BP-14 Generation Inputs Workshop

June 27, 2012

Agenda

Introduction

- This is the sixth generation inputs workshop of the BP-14 Rate Case. More workshops are scheduled through August 2012.
- Workshops will be posted on the BPA agency calendar. Tech Forum notices will inform you of the dates and provide the link to workshop materials.
- These workshops are discussions between BPA and customers and stakeholders prior to BPA crafting an Initial Proposal.

Dynamic Balancing Reserve Adjustment

Dynamic Balancing Reserve Adjustment

Discussion of the Dynamic Balancing Reserve Adjustment topic that was presented at the 13 June 2012 Generation Inputs workshop. We ran out of time to receive feedback on the presentation at that time.

Facilitated discussion limited to 30 minutes. Additional discussion at the end of the meeting, if time is available.

Slides from the 13 June workshop are included for reference.

Dynamic Balancing Reserve Adjustment

BPA has been asked to consider:

- Whether balancing reserves can be reduced to save costs when wind generation is forecasted to be low.

- Whether the need for additional balancing reserve can be predicted to allow short-term acquisition of additional capacity to reduce Dispatcher Standing Order (DSO) 216 risk.

  A key issue affecting this analysis is that wind generators do not currently schedule to a forecast that is visible to BPA, and they appear to determine their schedules at various time frames ahead of the delivery hour.

  This analysis focuses on the difference between a centralized wind forecast and actual generation, not on the difference between scheduled and actual generation. It implicitly assumes that wind is scheduled to the forecast.

Topics

1. Wind forecast accuracy/potential reserve quantity reductions.

2. Potential costs or savings for customers.

3. Risks to BPA Operations.

4. Alternate approaches to reserve quantity reduction and cost savings.

1. Wind Forecast Accuracy/Potential Reserve Quantity Reductions

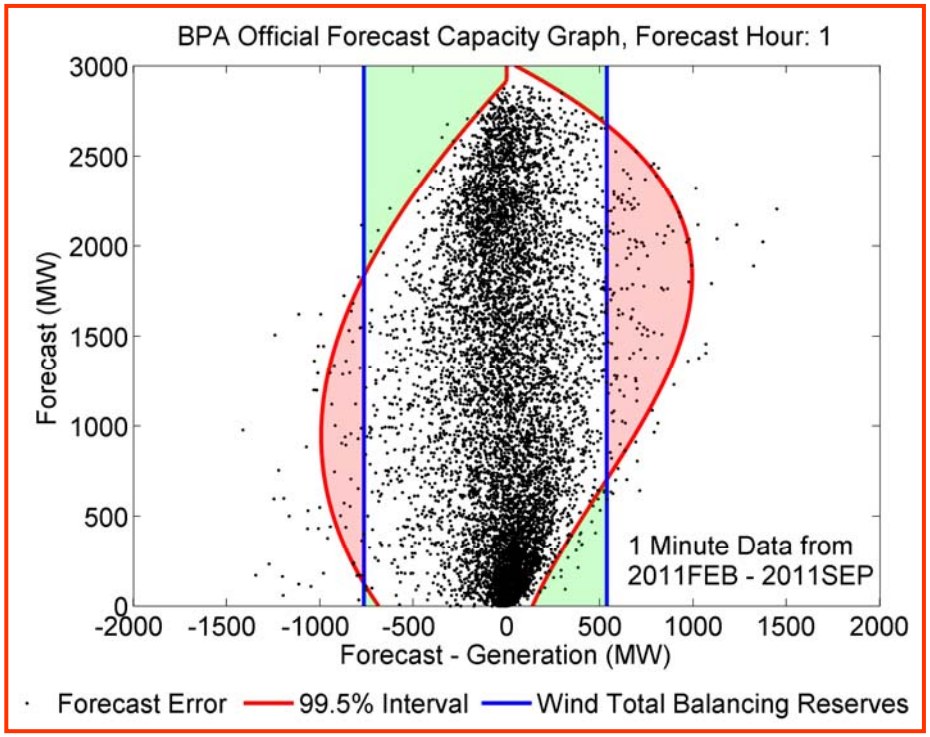
a) Wind Power Forecast Accuracy study (short time intervals, not including reserves for load).

b) Assess forecast time frame that allows for marketing and operations planning.

c) Assess frequency/duration of high and low wind generation periods.

a) Wind Power Forecast Accuracy Study

- Blue line – wind only balancing reserve quantity based on 30/60 persistent schedule as established in the Rate Case
  - Does not include the pooling benefit from Load
- Red line – 99.5% confidence interval around the distribution of forecast error
- Green shaded areas identify potential periods of wind balancing reserve reduction. Dots within the green area represent frequency of events.
- Red shaded areas are potential reserve increases.
- Negative values represent *dec* reserves, positive values represent *inc* reserves, assuming forecast = schedule.



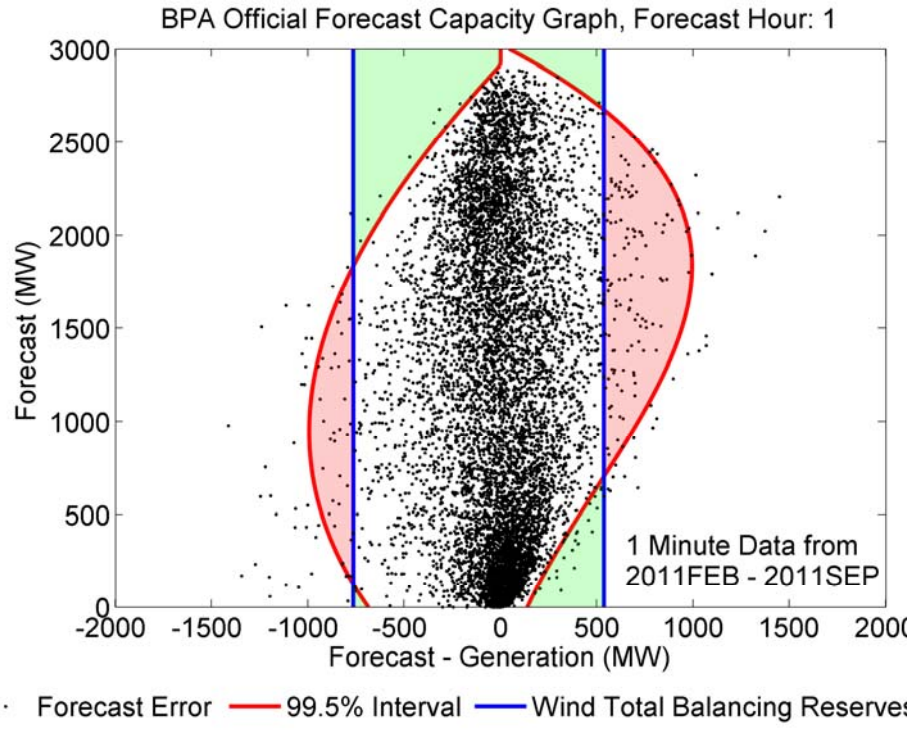
b) Time Frame Required for Marketing/Operations Planning

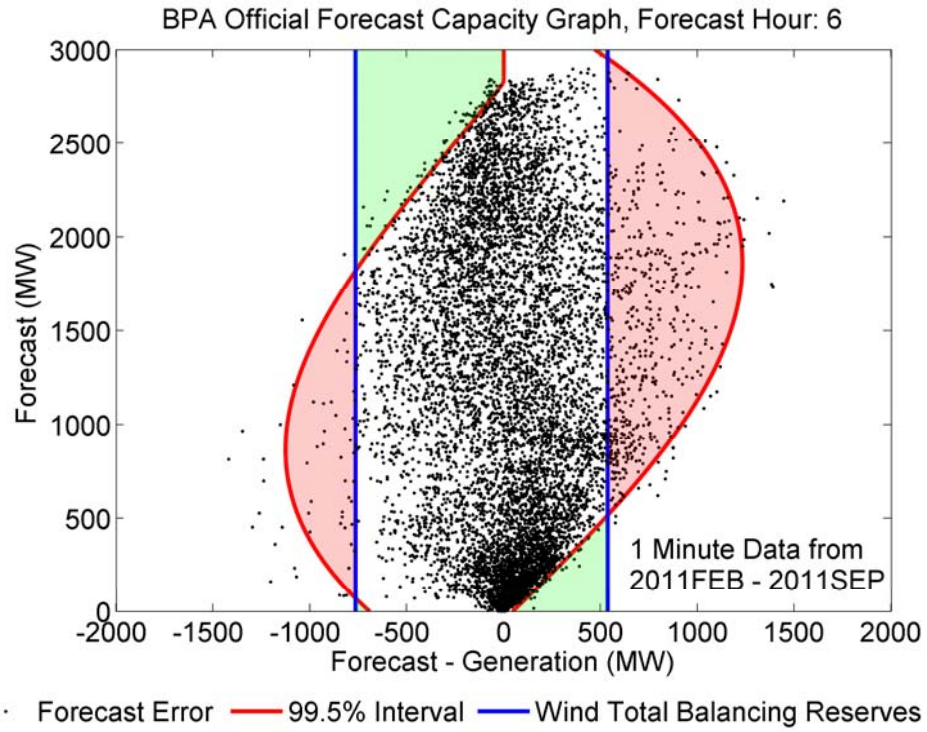
- If balancing reserves are reduced, BPA would need to remarket the capacity in real-time to recover costs from the customer credit.

- If balancing reserves are increased, BPA must purchase additional non-Federal capacity.

- Use of the one-hour ahead forecasts does not allow sufficient marketing and operations planning time.
  - The next hour forecast posts at xx:20.
    - 20 minutes before the close of the scheduling window
  - Marketing time requirement is not constant through the day/year.
    - Longer time may be required at night than during the day or at times when liquidity is limited.
  - Not enough time to re-plan hydrology.
  - Not enough time to purchase or sell capacity.

Six-Hour Forecast

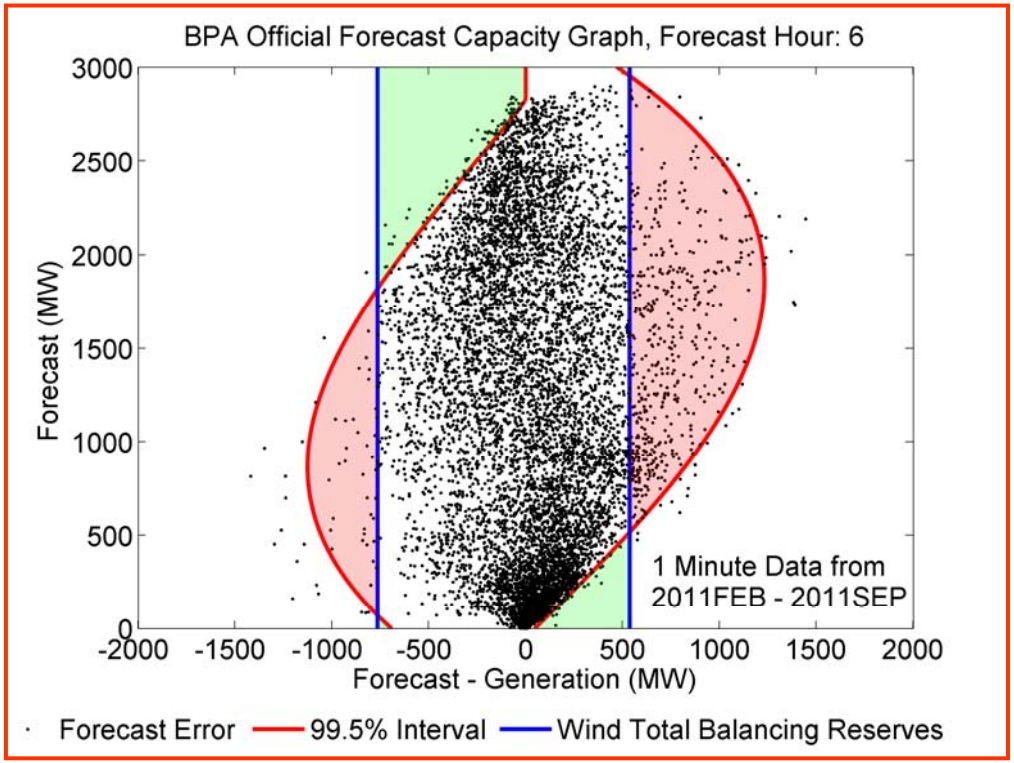




Six-Hour Forecast

- BPA studied the six-hour time as the absolute minimum possible time for repositioning. It is likely more time would be needed.
- Six hours might give time to remarket some (small) portion of balancing reserve capacity, acquire small amounts of additional reserve capacity and/or re-plan hydrology for a portion of the reserves.
- The six-hour forecast identifies more reserve additions than the one-hour forecast and increases uncertainty about accuracy (red areas).
- More decision error would be expected from using the six-hour forecast – if BPA reduced reserves, DSO 216 risk would increase. If BPA increased reserves, DSO 216 risk would decrease, costs would increase but there is high likelihood the extra capacity would not be needed.

c) Frequency/Duration of High Wind Generation Period



- There are two components affecting a potential reserve adjustment:
  - The quantity or area between the blue line and the red line (green and red areas).
  - The frequency and duration of forecasts being in the shaded areas (dots within the areas, difference between six-hour and one-hour graphs).

Summary: Reserve Reduction Quantity

- All participating wind generators would have to schedule to a centralized forecast.
- Potential quantity of reserve reduction varies depending on forecast time horizon.
- Potential reserve reduction is associated with high wind times (*dec* savings, upper left green area) or low wind times (*inc* savings, lower right green area), which occur only part of the time.
- Averaging savings over time and assuming six hours to allow for hydro operations planning and marketing yields potential *inc* reserve reduction of 17% and potential *dec* reduction of reserve reduction of 11%.
  - This does not translate to a cost reduction of 17% or 11%.
  - DSO 216 risk would increase.

Summary: Reserve Increase Quantity

- All participating wind generators would have to schedule to the centralized forecast.
- Purchasing additional reserves based on six-hour forecast will lead to many false positive decisions (difference in frequency of dots in red areas between one-hour and six-hour graphs), and will increase costs.
- Purchasing additional reserve would reduce DSO 216 risk.
- If BPA increased reserves based on the 6 hour forecast, it would add an average of about 8% in *dec* reserve and about 46% in *inc* reserve (amounts would be higher but for short periods of time. These changes are significantly different amounts than the rate case study methodology because of the false positives associated with the 6 hour forecast.

Potential Costs or Savings for Customers - Cost Methodology

- Two cost cases were evaluated:
  - One case assumed the current level of balancing reserves as a maximum, but reduced reserves a portion of the time based on the six hour forecast.
  - The second case assumed that BPA would react in either direction -- increase or decrease available balancing reserve based on the six hour wind forecast.

Cost Analysis: Reserve Reduction

- Although there is potential for cost savings (green areas), the likelihood of schedule error falling into those areas (dots within the area) is low.
- Higher frequency cost saving events exist but the magnitude of the savings is small.
- Also, a risk premium associated with attempting to recover reserve costs via Real-Time marketing must be considered. This cost is driven by price volatility and correlation.

Marketing Basics

- To meet hydraulic objectives while maximizing the value of the Federal Columbia River Power System (FCRPS), energy transactions occur over several time frames:
  - Long Term: 20-year contracts.
  - Mid Term: within fiscal year.
  - Short Term: within month and Real-Time.
- The goal is to avoid forced marketing in Real-Time. Forced marketing puts both hydraulic objectives and FCRPS value maximization at risk.

Reserves and FCRPS Planning

- Carrying reserves is incorporated into operations planning along with the resultant marketing actions.
- Opportunistically reducing reserves requires undoing in Real-Time months of Term marketing and system planning.
- Real-time transactions will not always be of a value greater than or equal to all forward transactions used to set up the system for carrying reserves. To prevent cost shifts to power customers, this risk must be assigned a price.

Risk Premium

- Forced marketing puts FCRPS value at risk; resulting in the need to recover the expected loss in FCRPS value:
  - Lack of time available to capitalize on favorable price spreads. Term trading opportunities are lost and forced into real-time.
  - Products may not be comparable – lack of capacity market means reselling energy products instead of capacity products.
  - Price volatility in real-time is greater than in the term markets.
  - Imperfect correlation between term market prices and real-time prices.
- Even if Term spreads were equal to real-time spreads on an expected basis, the risk of adverse price movements poses a cost shift risk to PF customers. In order to cover the risk, the extrinsic factors of price volatility and correlation must be accounted for and valued.
- This results in an expected risk premium of $3.25/MWh.
- An additional significant risk not quantified in this analysis is the market liquidity risk.

Costs of Reducing Reserves

- Studies show a net <u>increase</u> in the variable cost of balancing reserves from $600,000 to $3,500,000:
  - The $600,000 cost is the case where BPA only reduces reserves. It reflects the variable costs and risk premium associated with BPA's ability to recover the cost of repositioning to provide less *inc* and *dec* reserves.
  - The $3,500,000 cost is the case where BPA increases and decreases reserves. It reflects the variable costs and risk premium associated with BPA's ability to recover the cost of repositioning to provide more or less *inc* and *dec* reserves. It does not include embedded cost for *incs*.
- Embedded costs are not impacted by reducing reserves because these costs do not change with operations. Allocating embedded costs when increasing reserves needs further study.
- The net impact is an increase in the total cost of balancing ranging from 1% to 4% if BPA were to dynamically adjust FCRPS reserves.
- Costs of acquiring non-FCRPS reserves is a topic for the reserve acquisition discussion.

BPA Operational Risks and Other Issues

- Inventory analysis:
  - Uncertainty in obligations for short term modeling and for setting up for load peaks and night time minimum operation
- Statutory obligations:
  - Added complexity to hydro operations for meeting non-power objectives
- Reliability:
  - Actual scheduling differs from forecasts
- Cost to implement:
  - More FTE & IT systems to implement
- Risk of cost shift

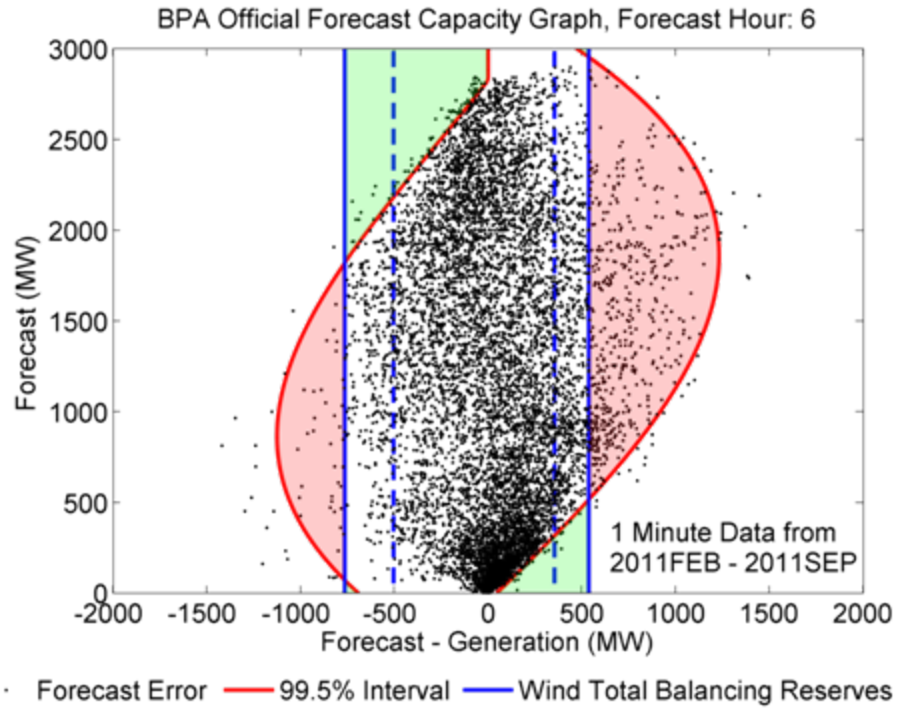
Conclusion on Short Term Reserve Adjustments

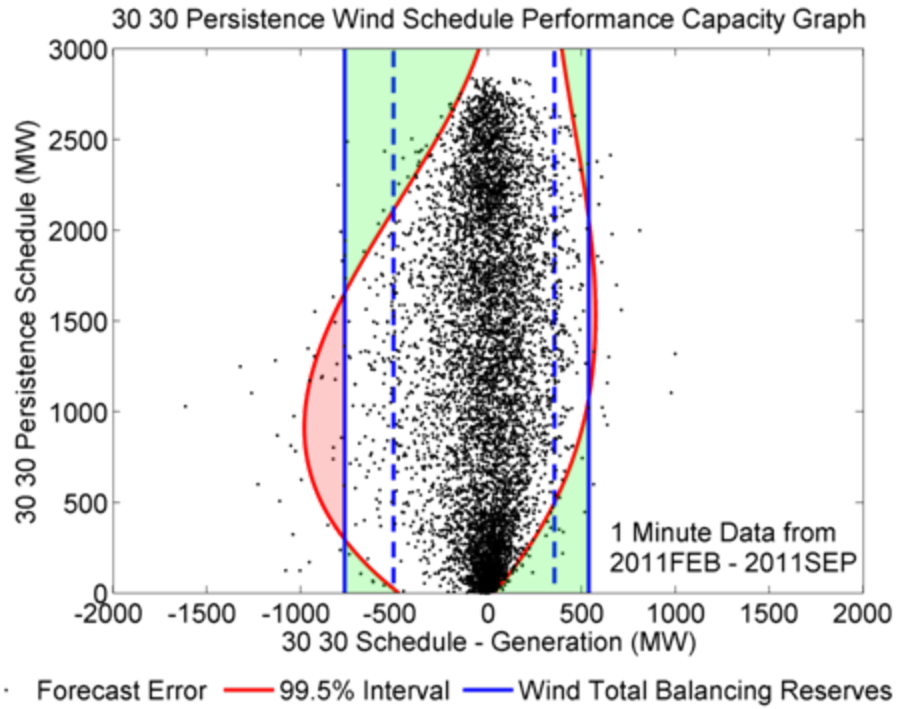
- BPA recommends against adjusting FCRPS reserves downward on a short term basis because:
  - Costs increase, not decrease.
  - Added complexity for hydro operations.
- BPA recommends that customers wishing to time acquisition of additional reserve capacity based on forecasted wind generation make their own purchases using an enhanced supplemental service:
  - Non-FCRPS capacity may be better able to adjust on short notice.
  - Customers would retain control of their benefit/cost decision.

Side Note -- Committed Intra-Hour Scheduling Can Result in Reduced VERBS cost

- Currently 30/30 scheduling relies on persistence based scheduling.
- There is a possibility for further improvements in forecasted scheduling accuracy.
- Short term scheduling tied to centralized forecast (persistence based or better) yields greater and more reliable reduction in reserves.
- Currently cost reduction for Committed Intra-Hour Scheduling is based on the fleet level estimate of 34% reserve quantity reduction and cost savings.
- Reserves are reduced at all times, while maintaining same DSO 216 risk as base service.

Six-Hour Forecast vs. 30/30 Scheduling





VERBS Rate Design

Discussion on VERBS Rate Credit for FY 2014-2015 Rates

In the FY 2012-2013 Final Record of Decision, BPA agreed to hold a workshop on whether a Variable Energy Resource Balancing Service (VERBS) rate credit should be established.

Decision:

"VERBS is a service that is subject to reductions from time to time due to hydro system limitations. The record in this proceeding is not adequate to support the establishment of a credit for VERBS customers when reserves are reduced. BPA proposes to hold a technical workshop shortly after the close of this proceeding to discuss the possibility of establishing such a credit as a proposal in the next rate proceeding or possibly through an expedited section 7(i) process prior to the next rate proceeding. "

VERBS Rate Credit, Continued

The issues we would like to discuss are:

1- Should there be a credit?

- Is the amount large enough to warrant a credit?
- Most VERBS costs are embedded costs.

2- If a credit is given, who picks up the costs?

To put the level of unavailability into context, we present data from 2010 through May 2013.

VERBS Rate Credit, Cont'd

Reserve reductions for all hours, including Environmental Redispatch (2011) and Oversupply Management (2012)

Year	Average Allocation (MW)		Average Available (MW)		Average Reduction (MW)		Average %
Available	INC	DEC	INC	DEC	INC	DEC	INC
	DEC						
2010	799.9	990.0	799.5	982.8	0.4	7.2	99.95%
	99.27%						
2011	759.2	933.0	696.1	816.7	63.0	116.3	91.70%
	87.54%						
2012*	672.4	846.3	655.8	804.1	16.6	42.2	97.54%
	95.02%						

*Through May 31, 2013

VERBS Rate Credit, Continued

Example credit calculation using average VERBS balancing reserves costs for FY 2012-2013 and average forecast VERBS generating nameplate capacity of 4,693 MW. Average *inc* cost of $43,317,740 and average *dec* cost of $12,430,457.

Year	INC % Avail.	DEC % Avail	INC Credit	DEC Credit	Total Credit per MW Nameplate
2010	99.95	99.27	$ 21,658	$ 90,742	$ 23.95
2011	91.70	87.54	$3,595,372	$1,548,835	$1,096.14
2012	97.54	95.02	$1,065,616	$ 619,037	$ 131.91

We also calculated percent availability with Environmental Redispatch (ER) and Oversupply Management (OM) hours removed, but this made only a small change in the percentages. The driver for unavailability was hydro system conditions outside ER or OM hours. In June 2011, *incs* and *decs* were reduced for the entire month, with 80 hours of ER.

VERBS Rate Credit, Continued

Embedded Costs of Providing VERBS

About 68% of the costs of providing VERBS are embedded costs. These costs are an allocation of Federal Columbia River Power System (FCRPS) costs and are incurred whether or not the reserves are deployed.

If a credit for unavailability is provided, these costs will be reallocated to other users of the FCRPS.

Cost Allocation of Credits

Costs of a reserve reduction credit could be allocated to:

- Balancing reserve users (load, thermal, wind)
- Power customers and wind customers, similar to BPA's proposed allocation of OM costs
- Power customers
- Other?

Request for Wind Generation Data

- BPA is requesting sub-hourly values for the total Potential Generation for all Wind Plants, who have or can calculate and archive such data, connected to the BPA system in the smallest time increment available (one minute average preferred) for the period of October 1, 2009, to Present. If data is unavailable for this entire time period, please provide whatever data you do have.

- For those that are able to provide data to BPA immediately, please provide it (MW) in digital format (via email or mail a CD/DVD) to BPA in one of the following formats: comma separated variable (*.csv), Excel (*.xls or *.xlsx), MatLab (*.mat) or text (*.txt).
  - Provide data to Frank Puyleart: frpuyleart@bpa.gov
- A Official Request Letter was sent out on April 16, 2012 through the Transmission Account Executives.
- Please fulfill this request ASAP for inclusion in the BP-14 Rate Case.
  - The letter required delivery by May 1, 2012; While a majority met this deadline, many still need to respond.
- Please contact Frank Puyleart at frpuyleart@bpa.gov with questions.

Customer Feedback or Discussion on Generation Inputs Issues

Next Steps

- Next Generation Inputs discussion workshops planned:
  - 26 July 2012, 9:00-12:00
    - FCRPS Provision of Balancing Reserves
    - Rate Design Constructs for VERBS and DERBS
  - 22 August 2012
  - Tech Forum announcement will be sent to confirm dates and times.