COLUMBIA RIVER REGIONAL FORUM

TECHNICAL MANAGEMENT TEAM
January 29, 2009 Meeting

FACILITATOR'S SUMMARY NOTES ON FUTURE ACTIONS
Facilitator: Robin Gumpert
Notes: Erin Halton

The following notes are a summary of issues that are intended to point out future actions or issues that may need further discussion at upcoming meetings. These notes are not intended to be the "record" of the meeting, only a reminder for TMT members.

Review of Minutes/Agenda
The 1/14 facilitator notes and official meeting minutes were posted to the TMT webpage. An edit to the 1/14 facilitator notes was submitted by Kyle Dittmer, CRITFC:

- At the bottom of page 1, change text to read "Climate Prediction Center."

With that change made, the 1/14 facilitator notes were considered final. Edits to the 1/14 official minutes were submitted by Steve King, RFC; TMT members will review those edits and look to finalize the official minutes at the 2/11 TMT meeting.

Wind Integration Presentation
Steve Barton, BPA/member of the wind integration technical team, provided TMT with a power point presentation linked to the agenda. The presentation included information on wind integration status, challenges/issues the team is facing, how they plan to address those issues and how the issues impact the hydro system. Barton said that one unique aspect of wind integration in the northwest is that only a couple hundred megawatts (25% of total generation) actually serve northwest loads. Barton said that the wind generation capacity is expected to grow to above 3,000 mega watts by late 2009 and to approach 6,000 mega watts by 2012; he clarified that most new generation project sites will serve loads outside of the BPA balancing authority. The presentation included slides that outlined how the wind generation supplements hydro generation and how scheduling at the projects is affected by fluctuations in wind direction/velocity and load demands for the region. Barton acknowledged the regional interest in minimizing the amount of energy needed in reserves and the need to balance that with meeting federal liability requirements. Barton noted the many economic issues at play, which drive the capacity of storage systems currently in place. Barton said that management efforts would be supported by access to more frequent real time wind weather data, similar to that used by the aviation industry, and by an improved ability to capture the diversity by integrating a bigger "geographic footprint".

Regarding potential impacts to hydro operations, Barton noted the following:

- Projects must have the flexibility to operate to greater hourly minimum discharges and decreased hourly generation capacities.
- More fluctuations in actual generation for those projects on auto-response.

- When there is a need for spill during lack of load, BPA would like to be able to displace wind and avoid excessive TDG. (This issue has been brought up at the last two wind integration technical team meetings and they are working with other stakeholder partners in the wind community to address this.)
- Increased volatility (depending on the ability to improve load scheduling accuracy.)
- Impacts to spill fluctuations are likely to be observed during the runoff season.

Action/Next Steps for the Wind Integration Team:

- Continue to monitor reserve requirements and enforcement mechanisms;
- Discuss displacement issue with utilities and the wind community;
- Continue efforts to support improved scheduling accuracy to minimize needed reserves;
- Explore new industry practices and products (3rd party supply of reserves, sub-hourly markets, ACE diversity, etc.);
- Coordinate with many external partners and look for cross-agency coordination opportunities that will lead to better transmission regionally and nationally.
    - BPA is scheduled to meet with the NPCC in March to discuss funding support for improvements to the regional wind forecasting network.

TMT members thanked Barton for coming to the meeting and sharing his insights; Barton said he is optimistic that there will be improvements to wind energy integration performance because of the increased collaborative efforts and financial incentives.

Next Steps for TMT:

- Agendas for the Wind Integration Technical Team meetings are available online. (at http://www.bpa.gov/corporate/About_BPA/wind/meetings.cfm)
- TMT will coordinate with Barton on when to schedule an update for a TMT meeting.
- Barton will coordinate with Tony Norris, BPA, when wind integration activities that affect the hydro system are imminent; to give TMT a head's up.

Operations Review

Reservoirs: Grand Coulee was at elevation 1280.4', and Hungry Horse was at elevation 3520.79', with outflows of 3-3.2 kcfs. Early bird forecasts for February showed a drop in snow pack. Libby was at 2409', with inflows of 2 kcfs and minimum outflows of about 4 kcfs expected for the near term. Albeni Falls was in the range of 2051 - 2052' and passing inflows of about 16 kcfs. Dworshak was at 1528.97', with outflows of 6 kcfs. Seven day average inflows were 33.5 kcfs at Lower Granite, 164 kcfs at McNary and 174.6 kcfs at Bonneville.

Other: Jim Adams, COE, reported that a crane boom collapsed at The Dalles on 1/26 (no one was hurt ☺). All spill wall construction was suspended through at least 1/28; the extent of damage to the wall was not yet known. **Action:** Adams will share information

with TMT as it is made available. The Bonneville pool will be held as steady as possible while damage is assessed.

Fish: Nothing at this time.

Power System: Tony Norris, BPA, said that the Snake River projects were on zero generation at night for a few days, for the first time this year.

Water Quality: Nothing at this time.

Next face-to-face TMT Meeting: February 11, 2009
Agenda items will include:

- Updated Water Supply Forecasts
- Flood Control Updates
- HEC 3-D Cam Updates
- Status of FPP / FOP
- The Dalles Spillwall Update (if any available)
- Operations Review

Columbia River Regional Forum
Technical Management Team Meeting
Jan. 29, 2009

1. Introduction

Today's TMT meeting was chaired by Jim Adams (COE) and facilitated by Robin Gumpert (DS Consulting) with representatives of COE, BPA, Montana, BOR, NOAA, USFWS, FPC and others participating. The following is a summary (not a verbatim transcript) of the topics discussed and decisions made at the meeting. Anyone with questions or comments about these notes should provide them to the TMT chair or bring them to the next meeting.

2. Review Meeting Minutes for Jan. 14, 2009

Jan. 14, 2009, facilitator's notes: In the last paragraph on page 1, change "Climate Control Center" to "Climate Prediction Center," Kyle Dittmer (CRITFC) said. With this change, the facilitator's notes were deemed final.

Jan. 14, 2009, official minutes: These were posted on the web, after which Steve King (National Weather Service) sent comments regarding his presentation, Adams reported. Under The Dalles spill wall construction update, the Jan. 14 facilitator's notes cite an additional operational constraint that isn't included in the Jan. 14 official minutes, Tony Norris (BPA) said. Under the power system update, add a sentence explaining that the powerhouse tripped offline at Lower Granite only, not for the whole Snake River system. The official minutes for Jan. 14, 2009 will be finalized at the Feb. 11 TMT meeting.

3. Wind Integration and the Columbia River Hydro System

Steve Barton (BPA wind integration team) gave a slideshow presentation on effects that wind power integration into the Northwest power supply is having on regional hydropower operations.

The Northwest currently has 1,671 MW of wind generation capacity installed in BPA's wind balancing authority area (BAA), which represents about 16% of the BAA's peak load.

Wind generation capacity is expected to grow steadily over the next several years, nearly doubling to 3,000 MW by late 2009 and to 6,000 MW by 2012. This is roughly the equivalent of another Grand Coulee Dam in terms of installed capacity. These projections are based on actual integration requests BPA has received.

A little over half the wind generation connected to the Northwest grid is in the BAA; however, less than a quarter of that actually serves federal loads. This

is not the case in other wind power-producing areas of the country, and it creates unique difficulties in integrating wind power with hydro system operations.

Furthermore, most of the wind farms in the Northwest are clustered in the Columbia Gorge between The Dalles and Boardman, so the region's wind energy supply lacks geographic diversity. Because they're subject to similar wind patterns, the generators in the Gorge all tend to operate as a group rather than offsetting each other's energy production. As an example of the effect geographic diversity has on energy production, slide 9 of Barton's presentation shows that power generation in the Northwest wind resource area was zero this winter while the wind howled fiercely in the gorge's west end.

Litchfield asked whether the projections of rapid growth in wind capacity include potential effects of the recession; Barton said no. Most new wind generation sited between now and 2012 in the BAA is expected to serve investor-owned and public utility customers in the Northwest, as well as customers in California and elsewhere outside the region.

Wind power production in the Northwest is currently backed up by hydropower generation. Wind generation requires backup because it's an intermittent resource, producing energy whenever the wind blows and not in response to demand. Studies have found zero correlation between wind power production in the Northwest and demand. In order to maintain load-resource balance, loads versus generation must equal zero. This means another resource must be available within the hour to follow the intermittency and variability of wind generation.

BPA faces unique challenges in this situation, given that (1) large portions of wind power are serving non-BAA loads, and (2) wind generation is so difficult to predict. Wind energy providers submit production schedules to BPA, which uses them to plan residual loads on the federal system. Most of BPA's efforts to study wind have been to quantify the reserves wind generation requires. BPA is also working with providers on improving scheduling accuracy. In planning for the bi-directional hydro reserves that would be necessary to maintain system reliability by 2012-13, BPA found that a hydro equivalent of 25-35% of the installed wind fleet capacity would need to be held in reserve. However, the reserve requirements associated with a given wind fleet size could drop substantially in response to improved wind scheduling accuracy.

A third area of concern is gaining understanding of the impacts that maintaining reserves within an hour of volatility has on hydro system operations. Litchfield asked whether this means the 3,000 MW of wind capacity expected by the end of 2009 will be backed by a third (1,000 MW in both directions, or 2,000 total MW) of reserve hydro capacity which could be needed at any time to respond to changes in wind generation. Barton said that is correct. There is interest in holding smaller reserves on the system, but that will depend on

whether scheduling accuracy improves. At present, a third of scheduling values were more than 25% in error, and roughly half were more than 20% in error, as depicted in slide 11 of this presentation. In response to this instability, the wind integration public forum has begun to explore the need for an enforcement mechanism to ensure that the hydrosystem doesn't get over-deployed.

Barton presented numerous slides depicting BPA's analysis of the situation, all of which are linked to today's agenda and are also available on BPA's website. Dan Feil (COE) asked what physically happens to the hydro system if 1500 MW of wind generation drops to 800 MW. If wind generation drops by 700 MW, the balancing resource needs to increase generation by 700 MW, assuming all other factors are constant, Barton said. There has to be sufficient capacity on the system to counteract the dips and peaks in wind production.

Impacts on fish operations could be significant. In general, wind power schedules predict fewer megawatts than actual production levels. This has created a net storage effect on the federal system. From October 2006 to now, the accumulated error peaked at 70,000 MWh of generation imbalance supplied by the FCRPS in the form of stored energy. The FCRPS essentially stores this energy for free, and it has become a water management issue, as wind power can ramp up very abruptly – for example, from zero to full load or 1,500 MW in just 90 minutes last Christmas season. The largest 60-minute ramp-up seen was 1,161 MW, or 77% of capacity within an hour. Efforts are underway to predict these extreme ramps because they are what drive reserve requirements. Slide 17 depicts a real-life example at John Day in April 2008 of what can happen when the hydro system follows a sudden wind power ramp-up. As the wind imbalance at John Day grew to 200 MW, the impact of unexpected wind generation spread to Grand Coulee. Once a project hits its minimum generation level to accommodate wind, the response shifts to any project that can respond.

FCRPS projects could end up with spill variances as a result, Litchfield said. Slide 19 depicts a time when John Day Dam went from its planned 60% spill level to nearly 64% spill, exceeding the +/-1% bandwidth (the COE's definition of a spill variance) while following increases in wind generation, Barton said.

The situation has potential for more gas generation, David Wills (USFWS) observed. It implicates how the region handles its ESA responsibilities for water quality and fish. BPA shares that concern and has been studying spill impacts, specifically the increase in mid-hour spill adjustments. For a 450 MW increase in wind fleet capacity (from 730 to 1,180 MW), there was a 1.8% increase in the number of mid-hour spill adjustments made at McNary, a 3.8% increase in mid-hour spill adjustments at John Day, and a 7.7% increase in mid-hour spill adjustments at The Dalles. In other words, Barton said, as wind power capacity increases, so does system volatility. BPA transmission managers are aware that

there's a finite amount of reserves the FCRPS projects can carry, especially in light of congested transmission pathways to Grand Coulee and Chief Joseph dams. Quantifying how much the hydrosystem can handle is a challenge.

A few wind projects are planned in eastern Washington, the Kittitas Valley, and near Walla Walla, which could increase geographic diversity, Barton said. Adams asked about the potential for chemical energy storage of wind power. That's a research issue now, Barton replied. Present storage technologies are cost-prohibitive, but BPA is looking for ways to do it more cheaply. There was discussion of transmission costs involved in shipping power to population centers from the remote, unpopulated areas where wind usually blows strongest. Wind power production in the eastern gorge currently has an annual 30% capacity factor, meaning that a 100-megawatt wind power facility can be expected to produce 30 MW annually, Barton said.

Paul Wagner (NOAA) asked about seasonal variations in wind capacity. The wind tends to blow in response to the weather fronts that bring spring and fall rains, and it tends to stop blowing when cold, stagnant air or hot air predominates. That means wind power tends to be unavailable when demand peaks in winter and summer. Spring 2008 was a good wind season, with capacity factors of around 45% for most wind facilities in the Northwest, Barton reported.

Laura Hamilton (COE) asked how many more MWs of wind power BPA expects to place on the system before and during 2009 spill season. Barton gave a preliminary estimate of 1,700-2,000 MW.

To address concerns regarding spill and TDG levels, BPA is working with the wind community on developing incentives to displace wind generation with hydro at times when spill volumes are high and tailrace TDG levels might exceed the 120% state water quality standard. BPA is also working with providers on fiscal incentives to improve scheduling accuracy and adjust wind operations to conform to the schedule. Possibilities for developing region-wide wind forecasting are also being explored, as well as proposals to build transmission in remote, windy areas with the intent of increasing regional wind power capacity and geographic diversity. Kyle Dittmer (CRITFC) asked: "What specific weather information would be needed to improve wind generation operations." Barton said having surface observations at 5-minute intervals (to help with rapid ramping up/down), a new National Weather Service product for wind-power users (currently geared for aviation users), and surface wind forecasts.

USFWS, Montana and the COE requested that BPA keep TMT apprised of issues that wind integration brings to the hydro system so any problems that arise can be dealt with quickly.

4. The Dalles Spill Wall Update

On Jan. 26, a crane boom collapsed onto the derrick barge Alameda, Adams reported. There were no injuries, but spill wall construction has been suspended, and the contractor has requested that the Bonneville pool be kept as flat as possible until the crane can be removed and repaired to prevent any further damage. The schedule, which was already behind, will need to be revised accordingly. The crane has to be removed before damage to the wall can be assessed.

5. Operations Review

a. Reservoirs. Grand Coulee is at elevation 1,280.4 feet, slowly drafting.

Hungry Horse is at elevation 3,520.79 feet, with discharges of 3-3.2 kcfs to meet the Columbia Falls minimum flow.

Libby is at its minimum elevation of 2,409 feet, with inflows of around 2 kcfs and outflows of 4 kcfs. The RFC April-August precipitation forecast is 89% of average.

Albeni Falls is at elevation 2,051-2,055 feet, passing inflows of 16 kcfs.

Dworshak is at elevation 1,428.97 feet, a foot above the end of January target of 1,528 feet elevation. Outflows are 6 kcfs daily as the pool drafts down to its January elevation. The RFC April-September precipitation forecast is 89% of average.

The 7-day average inflow is 33.5 kcfs at Lower Granite, 164 kcfs at McNary, and 174.6 kcfs at Bonneville.

b. Fish. There was nothing to report today.

c. Power System. Over the past few days, and for this first time this winter, Lower Snake projects have gone to zero generation at night per specifications, Norris reported.

d. Water Quality. Temperatures are cool and gas levels are low throughout the system, Adams reported.

6. Next Meeting

The next regular TMT meeting will be Feb. 11, 2009. The agenda will include finalizing notes for Jan. 14 and today; the February water supply forecast; updates on flood control, The Dalles spill wall construction, the Fish Passage Plan and Fish Operations Plan; and the standard operations review.

The following TMT meeting Feb. 25 could include a site visit to The Dalles to view spill wall construction in progress. This summary prepared by consultant and writer Pat Vivian.

Name	***Affiliation***
Jim Adams	COE
Tony Norris	BPA
Dan Feil	COE
Jim Litchfield	Montana
John Roache	BOR
Paul Wagner	NOAA
David Wills	USFWS
Steve Barton	BPA
Laura Hamilton	COE

Phone:

Kyle Dittmer	CRITFC
Russ Kiefer	Idaho
Margaret Filardo	FPC
Tim Heizenrader	Centaurus
Russ George	WMC
Yuan Me	Edison Mission Group
Ruth Burris	PGE
Tom Le	Puget Sound Energy
Scott Bettin	BPA
Richelle Beck	DRA