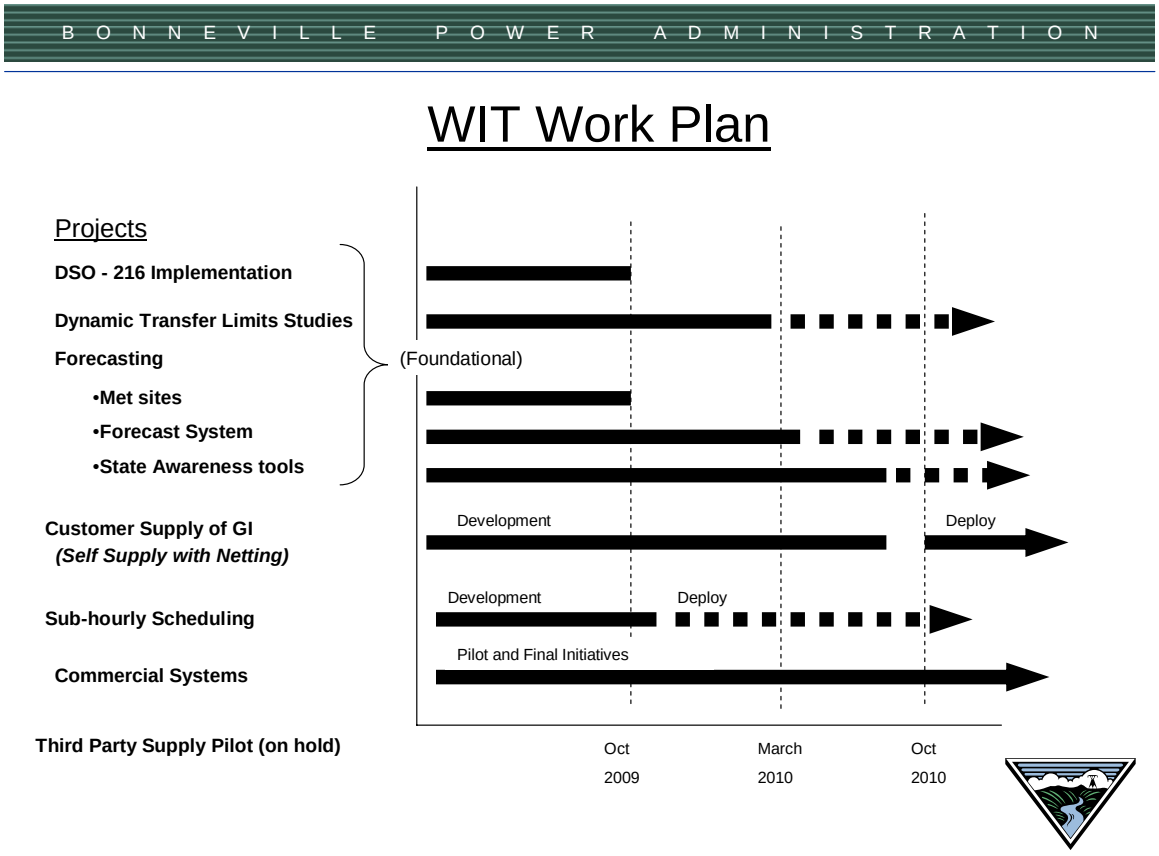
where transmission is available. BPA, the receiving utility and the wind project involved all must install significant control and communications equipment to make this work. We will identify wind projects that want to participate immediately. While the study is in progress, we will adapt the federal hydropower system's Automatic Generation Control and other systems to accommodate dynamic transfers. We will launch the first opportunity for wind projects to self-supply their own generation imbalance reserves no later than October 2010.

6) **Third-party Supply (delayed)**: BPA had planned to launch a pilot project this fall on augmenting its own reserves with non-federal supplies located in BPA's balancing area. This uses the same staff as the self-supply project that's a high customer priority, so we are delaying this pilot project. The Automatic Generation Control modifications and other techniques for the self-supply project also will support eventual non-federal additions to BPA's reserves. As we recruit additional operational expertise, we may be able to continue design work that would support third-party supply of reserves to BPA without affecting other efforts.

Overview of Timelines

BPA has accelerated Wind Integration Team projects of highest priority to stakeholders by one year, compared to our February 2009 work plan. At the same time, we have delayed a pilot project to explore adding reserves to BPA's system beyond the federal hydropower system, because it would encumber the same staff and is of lower priority to BPA customers.

Three of the six WIT projects are "foundational" in that they are necessary to support continued growth of the wind fleet today and to enable use of new wind management techniques. The remaining three projects are the new techniques.



Upgrading BPA's commercial transmission business systems

While all the projects in this work plan are slated for implementation by October 2010, BPA will need to complete additional upgrades to its commercial systems for transmission transactions to support full, system-wide implementation of the work plan's new grid management techniques. OATI, the company that provides BPA's transmission reservation system, says BPA already has a higher volume of transmission transactions than any of its other customers in North America. Dynamic transfers and within-hour changes in power schedules, in particular, will significantly increase the number, frequency and complexity of transmission transactions. Over the next few years, BPA expects to significantly upgrade its OASIS transmission reservation system and business practices. The "commercial systems" line on the above graph represents this ongoing work.

Funding

Under the 2009 rate case settlement agreement, the Wind Integration Team has budgeted $2 million per year in BPA's revenue requirement for rates for fiscal years 2010 and 2011. Accelerating the WIT work plan will increase costs and staffing requirements this year and in FYs 2010-2011. Including loaded staffing costs, the net increases are roughly $2.7 million for FY 2009, $7 million for FY 2010 and closer to $8 million in FY 2011. BPA may seek external funding for some projects and is conferring with its customers on schedules for other work.

Continued stakeholder involvement

BPA will continue to keep stakeholders apprised of progress in the WIT projects through its WIT e-mail list at least quarterly and through WIT meetings as needed. In addition, we anticipate that several of the WIT projects will need to engage customers and interested parties in specific areas. For example, new power or transmission products may emerge. We will inform customers and other interested parties of opportunities to participate in wind-related public involvement and customer engagement processes through the WIT e-mail list and the Tech Forum transmission customer e-mail list. To sign up for the WIT e-mail list, go to www.bpa.gov/go/wind.

BPA customers also will be apprised of wind integration developments through BPA Transmission Services regular Joint Operating Committee and Customer Forum meetings.

Finally, at the May 29 public WIT meeting, customers offered to assist BPA with WIT projects. We are conferring with interested customers on what form this assistance might take.

Wind Integration Team Work Plan
Project Descriptions

New Operating Protocols:
Dispatcher Standing Order #216 (DSO 216)

Executive Sponsor: Hardev Juj
Project Lead: Kevin Johnson
Market and Sales Lead: Dave Fitzsimmons

Project Description

This project implements automated tools and communication protocols to limit wind to schedule or curtail e-Tags to actual in response to the amount of reserves deployed per the 2010/2011 wind integration rate, beginning on Oct. 1, 2009. BPA completed modifications to its Automatic Generation Control system on April 3 to limit wind to schedules if reserves are exhausted. This Phase I (Limit Wind to Schedule) protocol is in effect. Phase II of the project, shown below, is in progress. By the completion date of Oct. 1, 2009, all software to implement Phase II will be installed, BPA will implement Dispatch Standing Order 216 in full, and rates relying on the protocol will be in effect. Under DSO 216, if wind plants are undergenerating and BPA is supplying incremental reserves, BPA will send a warning of possible transmission curtailment when 85 percent of reserves are consumed, and will curtail transmission tags to actual wind output plus allocated reserves when 90 percent of reserves are consumed. When plants are overgenerating and BPA is supplying decremental reserves, BPA will send warnings when reserves are 85 percent consumed and will send signals to limit wind generation to output and allocated reserves when reserves are 90 percent consumed. See diagram on page 8.

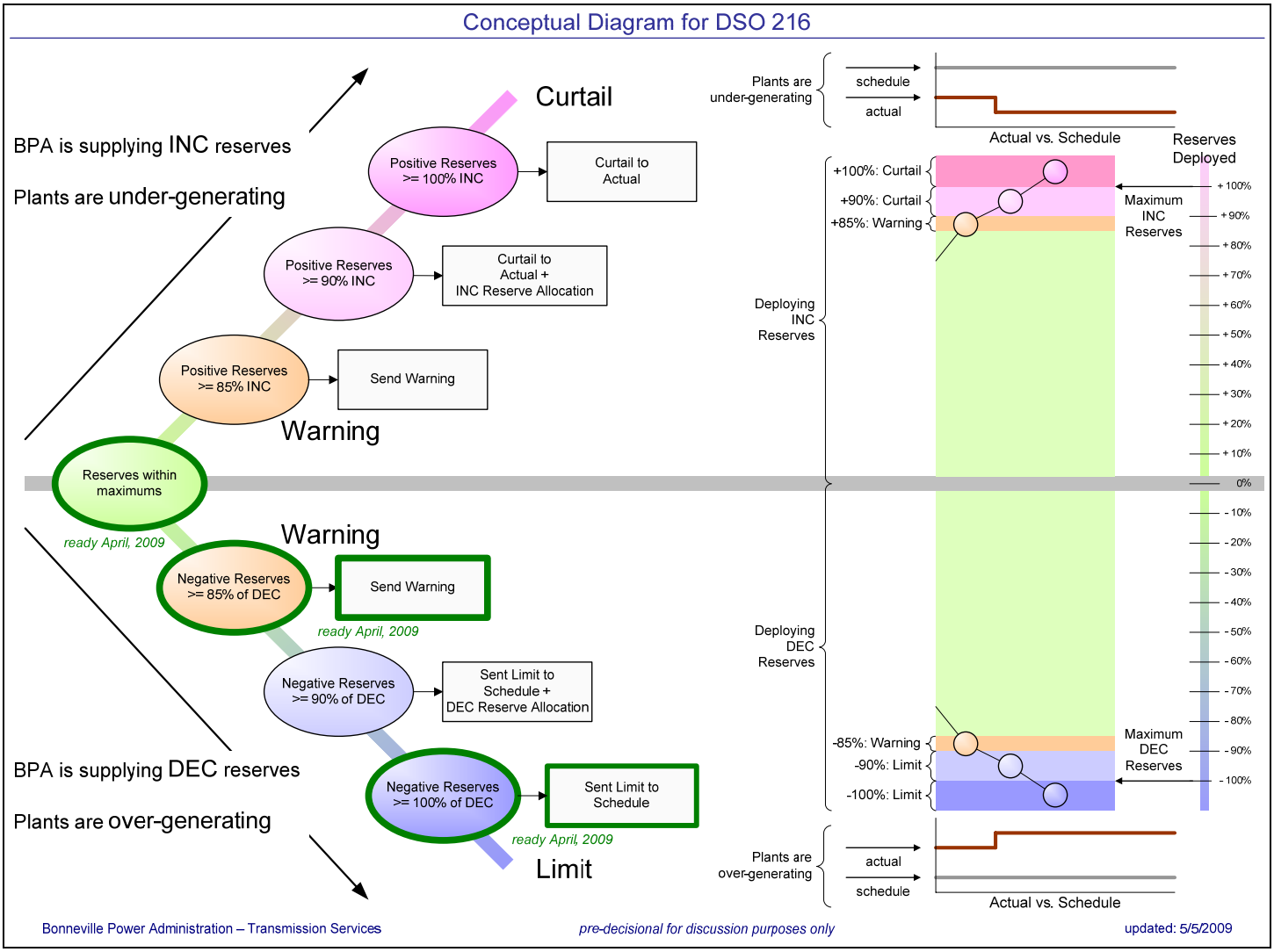
Completion Date: Oct. 1, 2009

Assumptions:

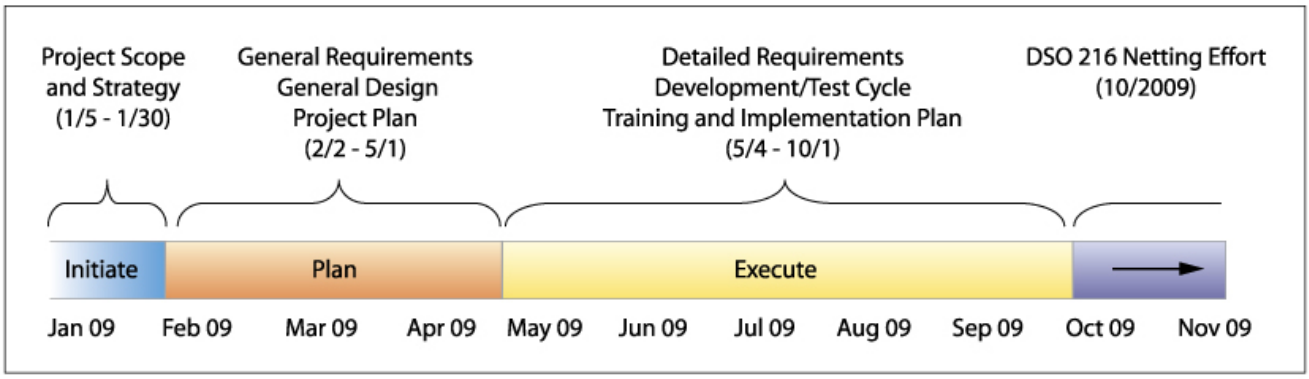
This project, as planned, does not provide wind generation owners the ability to manage generation imbalance through self supply or netting and does not aggregate signals where a single owner operates multiple plants.

Deliverables:

- Calculate and communicate aggregate reserve obligations (total, load, and wind generation).
- Calculate and communicate aggregate reserves deployed.
- Determine reliability threshold levels for warning at 85 percent and limit at 90 percent and issue alarms and notification when needed.
- Develop and deploy a wind "dashboard" for BPA Dispatch and designated wind plant operators per the Large Generator Interconnection Agreement (known as Operating Representative).
- Allows for bi-directional communication of acknowledgements of dispatcher directives.



Phase II Timeline



Wind Forecasting

Executive Sponsors: Steve Oliver and Hardev Juj
Project Lead: Matt Neel
Transmission Services Lead: Kevin Johnson

Project Description

This project will improve BPA's ability to forecast wind power generation and to develop, test and deploy tools for dispatch and hydro duty schedules to achieve greater understanding and awareness of wind generation patterns and operational risks.

Completion Dates:

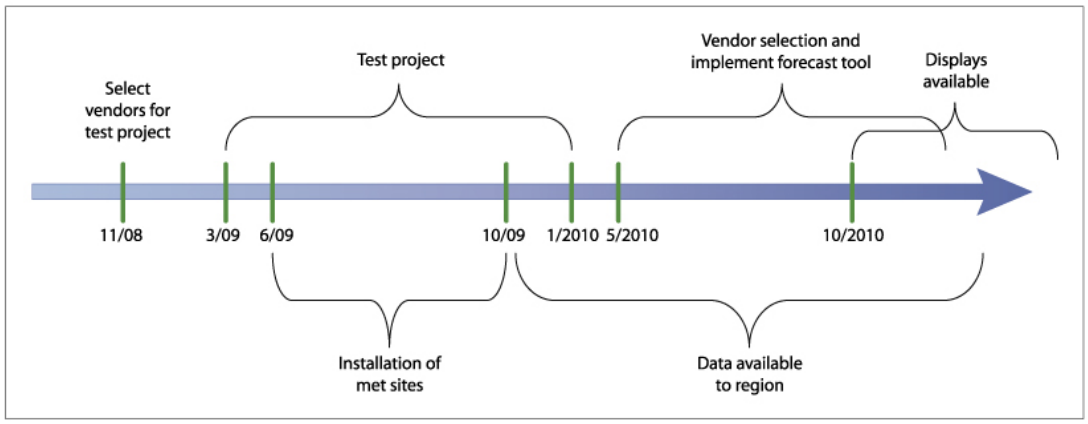
Oct. 1, 2009: Met Sites
May 31, 2010: In-house forecasting
Oct. 1, 2010: State awareness (phase in displays as information becomes available)

Assumptions:

- The information from the surface observation sites will be available to the public and also used in BPA's forecasting process.
- Maintenance of the observation sites will be funded through the renewables budget.
- The wind generation forecast will be used for internal operations and planning. There are no plans to share the wind generation forecast with outside entities at this time.
- This effort meets requirements of both Power and Transmission Services. Transmission Services will "own" the process once fully implemented, with Standards of Conduct compliant deliverables to Power Services under the prevailing SOC interpretation.
- The wind generation forecast product is expected to be a vendor-based solution (with appropriate customization) to which BPA would subscribe.

Deliverables:

- BPA will install meteorological equipment on up to 16 BPA facilities by Oct. 1, 2009.
- By May 31, 2010, BPA will complete and begin implementing a within-hour in-house wind forecasting system.
- By Oct. 1, 2010, dispatchers will have a full complement of wind generation and forecast displays. These displays will continue to develop as needs change.



Sub-Hourly Scheduling Pilot

Executive Sponsors: Cathy Ehli
Project Lead: Troy Simpson
Market and Sales Lead: Michelle Manary

Project Description

This project initiates BPA's ability to change schedules on a sub-hourly basis. BPA will begin the development of systems and processes that will enable purchasing/selling entities to schedule excess wind generation from the BPA BAA (on the half hour) that otherwise might have been susceptible to limit directives by DSO 216 implementation. This will make it possible for customers to sell excess power that might otherwise have been limited and will minimize generation imbalance charges. By the completion date, BPA will be able to offer scheduling of exports from the BPA balancing authority on the half-hour to participating wind generators in situations where they are generating in excess of their existing schedules. While the pilot is in progress, BPA will evaluate other options for increasing flexibility in scheduling wind generation.

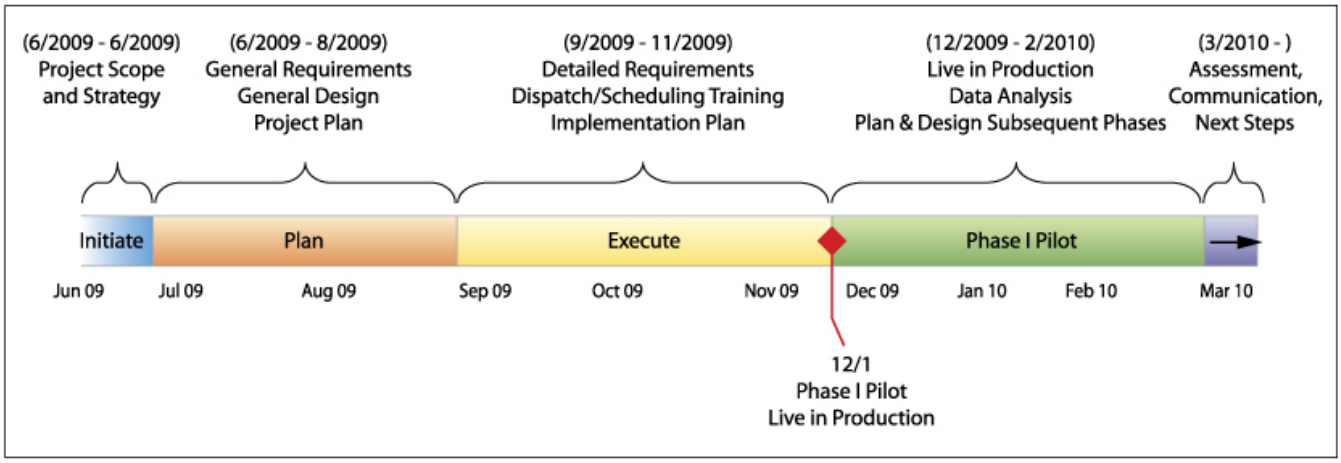
Completion Date: Dec. 1, 2009

Assumptions:

- Project does not reduce BPA's reserves obligation or provide unlimited mid-hour scheduling of resources.
- Project will require bi-lateral participation.
- Full implementation of sub-hourly scheduling will require establishment of an hourly Available Transfer Capability (ATC) methodology.

Deliverables:

By December 2009, BPA will begin offering reservation and transmission scheduling for excess wind generation on the half-hour.



Dynamic Transfer Limits Study

Executive Sponsors: Hardev Juj and Cathy Ehli
Project Lead: Brian Tuck
Market and Sales Lead: Rich Gillman

Project Description:

This project will determine the evaluation criteria and necessary requirements and to establish a credible, repeatable, and timely methodology to allow dynamic scheduling on BPA's network system and interties.

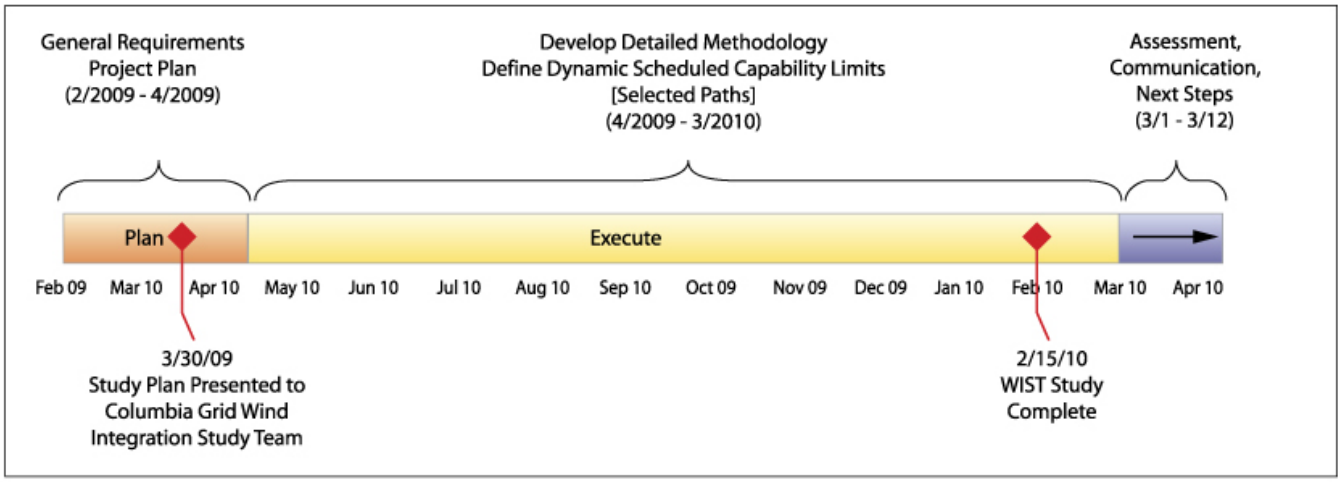
Completion Date: Feb. 15, 2010

Assumptions:

This project does not identify dynamic limits of any particular generator, load nor implement dynamic scheduling.

Deliverables:

By the completion date of Feb 15, 2010, this project will have completed the methodology and evaluated limits on four specific paths, including the Northern Intertie, Southern Intertie, Idaho to Boardman and Libby to Garrison in Montana. Transmission paths internal to the BPA grid will also be considered in the study, including: south of Allston, cross-Cascades north and south, north of John Day, north of Hanford, west of McNary and west of Slatt.



Customer Supplied Generation Imbalance (Self-Supply with Netting)

Executive Sponsors: Cathy Ehli, Hardev Juj, and Steve Oliver
Project Lead: Salah Kitali
Marketing and Sales Lead: Bob King
Power Services Lead: Kasi Beale

Project Description

This project will begin the development of systems and processes that would enable customers to self supply generation imbalance from their own resources or to contract for reserves for one or more wind generators. Under self-supply, all of the generators owned or contracted by a given customer will be netted for the purposes of calculating Generation Imbalance (GI), wind limits and e-Tag curtailments. If given a limit order, the customer will have the option of which resources to limit; including thermal and contract resources. The generator owner/operator, not BPA, will deploy reserves needed for imbalance of its resources.

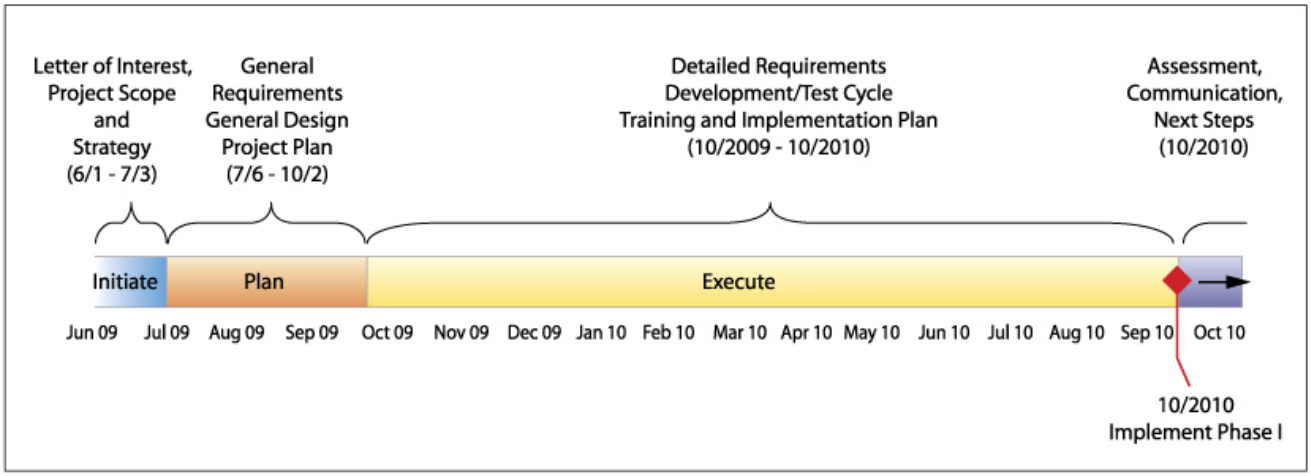
Completion Date: Oct. 1, 2010

Assumptions:

- Customer supplied generation imbalance does not provide regulating reserves.
- DSO 216 would need to be revisited for potential enhancements to accommodate customer supplied generation imbalance.
- The Joint Initiative Dynamic Scheduling System (DSS) will be implemented in BPA's Automatic Generation Control and base point displays to enable management of dynamic schedules in real-time (DSS will be implemented 3/2010).

Deliverables:

This summer, BPA will solicit customer interest in self-supplying reserves. The completion date of Oct. 1, 2010, is the date on which BPA and the customer(s) participating in the initial implementation will have the necessary equipment and signals in place to begin self-supply operation.



Third-Party Supply Pilot: – RFI Implementation

(Balancing Area Reserve Augmentation)

Executive Sponsors: Steve Oliver, Hardev Juj, and Cathy Ehli
Project Lead: Kasi Beale
Transmission Services Lead: Salah Kitali
Marketing and Sales Lead: Bob King

Project Description:

This project is to define criteria and processes for third party supply of with-in hour balancing reserves and then establish a pilot project to test access to non-FCRPS generating resources for balancing reserves.

Completion Date:

Project on hold. Commercial implementation of this project is being put on hold based on feedback received at the May 29 Wind Integration Team public meeting. As positions now open are filled, BPA will assign staff to define criteria and processes for third-party supply, particularly where those requirements parallel or are the same as those needed for customer self-supply.

Assumptions:

- The pilot process is intended to ensure BPA is ready to implement third-party supply when it is estimated additional balancing reserves may be needed.
- Third party supply differs from self supply in that the generator is responding directly to BPA's Automatic Generation Control signal. In self-supply-netting, the non-FCRPS generator is responding only to signals from the netted generators.
- Third party supply will help fulfill the BA's reserve obligation. Self supply covers a portion of the generator's imbalance obligation, offsetting the portion of the balancing authority capacity requirement for imbalance for the netted generators.
- BPA reserves requirements are expected to exceed the FCRPS ability in 2012, according to the February 2009 Preliminary Needs Assessment analysis.
- Initiation depends on implementation of AGC changes to enable signaling and deployment of third party supply.

Deliverables:

Currently on hold.

Appendices

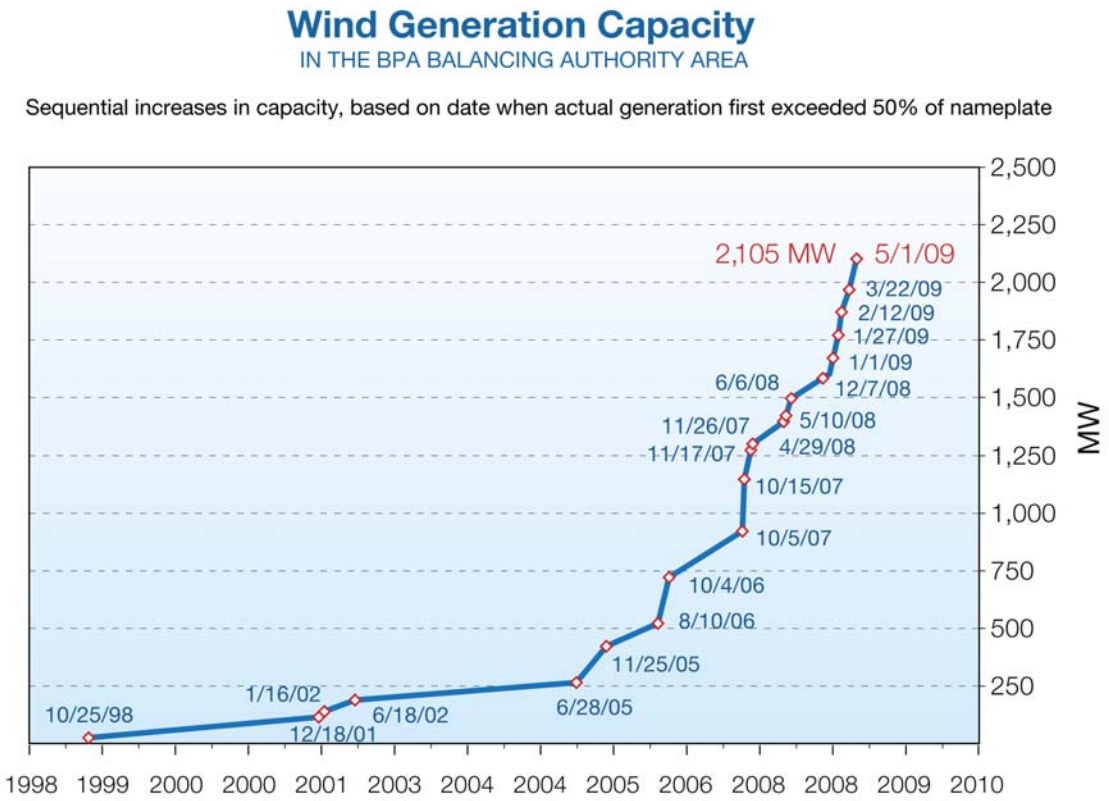
I. Background

The Pacific Northwest is advantaged by a federal hydroelectric system that is a major source of carbon-free, renewable electricity. This system is now being called upon to support the growth of another source of carbon-free, renewable electricity – wind energy.

Washington and Oregon rank fifth and sixth today in wind power installed among the 50 United States. They are two of nine states in the American Wind Energy Association's "Gigawatt Club" of states with more than 1,000 megawatts of wind installed.

Oregon and Washington rank 23rd and 24th, respectively, in wind power potential of the 50 states, according to the American Wind Energy Association. Wind power's early success in the Pacific Northwest is due in part to the advantages provided by the Northwest's federal hydropower system and its transmission system.

BPA has interconnected 21 wind projects into its transmission grid. We have built five substations and six tap lines to do so, with more in the works. The transmission grid built to carry power from remote hydro electric dams to Northwest cities and to California and the Southwest now also carries up to about 2,000 megawatts of wind power – at peak wind power output, that's enough to serve the average power needs of Portland and Seattle.



Increasing transmission for new wind projects

BPA's transmission system is a major component of the Western Interconnection, which extends from Mexico to Canada and supports long-distance transfer of electricity. In addition to physical project integrations, BPA has developed three innovative new mechanisms to increase available transmission capacity, so that more wind projects can get their wind power to market in the Northwest and exported from the Northwest to utilities across the Western Interconnection. These include:

1) <u>New transmission service without new construction.</u>

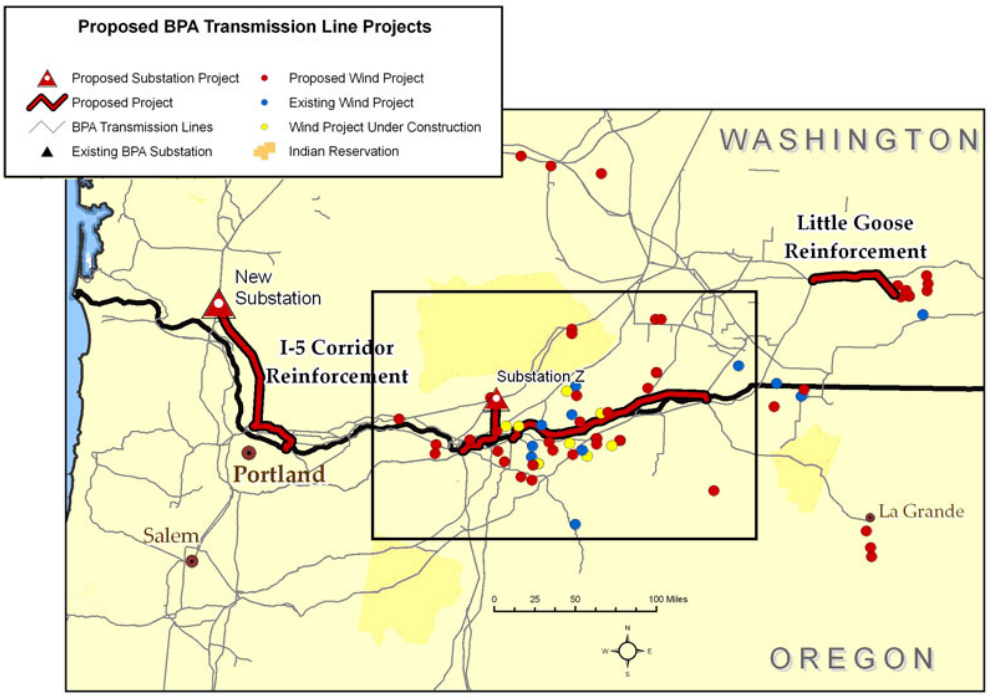
Last year BPA conducted a first-of-its-kind Network Open Season to sort out a complicated queue of service requests from customers seeking access to BPA's transmission system. We found that we could provide service for 1,780 megawatts of new service without major construction, simply by withdrawing from the queue those not ready to commit to taking service. Of the more than 6,000 megawatts of new power projects that requested service through the Network Open Season, more than 4,700 megawatts are wind power projects. The 2009 Network Open Season is now in progress.

2) <u>Greater use of existing transmission capacity.</u>

In March 2009, BPA began offering Conditional Firm transmission service to another 1,200 megawatts of new service requests. Conditional Firm service provides transmission with the potential for a small amount of interruption if transmission becomes congested. We expect to make additional offers of Conditional Firm service on an interim basis in the future.

3) <u>New transmission construction financed</u>

We are preparing to offer transmission service with four new transmission lines and one system upgrade for 3,700 megawatts, almost 2,800 of which will come from renewable, non-



carbon-emitting generation. With the assurance of additional borrowing authority with the Treasury that Congress provided in the American Recovery and Reinvestment Act, BPA is confident it can move forward with these projects. Three are about to undergo environmental analyses. The agency has announced construction of the 79-mile, McNary-John Day line that will deliver more than 700 megawatts of wind energy across BPA's transmission system.

Implementing the 2007 Northwest Wind Integration Action Plan

Northwest collaboration on wind integration has been prominent since the 2007 Northwest Wind Integration Action Plan, led jointly by BPA and the Northwest Power and Conservation Council. That plan, completed in early 2007, found no technical obstacle to adding 6,000 megawatts of wind power to the Northwest grid by 2020, and identified 16 action items necessary to realize this goal. Since then, the region has made substantial progress on all these action items and has completed several of them. A complete update on implementation of the 16 action items is included in Appendix III.

Minimizing wind integration costs

The American Wind Energy Association says wind power "backs down more expensive sources of generation…mainly natural gas and coal." Because the Northwest relies primarily on hydropower for electricity, wind power in the Northwest has been matched with renewable hydropower, not fossil fuels. As the wind fleet grows, we are reaching the limits of the federal hydropower system to alone provide these balancing services.

Hydroelectric plants can quickly change generation levels without loss of fuel. Ten of the Northwest's federal dams are on Automatic Generation Control that changes hydro generation up and down to maintain a constant balance between load and generation. Historically, Automatic Generation Control was designed to follow and regulate within-hour changes in loads. As wind power has joined the system, the Automatic Generation Control also has picked up and compensated for moment-to-moment discrepancies between wind power schedules and actual generation. Until 2009, BPA did not charge wind projects for these balancing services, because, with small amounts of wind power connected to BPA's transmission grid, the cost of providing these services was insignificant.

Today, with larger amounts of wind located in its balancing area, BPA reserves water and generating capacity to provide sufficient balancing services for the growing wind fleet. A Preliminary Needs Assessment for BPA's 2009 Resource Program found that BPA will need to seek reserves from sources beyond the federal hydropower resources in the next few years. The grid management techniques of the WIT projects will make more effective use of existing reserves and make it easier to tap new ones.

Beginning in 2009, BPA established a rate for wind integration services to assure that those benefiting from these services pay for them. The 2009 Wind Integration Rate includes costs of two forms of reserves: regulation for changes in generation from moment-to-moment and following changes within a 10-minute time frame.

During the last year, a third form of reserves has required the greatest deployment and thus incurred the highest cost. This is generation imbalance, which compensates for discrepancies between scheduled power output and actual generation across each hour. BPA is now setting rates for fiscal years 2010-2011. The 2010-2011 rate proposal includes a wind integration rate based on the cost of providing all three forms of reserves: generation imbalance as well as regulation and following reserves.

The actions of the Wind Integration Team to date and incorporated in this plan are expected to help limit reserves BPA must assign to wind integration to assure reliability, and should moderate costs. The rate case is subject to *ex parte* restrictions, and BPA cannot publicly discuss potential changes from its initial proposal outside of publicly noticed rate case venues until the draft Record of Decision is released at the end of June.

Implementing the 2009 Rate Case Settlement Agreement

Customer settlement of the 2009 Wind Integration Rate called for a number of specific actions to further BPA's ability to cost-effectively integrate large amounts of wind power, including creation of the Wind Integration Team. A cross-reference status on fulfillment of these 2009 rate settlement actions to date is included in Appendix IV.

II. **Stakeholder Comments on Work Plan Draft** *and BPA Response*

BPA shared its draft Wind integration Team Work Plan with stakeholders on May 27, 2009, and held a public meeting to receive and discuss stakeholder response on May 29. Because wind integration issues are closely related to wind integration rates, BPA notified parties to its current rate case that rate issues might be raised at the meeting.

In general, both BPA customers and the wind community received the Draft Work Plan positively. As one commenter put it, "You have the right things on the list. We couldn't think of anything you left off."

Commenters did offer several suggestions. Here are the primary comments with *BPA's response*.

1) BPA should accelerate pilot projects for wind project self-supply of reserves and within-hour power scheduling. *Done*.

2) BPA's pilot project for third-party supply of balancing resources to BPA is of less interest to stakeholders, and could be delayed. *Done*.

3) Stakeholders recognize and accept BPA's need to complete implementation of Dispatcher Standing Order 216 and Joint Initiative studies to define the extent to which BPA can dynamically schedule power from its system to other balancing areas. *We appreciate the support.*

4) BPA should provide complete timelines for full implementation of the technical improvements outlined in the work plan, rather than just pilot project milestones. *We're providing timelines as far as we know them but, until the foundational studies on dynamic transfer limits are complete, we don't have a good enough understanding of the scope of work ahead to commit to schedules for full implementation. We will continue to work with the WIT stakeholders to fill in these full-implementation completion dates as quickly as possible.*

5) Stakeholders expressed interest in working with BPA to complete the work of the Work Plan in a timely manner and offered to identify experts who could assist in technical areas. *We agree, and are conferring with stakeholders on how best to work with them. At a minimum, we will report out progress on WIT projects quarterly via the stakeholder e-mail list. (To join this list, go to www.bpa.gov/go/wind.)*

6) Customers also asked for opportunities to consider adjusting rates during the 2010-2011 rate period if costs of wind integration are modified during that rate period as a result of WIT projects or other factors. *This comment was referred to the current BPA rate case.*

7) Supporters of small wind projects asked that wind projects of 10 megawatts or less that qualify for Public Utility Regulatory Policy Act sales to utilities be exempted from BPA's wind integration rate. *This comment also was referred to the rate case.*

III. Implementing the Northwest Wind Integration Action Plan

In 2007, BPA and the Northwest Power and Conservation Council completed an Action Plan that confirmed that adding 6,000 megawatts of wind generation in the Northwest by 2020 is technically feasible. The unexpected speed of wind's actual development has put a priority on resolving the technical issues the Council and BPA identified to realize this goal.

In the two years since completion of the Northwest Wind Integration Action Plan, BPA and other entities in the region together have made considerable progress on most of the 16 Action Plan items, including the Network Open Season, Conditional Firm Transmission Service, and financing new transmission construction for wind and other new resources.

Status of the 16 Recommended Actions of Northwest Wind Integration Action Plan:

- **Action 1 - Assess the peaking capacity value of wind power:** Through the Pacific Northwest Resource Adequacy Forum, the region reevaluated the capacity value of Northwest wind resources.

- **Action 2 - Refine assessments of the cost and availability of existing wind integration capability:** In the current 2010-2011 power and transmission services rate case, BPA refined its study methodology and estimates of wind integration costs.

- **Action 3 - Develop wind resource data:** BPA and the National Renewable Energy Laboratory funded development of a high resolution wind data set for Northwest wind resources.

- **Actions 4 and 5 - Develop and apply transmission planning methodologies:** ColumbiaGrid and Northern Tier Transmission group have established the Wind Integration Study Team (WIST). One of the issues the WIST is looking at is developing a planning methodology that takes into account the cost of transmission capacity and the value of delivered wind energy.

- **Action 6 - Remove regulatory barriers to more efficient use of transmission for wind and other renewable resource development:** The Northwest Wind Integration Forum convened Northwest regulators to discuss regulatory barriers to greater use of non-firm firm transmission service.

- **Action 7 - Greater utilization of the transmission system:** BPA implemented a re-dispatch pilot project and made offers totaling 1,200 megawatts of Conditional Firm Transmission Service. The re-dispatch project used non-federal and federal generation to relieve transmission congestion. BPA also found 1,780 megawatts of transmission requests it could fill without new construction as a result of its 2008 Network Open Season offer.

- **Action 8 - Planning for expansion of transmission capacity on BPA's system:** BPA completed its WECC Regional Planning Project Review process for the West of McNary and I-5 Corridor projects through ColumbiaGrid, a sub-regional transmission planning entity.

- **Action 9 - Financing expansion of transmission capacity on BPA's system:** BPA developed and implemented its first Network Open Season which resulted in moving forward on a billion dollars of new transmission investment and beginning of construction of the McNary-John Day 500-kilovolt line, which will enable at least 700 megawatts of new wind generation and strengthen linkages to other renewable resource areas in Idaho and

Montana. The added assurance of additional U.S. Treasury borrowing authority in the American Recovery and Reinvestment Act gave us the confidence to move forward with this project and initiate planning and design for three others. The success of the Network Open Season demonstrated the utility of this new financing model.

- **Action 10 - Planning for expanded capability for delivering wind power from Montana and other isolated wind resource areas:** BPA is actively engaged in planning studies with Montana and other Northwest parties on expansion of the Colstrip 500-kilovolt transmission line, which is geared toward tapping wind resources in Montana.

- **Action 11: Evaluate benefits of a regional wind forecasting network:** The Northwest Wind Integration Forum held initial discussions on a regional wind forecast; however, there was not a strong interest in testing a centralized forecasting effort. BPA's Wind Integration Team began its work on this proposal in fall 2008. Discussions are underway with the wind community on how to implement short-term persistence forecasting in order to reduce the magnitude of the increase in BPA's 2010-2011 wind integration rate. In addition, as part of this work plan, BPA is establishing its own wind forecasting system.

- **Action 12: Implement ACE diversity interchange**: BPA has joined a number of other Northwest utilities in implementing the Area Control Error (ACE) Diversity Interchange, with the purpose of facilitating integration into the transmission system of more intermittent renewable resources.

- **Action 13 - Reduce barriers to marketing system flexibility:** BPA, ColumbiaGrid, Northern Tier Transmission Group (NTTG), and WestConnect – subregional transmission planning entities - have initiated the Joint Initiative, which is addressing dynamic scheduling and intra-hour schedule changes to further facilitate renewable generation integration. BPA is also working with the ColumbiaGrid/NTTG Wind Integration Study Team (WIST) to determine the evaluation criteria, necessary requirements, and to establish a credible, repeatable, and timely methodology to allow dynamic scheduling in BPA's network system and interties.

- **Action 14.a - Assess options for augmenting system flexibility:** The Council is preparing a resource flexibility assessment for its Sixth Power Plan. BPA's Technology Innovation R&D Program is also committed to exploring promising system flexibility options on both the supply and demand side. BPA's 2009 Draft Resource Program will address amounts and types of resources BPA will need to add to its resource supply to meet its contractual requirements, including resources that meet capacity and system flexibility needs.

- **Action 14.b - Assess tradeoffs between competing uses of system flexibility:** The Council has expanded the capability of its GENESYS system reliability model to model hourly wind project output. With hourly wind modeling capability available, the Council plans to assess the impact of increasing wind penetration on system performance.

- **Action 15 - Develop a planning framework for maximizing the value of wind energy.** The Council is working to factor in the many different dimensions of the wind integration question into its Sixth Power Plan. The Council expects to release its draft plan in July.

- **Action 16 - Establish a Wind Integration Forum:** In April 2007, the Northwest Wind Integration Forum was chartered as an advisory committee of the Council for a two-year period. Two meeting of the Steering Committee has occurred since inception. The Core Analytical Team/Technical Work Group has met in May 2007, July 2007 and January 2008.

IV. Implementing the 2009 Wind Integration Rate Case Settlement Agreement

BPA first established a rate for wind integration within-hour balancing services for fiscal year 2009. A settlement agreement between BPA and parties to this rate case calls for creation of the BPA Wind Integration Team. Following is a list of specific actions discussed in the settlement agreement, as specified in the FY2009 Wind Integration Rate Case Record of Decision, together with a *brief update* on work accomplished to date in each of these areas.

1. **Develop processes and procedures for managing the BPA Balancing Authority's requirements for generation inputs for reserves.**
   Dispatcher Standing Order 216 is specifically designed to achieve this. During the winter of 2008-09, BPA worked closely with regional stakeholders to adopt reliability protocols for wind and other variable generators to allow additional Large Generator Interconnection Agreements (LGIAs) to be signed. The protocols are to be fully defined in DSO 216. This will allow BPA to ensure reliability and could mitigate capacity requirements for managing generation imbalance.

2. **Identify new sources of such generation inputs**.
   BPA issued a Request for Information in 2008 seeking information on potential generation inputs. Based on information from this RFI, BPA has defined the criteria and process for procuring generation inputs for wind balancing from non-Federal entities. Under this work plan, a pilot project based on results of the RFI is delayed. BPA is also proposing to offer a self-supply pilot in fall of 2010. Improved dynamic scheduling capabilities will be necessary in order to make use of some sources of potential generation inputs.

3. **Reduce the demand on the existing capacity of the FCRPS to provide such generation inputs.**
   DSO 216 will limit demand for reserves on the FCRPS. The reliability protocols limit the amount of reserves that BPA will carry and put the responsibility of forecasting and scheduling wind generation with sufficient accuracy to meet the standard on the wind project owners. The level of accuracy required is being established in the 2010-11 rate case.

4. **Acquire cost-effective capacity resources to meet BPA's firm power obligations and its need for generation inputs to provide reserves."**
   The Preliminary Needs Assessment in BPA's Resource Program identified capacity resources as a primary need. BPA will address types and amounts of needed capacity in its Draft Resource Program this fall.

Under the Settlement Agreement, the Wind Integration Team also is to address several general areas, including:

5. **Wind forecasting**
   - *BPA is currently sponsoring a number of research and development projects on aspects of wind forecasting.*

- *We are developing a synthetic 20-year wind record by developing a model of wind generation based on 2006-2008 actual wind generation in the balancing authority and back-cast against actual weather records.*
- *We are installing 16 meteorological stations on our system. This work will be complete by October 2009. Data will be available to the wind community as well as to BPA dispatchers.*
- *We are creating an internal wind forecasting system with displays so that BPA system operators can better anticipate changes in wind output in power scheduling and dispatch.*

6. **Reserves allocation:**
   BPA has developed and refined an allocation methodology for reserves which is now being used in the FY 2010-2011 Rate Case. In this rate case, BPA refined its study methodology to identify the type of each reserve needed to integrate wind generation.

7. **Third-party supply of generation inputs to the BPA balancing authority**
   As noted above, a pilot project on this technique has been delayed in response to customer priorities.

8. **Dynamic Scheduling**
   BPA is working with ColumbiaGrid to determine the evaluation criteria and necessary requirements to establish a credible, repeatable, and timely methodology to allow dynamic scheduling in BPA's network system and interties.

   BPA is also participating in the Joint Initiative effort to develop the Dynamic Scheduling System (DSS), which is intended to be used to implement dynamic schedules between any number of BAs at any scheduling periodicity.

   The dynamic transfer study and self-supply project in this work plan will expand use of dynamic scheduling in BPA's system and lay the groundwork for further expansion.

9. **ACE (Area Control Error) Diversity Exchange.**
   BPA has joined a number of other Northwest utilities in implementing the Area Control Error Diversity Interchange

10. **BPA also agreed that, in its Resource Program, it would assess the capacity of the federal system available to meet all of BPA's present and future capacity obligations.**
    This has been achieved in the Preliminary Needs Assessment for BPA's 2009 Resource Program, issued in March 2009. The Draft 2009 Resource Program that will be issued this fall for public review will include a Needs Assessment revised to reflect more current data and BPA's response to public comments on the preliminary draft.

11. **Finally, the parties to the Settlement Agreement that own or operate wind generators in the BPA Balancing Authority Area agreed to make a good faith effort to supply certain data related to the output of their wind generators, while BPA agreed to certain confidentiality restrictions regarding the data."**

V. Definitions

Ancillary Services: Services necessary to support the transmission of energy from resources to loads: reliability, scheduling and dispatch, spinning reserves, emergency reserves, load following and regulation, automatic generation control, energy or generation imbalance, transmission losses, control area reserves for resources and for interruptible purchases.

Automatic Generation Control (AGC): The regulation of the power output of electric generators within a control area in response to changes in load, system frequency, and other factors to maintain the scheduled system frequency and interchanges with other control areas

Area Control Error (ACE): A number determined in the regulation of the power output of electric generators within a control area (automatic generation control) indicating how much the generation in a power system area deviates from load. The total ACE is subdivided into a schedule of station control errors and transmitted to power plants for the readjustment of specific generators; instantaneous difference between actual and scheduled interchange, taking into account the effects of frequency bias.

Available Transfer Capability (ATC): Measure of the transfer capability remaining in the physical transmission network for further commercial activity over and above already committed uses. Total transfer capability less existing transmission commitments, less a capacity benefit margin, less a transmission reliability margin.

Balancing Area Reserve Augmentation (Third-Party Supply) is the provision of Balancing Reserves from a source other than the FCRPS in exchange for BPA payment for the service. Because Third Party Supply is providing Balancing Reserves the resources are available to BPA to meet BA balancing needs.

Balancing Authority Area: A balancing authority area is the collection of generation, transmission and loads within metered boundaries. The balancing authority is an entity responsible for scheduling generation on transmission paths in that specific area. The balancing authority maintains a balance between generation and load in its area at al times and supports interconnection frequency in real time.

Balancing Reserves: Incremental and decremental generation flexibility or demand response that is connected to BPA's AGC system and is capable of responding to signals requesting Regulation Service and Within-hour Following Service in proportion to the automatic generation control signal requirements. Balancing Reserves can be provided from BPA generation, Third Party Supply sources or Self Supply sources.

ColumbiaGrid: Regional transmission entity for participating Northwest utilities. Current participants include Avista, BPA, Puget Sound Energy, Chelan and Grant Public Utility Districts, Seattle City Light and Tacoma Public Utilities.

Decremental (DEC): Downward-regulation reserves, a backing-off of a system's generation as wind or other generation picks up, or as area load drops off.

Dispatcher Standing Order #216 (DSO 216): Dispatcher Standing Orders are rules BPA dispatchers and transmission customers abide by in operating and using the transmission system. DSO 216 specifies that, if wind is generating above scheduled output and reserves are 90 percent depleted, dispatchers will give wind projects a signal to curtail generation to their schedule plus their share of balancing reserves. When wind project generation is below that scheduled and reserves are 90 percent depleted, BPA will curtail transmission tags for wind generation to actual output plus the projects' share of assigned reserves.

Dynamic Schedule: A telemetered reading or value that is updated in real time and used as a schedule in the Automatic Generation Control (AGC) and the Area Control Error (ACE) load/generation balance equation. Dynamic scheduling is implemented as an interchange transaction that is modified in real-time to transfer time-varying amounts of power between balancing authorities. A dynamic schedule

typically does not change a balancing authority's jurisdiction; that is, the native balancing authority continues to exercise operational jurisdiction over, and provides basic balancing authority services to the dynamically scheduled resources. Dynamic schedules are to be accounted for as interchange schedules by the source, sink, and contract intermediary balancing authority(s), both in their respective ACE equations, and throughout all of their energy accounting processes.

Dynamic Transfer: The provision of the real-time monitoring, telemetering, computer software, hardware, communications, engineering, energy accounting (including inadvertent interchange), and administration required to electronically move all or a portion of the real energy services associated with a generator or load out of one Balancing Authority Area into another.

E-Tag: The electronic tag associated with a reservation for use of transmission capability that identifies the amount, time, type and ownership of the transaction from initial reservation to completion of the transaction.

Federal Columbia River Power System (FCRPS): The transmission system constructed and operated by BPA and the hydro-electric dams constructed and operated by the U.S. Army Corps of Engineers and the Bureau of Reclamation in the Northwest. Each entity is separately managed and financed, but the facilities are operated as an integrated power system.

Following: Correcting in real time for differences between load and generation within a 10-minute timeframe. Corrections are made by Automatic Generation Control or by dispatcher action.

Generation Imbalance: Difference between amount of power scheduled at the beginning of an hour and amount actually produced during the hour. As a service, the capability to fill in the difference between the actual generation output and scheduled generation across each hour.

Incremental (INC): Upward regulation reserves, increasing system generation as wind or other generation drops off or loads increase.

Intertie: A system of transmission lines permitting a flow of energy between major power systems. The BPA transmission grid has interties to British Columbia, California, and eastern Montana.

Joint Initiative: Several projects on which regional transmission organizations Northern Tier Transmission Group, ColumbiaGrid and WestConnect have joined forces to benefit from a broader reach of expertise and geography.

Large Generator Interconnection Agreement (LGIA): A contract between BPA and the owner of a large power plant under which BPA agrees to interconnect the power plant with BPA's transmission grid.

Netting: When orders are issued under DSO 216 to reduce output or curtail schedules, netting is the capability to comply by using another resource or load in the place of the over generating generator or the schedule(s) tied to an under generating generator. Netting does not provide balancing reserves or otherwise impact the provision of Wind Integration Service by the BPA balancing authority area. Netting may be financially viable if set-up costs and operating costs are low, because use is likely to be infrequent.

Netting of Generation Imbalance: Netting of Generation Imbalance allows generation owner/operators to match over- or under-generation with the dispatched output of another resource to offset the imbalance. This would require a self-provision design that is not dispatched against the needs of the balancing authority area, but one that is dedicated to the needs of the self-supplier. Wind generators would also like to net resource output of non-dispatchable resources to simplify the implementation of self supply and to lower their overall exposure to generation imbalance charges.

Network: A system of transmission (or distribution) lines interconnected and operated so that any principal point has multiple sources of power supply.

Northern Tier Transmission Group (NTTG): The Northern Tier Transmission Group (NTTG) is a group of transmission providers and customers that are actively involved in the sale and purchase of transmission capacity of the power grid that delivers electricity to customers in the Northwest and Mountain States.

Open Access Same-Time Information System (OASIS): is an Internet-based reservation system for high-voltage transmission services. OASIS is the primary means by which high-voltage transmission lines are reserved in North America. U.S. utility use of OASIS is established under Federal Energy Regulatory Commission (FERC) Orders 888 and 889.

OATI: A company that provides OASIS systems.

Regulation: The capability to balance against the moment to moment movement of generators or loads. Provided by Automatic Generation Control, which responds to a four-second signal cycle. Currently, regulation and within-hour following are provided from the FCRPS as a joint service.

Self Supply: A party other than BPA acquiring provision of balancing reserves for a power plant located in BPA's balancing area from a source other than the FCRPS. Self Supply can be either:

1. Provision of regulation service and/or within-hour following service from a source other than the FCRPS in order to avoid the capacity charge associated with wind integration service. When Third Party Supply is providing regulation service and/or within-hour following service the resource needs to be available to the balancing authority to meet the balancing authority's balancing needs, and needs to be capable of responding to signals requesting regulation service and within-hour following service in proportion to BPA's Automatic Generation Control signal requirements.
2. Provision of generation imbalance from a source other than the FCRPS in order to avoid the capacity charge associated with wind integration service. When Third Party Supply is providing generation imbalance, the resource is used to fill in the difference between the actual generation output as measured on 10 minute intervals and the scheduled output, and may be deployed by the party that acquired the generation imbalance service.

Standards of Conduct (SOC): Federal Energy Regulatory commission rules to assure utility transmission functions do not give preferential treatment to their affiliated marketing functions. Requires transmission function and marketing function employees to operate independently of each other, prohibits passing transmission function information to marketing function employees and imposes posting requirements to help detect any instances of undue preference.

Third Party Supply – Provision of regulation service and/or within-hour following service from a source other than the FCRPS in exchange for a payment for the service. Because Third Party Supply is providing balancing reserves, the resources must be available to the balancing authority to meet its balancing needs, and capable of responding to signals requesting regulation service and within-hour following service in proportion to BPA's AGC signal requirements.

Variable Generators: An electric generator that is not dispatchable and cannot store its fuel source and therefore cannot respond to changes in system demand or respond to transmission security constraints.

WestConnect: A regional transmission organization whose utility members are primarily in the Rocky Mountains and the Southwest. WestConnect is composed of utility companies providing transmission of electricity in the western United States, working collaboratively to assess stakeholder and market needs and develop cost-effective enhancements to the western wholesale electricity market.

Within-hour Following: The capability to balance against the movement of generators or loads over a ten-minute trend within the hour. Following can be in response to physical changes in generation and load within the hour or due to scheduling errors that result in imbalance. Responds fully within 10 minutes. Currently, regulation and within hour following are provided from the FCRPS as a joint service.