

Wind Integration Team

Work Plan 2.0

December 2010



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DRAFT. Dec. 16, 2010

In June 2009, BPA issued a work plan outlining six projects to improve its ability to support variable wind energy in the BPA transmission grid. BPA committed to completing specific steps on five of these projects by October 2010.

By October 2010, BPA had completed all the steps it had committed to and considerably more on all six Wind Integration Team pilot projects. BPA announced that the Wind Integration Team had completed the elements of its [2009 work plan](#).

We appreciate the sustained participation and creative contributions of the utility, wind power and public interest communities in the WIT 1.0 projects.

This document outlines the next phase of BPA's Wind Integration Team efforts or WIT 2.0. Much of this work furthers initiatives and efforts begun in WIT 1.0 and builds on what we have learned in the last 18 months. The success of the WIT projects to date has made it possible for BPA to host dramatically increasing amounts of wind power in its transmission grid while maintaining transmission reliability. The WIT 2.0 projects will help sustain this positive trend as the wind resource integration continues its fast growth.

A regional collaboration

A large portion of WIT 2.0 work goes beyond BPA. Several of the projects, rather than representing a BPA-only initiative, depend on BPA's participation in larger regional and west-wide initiatives, particularly the Joint Initiative of ColumbiaGrid, Northern Tier Transmission Grid and WestConnect regional transmission organizations.

Most WIT 2.0 projects will succeed only with active participation and collaboration by other parties. Intra-hour power scheduling, for example, works only if parties wish to buy and sell power in half-hour increments and if the terms and conditions for those sales are mutually beneficial.

We are looking forward to continuing to work closely with other utilities, the wind power community and interested stakeholders. Where BPA is changing its business practices or policies, we will provide an opportunity for stakeholder involvement through our regular communication and customer involvement channels.

For example, we are already working with customers on refining Dynamic Transfer Capability methodologies and award cycles and held a full-day informational workshop on the nature of DTC on Dec. 2, 2010.

Overview of Projects

As noted, most of the WIT 2.0 projects build on the momentum of the WIT 1 initiatives.

1. **Intra-hour Scheduling Pilot, Phase II:** BPA first scheduled power deliveries on the half hour in December 2009, when it launched its [Intra-Hour Scheduling Pilot](#). This pilot allows wind generators in BPA's balancing authority to schedule excess wind generation on the half hour. The Intra-Hour Scheduling Pilot, Phase II will expand participation in BPA's half-hour scheduling practice to include any generation for any reason. This will include new schedules into, out of, through and internal to the BPA balancing authority. However, half-hour schedules will continue to be limited to transmission e-Tags using NERC nonfirm (priority 1-NS) transmission reservations. The Intra-Hour Scheduling Pilot Phase II will meet the requirements of step one in the Joint Initiative's four step intra-hour scheduling proposal.
2. **CAISO Intra-Hour Scheduling Pilot:** The mission of the CAISO Intra-Hour Scheduling Pilot is to expand the reach of intra-hour scheduling into California and to leverage their balancing resources to aid in Northwest wind integration. The mission will be achieved by seeking out a qualified and willing wind plant operator within the BPA Balancing Authority (BA) to agree to intra-hour schedule the output of the wind plant to the CAISO every half hour.
3. **Intra-hour Transaction Accelerator Platform (ITAP):** To help facilitate intra-hour schedules, BPA and other parties in the Joint Initiative are developing an Intra-Hour Transaction Accelerator Platform. ITAP is an electronic trading platform for bilateral power sales. BPA is one of 16 utilities that are actively involved. BPA will develop systems and processes to enable it to use ITAP once launched, with the goal of allowing BPA to buy and sell power within the hour and hourly through the OATI WebExchange system.
4. **Dynamic Transfer Capability Pilot, Phase II (DTC):** In WIT 1, BPA, in collaboration with the ColumbiaGrid [Wind Integration Study Team](#), developed a methodology for identifying available dynamic transfer capability on transmission paths in its system under existing system constraints. BPA then developed and implemented a process to allocate and award this DTC to requesting entities, resulting in Dynamic Transfer Operating Agreements that are in effect from July 2010 through Sept. 30, 2011. Customers requested that future award periods be aligned with BPA rate periods, and we are planning to do so. In WIT 2.0, BPA is continuing to work with the Wind Integration Study Team to validate and, if needed, refine the methodology and methods to manage DTC in real-time, and to determine how to increase the amount of DTC available. BPA is working with its customers and the wind power community to identify and award DTC quantities available through fiscal year 2013. This includes development of needed business practices. As a subset of this project, BPA, in cooperation with

other utilities, will evaluate options for implementing a Dynamic Scheduling System that has been developed by the Joint Initiative.

5. **Customer Supplied Generation Imbalance Pilot Evaluation:** In September 2010, BPA launched a one-year pilot project testing systems to allow a wind project owner to supply its own generation imbalance reserves. BPA will monitor the implementation of CSGI, and evaluate the success of this CSGI pilot. The evaluation will seek to determine whether self-supply of reserves can reliably reduce BPA's reserve requirements, help to reduce costs for all parties and work well for wind project owners/operators. BPA expects to offer Self Supply options in April 2011 for customers to make a final decision on Self Supply not later than May 1, 2011.

6. **Third Party Supply – Decremental reserves from non-federal generation:** BPA began exploring this third-party supply concept in September 2010 with a three month purchase of 75 megawatts of decremental imbalance reserves from the Calpine Corporation. In fiscal year 2011, BPA will evaluate the implementation of the third-party decremental reserves contract, and refine BPA's criteria and processes for acquiring decremental within-hour reserves from non-federal generators.

7. **BPA Wind Power Forecasting:** To enhance its wind forecasting system, BPA has purchased one year of service from two commercial wind forecast vendors. In fiscal year 2012, BPA will establish data connections with these forecast vendors and with wind generators and will collect additional data from wind generators to enable more accurate forecasting. BPA will make an aggregate forecast of wind in its balancing authority area publicly available through its Web site. BPA will update data connections to its older weather stations. By the end of the fiscal year, BPA will assess the benefits of the vendor forecasts and decide how to further improve the forecasting process in fiscal year 2012.

More innovation needed

It is critical to sustain the forward momentum on these various initiatives. The wind resource connected to BPA's transmission grid is growing at an astonishing pace, with more than 3,000 megawatts already interconnected. WIT 1 efforts are proving successful. The region's wind fleet is working smoothly, the lights are staying on, and wind power is becoming a significant part of the Northwest energy supply.

The work that's been done in the last 18 months has enabled BPA to continue to integrate additional wind projects into its transmission grid. But, to accommodate thousands more megawatts of wind power, more innovation is needed. More than 7,000 megawatts of wind projects have requested transmission from BPA in the last three years of the agency's transmission Network Open Season.

The WIT 2.0 projects will further improve BPA's tools to adapt its system operations, create more visibility, improve forecasting and align policies and procedures, to reliably accommodate this flood of variable wind power with traditional dispatchable power sources on its transmission grid and to improve coordination with the Federal Columbia River Power System.

Unique challenges ahead

Some of the challenges BPA is addressing in WIT 2.0 projects are similar to those of other areas with a high proportion of wind or solar energy such as Germany, Spain, Denmark or Texas. Like these areas, BPA must manage large swings in energy output from variable power sources in very short operational timeframes, while maintaining the constant balance between power output and consumption needed to keep the lights on.

BPA also faces unique challenges.

Most of the wind power locating in BPA's balancing authority serves loads in other balancing areas. BPA functions only as the transmission provider, but is required to provide the within-hour balancing reserves for this generation, regardless of where it is consumed.

For the 80 percent of the wind power exported from BPA's balancing authority, there is no relationship between the generation being produced in the balancing authority area and the load being served in that area. This fact greatly increases the challenge of maintaining generation/load balance and system reliability. BPA provides balancing reserves services by taking excess wind power into its system and storing water in federal reservoirs, or, conversely, by drawing water from reservoirs to provide power to the consuming utility that was scheduled to be provided by wind power but did not materialize.

Hydropower is exceptionally valuable in integrating wind power because its output can be increased or decreased in large quantities (100s or 1,000s of MW) very quickly (seconds). But the amount and variability of the wind resource in BPA's balancing area now exceeds the federal hydro system's ability to absorb wind power's variations under some conditions.

Compared to some of the larger systems in the United States, BPA's balancing authority area has a relatively small load of 5,000 to 7,000 megawatts served by a hydro and nuclear resource base with a firm annual energy capability of about 8,000 MW. BPA has already seen wind output comparable to more than 50 percent of its entire load within an hour, and has seen wind power output swings exceeding 2,400 MW within an hour.

The sheer scale of machine movement needed to counterbalance that much variation in within-hour output is exceeding the flexibility available from the FCRPS, given its other statutory obligations and physical limitations. In addition to BPA's load service obligations to its utility preference customers, federal hydro resources operate within

numerous constraints for hydraulic reliability, flood control, fish protection and other non-power requirements. Given this volatility, the FCRPS does not have sufficient flexibility to alone provide sufficient within-hour reserves for additional wind power in its balancing authority.

The WIT 1 projects developed new forecasting tools and commercial practices to help stretch the existing flexibility of the federal system as far as possible. The WIT 1 projects established BPA's ability to enforce limits on the amount of reserves available from the federal hydropower system (Dispatchers Standing Order 216). The WIT 1 projects also added non-federal reserves (customer supplied generation imbalance and BPA third-party reserve supply) to the mix of resources providing generation imbalance services for the rapidly growing wind fleet.

WIT 2.0 projects seek to expand these tools and add more ways to provide generation imbalance services without further stressing the federal hydro system. The WIT projects are developing BPA's core technical capabilities to support and manage large amount of variable energy resources in the grid.

Continued stakeholder involvement

We will keep interested parties apprised of opportunities for participation in WIT-related issues through our [WIT](#) and [Tech Forum](#) e-mail lists and the monthly WIT Update.

Where BPA is participating in a broader regional effort such as the [Joint Initiative](#), stakeholder involvement will take place as provided by the lead organizations for those processes.

BPA wind work beyond WIT

BPA's Wind Integration Team focuses on adapting power and transmission system operating tools and business practices to accommodate variable energy resources. BPA also is engaged in many other efforts that also further renewable resource development. These include but are not limited to the following:

- BPA funds research and development projects in wind forecasting and renewable energy storage.
- We recover costs of wind integration services through our wind integration rate to ensure that the costs of such services are borne by those creating the demand for the services. Equitable cost allocation is key to the future growth of wind energy.
- We have built and are building numerous substations and tap lines to tie individual wind projects into our grid.

- We are building or have proposed four major high-voltage transmission lines that will increase transmission available to carry wind and other energy from remote locations to cities across the Northwest.
- We are working with the Northwest Power Pool and others to ensure appropriate product designation and tagging designations for variable energy resources.
- We are working with the wind and utility communities to develop additional tools to manage periods when high wind and high water combine to create an oversupply of generation in the Northwest.

Links to these efforts are available on BPA's [wind power Web page](#).

WIT 2.0 Project Descriptions

Intra-hour Scheduling Pilot, Phase II

Executive Sponsor: Cathy Ehli

Project Manager: Troy Simpson

Project Description

BPA first scheduled power deliveries on the half hour in December 2009 when it launched its [Intra-Hour Scheduling Pilot](#). Intra-hour schedules so far have ranged from five in February 2010 to 98 in August 2010, with megawatt-hour values ranging from just over 200 to more than 7,000 in a given month. Intra-hour schedules under this pilot are limited to wind overgeneration that would otherwise trigger reliability protocol DSO-216. Half-hour scheduling has made it possible for wind projects to sell power that might otherwise have been reduced via DSO 216 to maintain system reliability.

The Intra-Hour Scheduling Pilot, Phase II will expand BPA's half-hour scheduling practice to include generation schedules from any power resource for any reason. This will include resources imported to and exported from BPA's balancing authority area, resources located and consumed within BPA's balancing authority area, and generation wheeled through BPA's balancing authority area from one neighboring BA to another. However, half-hour schedules will continue to be limited to transmission e-Tags using NERC nonfirm (priority 1-NS) transmission reservations. The Intra-Hour Scheduling Pilot Phase II will meet the requirements of step one in the Joint Initiative's four step intra-hour scheduling proposal.

To expand intra-hour scheduling as described, BPA will need to develop related electronic tag (e-Tag) validation procedures, scheduling and dispatch processes and business practices. We will work through the Tech Forum to engage with our customers and interested parties in developing these tools. The target date for completing this work and implementing Phase II is July 2011.

BPA is part of the [Joint Initiative](#)'s intra-hour scheduling effort. The Joint Initiative has laid out a four-step proposal to move Western utilities into intra-hour scheduling. When BPA implements its Intra-Hour Scheduling Pilot Phase II, it will have met the requirements of the first of the Joint Initiative's four steps.

Beyond Phase II, one of the remaining steps on the road to full intra-hour scheduling is adding the ability to allow schedule reductions as well as schedule increases within an hour. The ability to adjust existing tags (INC/DEC) is a stretch objective for both the Joint Initiative Step 1 and BPA's Phase II. It may be added as a later phase.

Completion Date for Phase II: July 31, 2011

Deliverables:

- By August 2011, BPA will begin allowing all types of schedules (import, export, wheel and internal) to change on the half hour.

CISO Intra-Hour Scheduling Pilot

Executive Sponsor: Cathy Ehli

Project Manager: Troy Simpson

Project Description

The mission of the CISO Intra-Hour Scheduling Pilot is to expand the reach of intra-hour scheduling into California and to leverage their balancing resources to aid in Northwest wind integration. The mission will be achieved by seeking out a willing and qualified wind plant operator within the BPA Balancing Authority (BA) to agree to intra-hour schedule the output of the wind plant to the CISO every half hour. The wind plant should:

- Be willing to schedule the entire output of the plant to CISO? Agreeing to 50% may be an option.
- Have experience as a CISO market operator
- Have firm transmission on the COI?

Go no go decision: January 2011 – based on availability of a willing and qualified wind plant operator.

Completion Date: October 2011

Deliverables:

Develop functionality in AGC to supply data streams to CISO:

- The projected delivery for each half hour. The CISO will respond with a signal confirming or limiting the half hour schedule.
- The ramped schedule value every AGC cycle. The schedule will ramp from :50-:10, be held constant from :10-:25, ramp from :25-:35 and be held constant from :35-:50. The CISO will respond with a signal confirming or limiting the schedule. If the schedule is limited, AGC will limit for the remainder of the half hour.
- Integrated MWh delivery amount after the hour based on the CISO return signal above.

Intra-Hour Transaction Accelerator Platform (ITAP)

Executive Sponsor: Allen Burns

Project Manager: Brenda Anderson

Project Description

To help facilitate intra-hour schedules, BPA and other parties in the Joint Initiative are developing an Intra-Hour Transaction Accelerator Platform. ITAP is an electronic trading platform for bilateral power sales. BPA is one of 16 utilities that are actively involved. OATI, the vendor that supplies OASIS transmission reservation services to most U.S. transmission providers, is the vendor developing the ITAP platform. ITAP would work for both intra-hour and hourly power sales but is expected to be of greatest use for intra-hour sales. It will post bids and offers for power and give users a list of transmission paths and costs. When power is purchased, ITAP will automatically populate the transmission tag to deliver the power to its destination. Technical development is underway, and implementation is scheduled for mid-2011.

This is a new addition to BPA's WIT projects, although BPA has been working on this project for some time through the Joint Initiative. BPA will develop systems and processes to enable it to use ITAP once launched, with the goal of allowing BPA to buy and sell power within the hour and hourly through the OATI WebExchange system.

Completion Date: July 31, 2011

Deliverables:

- BPA will have capability to buy and sell power within the operating hour and hourly through the OATI WebExchange system.

Dynamic Transfer Capability Pilot, Phase II (DTC)

Executive Sponsor: Randi Thomas

Project Manager: Scott Simons

Project Description

Dynamic transfer capability is used to allow wind projects to rely on their own generation imbalance reserves rather than on BPA or to move their wind projects electronically out of BPA's balancing authority into another balancing authority. Dynamic transfer capability has been used historically by owners of power plants located in other utilities' balancing authorities. Until now, its use has been fairly limited. DTC is of much greater import with the advent of large amounts of exported wind power in BPA's grid.

In WIT 1.0, BPA developed a methodology for identifying available dynamic transfer capability on transmission paths in its system. It found 90 to 225 megawatts of available dynamic transfer capability. BPA then developed and implemented a process to allocate and award this DTC to requesting utilities, resulting in Dynamic Transfer Operating Agreements that are in effect from July 2010 through September 2011. Customers requested that future award periods be aligned with BPA rate periods, and we are planning to do so.

In WIT 2.0, BPA is continuing to work with the ColumbiaGrid Wind Integration Study Team (WIST) to validate and, if needed, refine the methodology and methods to manage DTC in real-time, and to determine how to increase the amount of DTC available.

In WIT 2.0, BPA will identify and award DTC quantities available through fiscal year 2013. BPA expects to complete studies of available DTC and conduct an open period for DTC requests in late winter. This will allow customers to determine whether and to what extent they can plan to self-supply their generation imbalance reserves for 2012-2013 by the May 1 deadline in the BPA 2012-2013 rate case. (See CSGI pilot, below.)

BPA is working with its customers and the wind power community on the business practices for requesting and awarding DTC. We have posted two proposed business practices for comment: one on scheduling and operations for DTC and the second on requesting and allocating DTC. Transmission business practice comment requests are posted on BPA's Transmission Services [business practices Web page](#) and are noticed to interested parties through BPA's [Tech Forum](#) e-mail list.

The proposed business practice for [requesting and awarding DTC](#) is open for comment through Dec. 17, 2010. In the proposed business practice, BPA has listed specific priorities for allocating available DTC. The order is designed to optimize use of DTC on BPA's system to:

- 1) preserve historic use,
- 2) preserve committed uses,

- 3) facilitate participation in self-supply of wind balancing services as part of the Customer Supplied Generation Imbalance Pilot Project and/or customer-supplied generation imbalance in the 2012-2013 rate period, if BPA determines it has the ability to offer CSGI for that rate period (See CSGI pilot evaluation),
- 4) facilitate BPA's own use of DTC to purchase incremental and decremental balancing services for its own use, including to reduce the frequency and duration of DSO 216 events,
- 5) facilitate other uses of DTC.

BPA expects that DTC made available for 2012-2013 will be limited to that which does not increase switching requirements on the transmission system or impact hydropower operations. During FY 2011, we will do a preliminary assessment with WIST of what it would take to expand DTC, including grid and hydro operation impacts.

As a subset of this project, BPA, in cooperation with other utilities, will evaluate options for implementing a Dynamic Scheduling System (DSS) that has been developed by the Joint Initiative.

Completion Date: DTC 2012-2013 awards go into effect – Oct. 1, 2011

Deliverables:

- Finalize and post Requesting and Awarding Dynamic Transfer Business Practices – January 2011
- Finalize and post Dynamic Transfer Operating and Scheduling Requirements Business Practices – February 2011
- Determine Award(s) and Post DTC #2 awards – April 2011
- Build and test systems – April to September 2011
- DTC 2012-2013 awards in effect – Oct. 1, 2011 through September 30, 2012

Customer Supplied Generation Imbalance Pilot Project Evaluation

Executive Sponsor: Cathy Ehli

Project Manager: Salah Kitali

Project Description

In September 2010, BPA launched a one-year pilot project testing systems to allow a wind project owner to supply its own generation imbalance reserves. Under this [Customer Supplied Generation Imbalance](#) pilot project, Iberdrola Renewables, Inc., the largest wind power purveyor in BPA's balancing authority area, is responsible for supplying its own generation imbalance reserves through September 2011. All necessary communication and control systems for this project were installed and tested in fiscal year 2010. Iberdrola is also allowed to net the output of its various wind power projects for purposes of determining the amount of generation imbalance reserves it requires at any moment and respond to BPA DSO 216 requests.

In fiscal year 2011, BPA will evaluate the success of this CSGI pilot. The evaluation will seek to determine whether self-supply of reserves can reliably reduce BPA's reserve requirements, help to reduce costs for all parties and work well for wind project owners/operators.

The initial proposal for BPA's fiscal year 2012-2013 rates assumes a significant portion of the wind power located in BPA's balancing authority area will rely on customer supplied generation imbalance reserves in those years. In order to set rates, customers must make this election by May 1, 2011. BPA is therefore evaluating the CSGI pilot in early spring and will determine by April 2011 whether to continue and/or expand CSGI in 2012-2013.

BPA will continue to gather data on the CSGI pilot throughout its life and will use this information to inform further efforts to enable customers to supply their own generation imbalance service.

Completion Dates: Phase 1 CSGI Pilot evaluation due early spring. Phase 1 CSGI Pilot completed Sept. 30, 2011. Anticipate Phase 2 CSGI Pilot: Start – October 1, 2011 ending on September 30, 2013.

Variable generators that are interconnected to the BPA Balancing Authority Area or have an expected interconnected date during the FY 2012-2013 rate period must make an election by May 1, 2011, including whether they will be self-supplying components of the VERBS.

Deliverables:

- Complete evaluation of the CSGI pilot project using agreed-to evaluation elements. – March 2011
- Based on evaluation findings, determine BPA's ability to offer CSGI for 2012-2013 rate period. – April 2011
- Customer decision on Self Supply May 1, 2011

Third Party Supply – Decremental reserves from non-federal generation

Executive Sponsor: Allen Burns

Project Manager: John Wellschlager

Project Description

Another approach to expanding BPA's ability to support variable resources in its balancing authority area is to increase BPA's generation imbalance reserves beyond those available from the federal power system. BPA began exploring this third-party supply concept in September 2010 with a three month purchase of 75 megawatts of generation imbalance reserves from the Calpine Corporation's Hermiston Generating Plant. In fiscal year 2011, BPA will define criteria and processes for acquiring decremental (dec) within-hour reserves from third parties. BPA will then establish a pilot project to test access to multiple non-federal generating resources for dec reserves.

Completion Date: Sept. 30, 2011

Deliverables:

- Criteria and processes for acquiring decremental within-hour reserves from non-federal generators.
- Issue Request for Proposals for third-party decremental within-hour reserves.
- Based on evaluation of RFP responses, determine whether BPA should enter into agreements with third-party suppliers for part of the 2012-2013 rate period.

Wind Power Forecasting

Executive Sponsor: Steve Oliver

Project Manager: Scott Winner

Project Description:

BPA is developing a wind speed and wind generation forecasting system to better inform reserve management, system operation and power marketing decisions. Improved wind generation forecasting also will enhance hydroelectric generation reliability as more wind generation is integrated into BPA's transmission grid. BPA now receives only hour-ahead wind generation schedules from wind power operators. A wind energy forecast service can provide forecasts up to three days in advance. This information will put BPA in a position to make better, more cost-effective system management decisions.

In fiscal year 2009, BPA installed 14 anemometers on facilities across its system. This was in addition to six anemometer stations previously installed by BPA. The anemometer data and a custom data visualization display for the 14 new anemometer sites are available to the public through BPA's external Web site. BPA also developed a custom, multi-dimensional wind generation display for its system operators and wind generators in the BPA balancing authority. BPA developed its own in-house wind forecasting system and purchased one year of service from two commercial wind forecast vendors.

In WIT 2.0, to enhance wind forecasting capability, BPA will establish data connections with wind generators and with forecast vendors. BPA will collect additional data from wind generators to enable more accurate forecasting. The forecast will help BPA manage risk and make better-informed operational decisions and marketing decisions for power sales. BPA will make an aggregate wind forecast for its balancing authority area available to the public through its Web site. In addition, BPA will update data connections to its six older weather stations so that data from those sites can be available in the same manner as data from the 14 newer weather stations. By the end of the fiscal year, BPA will assess the benefits of the vendor forecasts and decide how to further optimize the forecasting process in fiscal year 2012.

Completion Date: September 30, 2011

Deliverables:

- Establish data connections with wind generators and forecast vendors
- Develop internal systems for data storage and transfers
- Collect additional data from wind generators
- Provide wind generation data to forecast vendors.
- Update communication links for the six older met sites
- Establish internal displays for the vendor forecasts
- Establish external Web displays for aggregate BPA balancing authority wind forecasts
- Assess value added from vendor forecasts
- Decide next steps for FY 2012