

BP-14 Generation Inputs Workshop

May 9, 2012



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Introduction

- This is the fourth generation inputs workshop of the BP-14 Rate Case. More workshops are scheduled through July 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.



Balancing Reserves 101

This presentation facilitates an educational discussion of BPA's Balancing Reserve Service



Introduction

- Welcome
- Scope:
 - Context
 - System Limitations
 - Reserve Service
 - Managing Reserve Service
- Objective:
 - Describe how balancing services work today



System Operations

- Maintaining a Generation and Load Balance
 - A coordinated responsibility involving Transmission and Hydro Operations
 - Operating time horizons are moment to moment, hourly, to days, weeks and months
- Imbalance = Schedule vs. Actual
 - Balancing Reserve Services keep these aligned
- Why Imbalance matters: 60Hz & Hydraulics
 - Affects the reliability of the transmission system
 - Affects hydraulic management – simultaneously achieve statutory objectives while moving and storing water for reserves
- Balancing Reserve Service
 - Is provided as a service for the specific and sole purpose of balancing unavoidable schedule error
 - Is not allocated to any particular resource – the capacity provided to TS for balancing serves a pool of loads and variable and dispatchable resources and is not allocated for the specific use of any one entity
 - Is subject to water, machine and system limitations



Columbia River System Hydraulics

- Interconnected hydraulic system: including Federal, Non-Federal, and Canadian hydro projects
- Storage Limited System: Federal storage about 30 million acre feet (MAF)
- Variable Water Supply: Average January-July runoff 106 MAF
 - Range of 50-150 MAF
- Operations are driven by non-power constraints
 - Flood Control and Endangered Species Act obligations
- Power production is a byproduct of our need to move or store water
- The availability of reserves is affected by hydraulic events hours in the past, and the deployment of reserves will affect hydraulics hours in the future



Balancing Reserves

- Requires spinning and non-spinning units
- Requires careful planning of the interconnected hydro system:
 - Planning to have water and machines are available at the right time and place
Ensure reserve deployments will accommodate future operations
 - *Inc* draws on project storage, increasing inflows to downstream projects
 - *Dec* stores more water into a project, reducing inflows to downstream projects
 - Important for reserves to have relatively unbiased storage or withdrawal over time.



Balancing Reserves (continued)

- Reserves are classified into two distinct categories:
 - Contingency Reserves
 - Quantities and business rules defined by NERC, WECC, and Northwest Power Pool
 - *Inc* direction
 - Maintained 8760
 - Deployed for qualifying contingency events
 - Balancing reserves:
 - No industry standards other than requirement to comply with BAL-001 - deployed for Regulation, Following, and Imbalance
 - Quantities and business rules are determined by rate case negotiations
 - *Inc* and *Dec* directions
 - Maintained with high probability, limited if hydraulic constraints or oversupply conditions require limitation
 - Deployed to balance net imbalance of wind, load and dispatchable generation



Balancing Reserves and AGC

- Balancing reserves are deployed via BPA's Automatic Generation Control (AGC) system
 - AGC is a system that deploys generation (up and down) to maintain load-resource balance in BPA's Balancing Authority. The primary input to AGC is the Area Control Error (ACE) which equals the difference between the total net actual interchange (energy flowing to and from BPA from and to other Balancing Authorities) plus a frequency component.
 - AGC cycles every two seconds.
 - Normal plants on AGC response: primarily Grand Coulee and Chief Joseph, John Day and The Dalles will also be on control.
 - All plants on the Columbia and Lower Snake Rivers are available for automatic control via BPA's AGC system.
 - For contingent events (loss of generation), AGC will automatically deploy contingency reserve to recover from the loss.

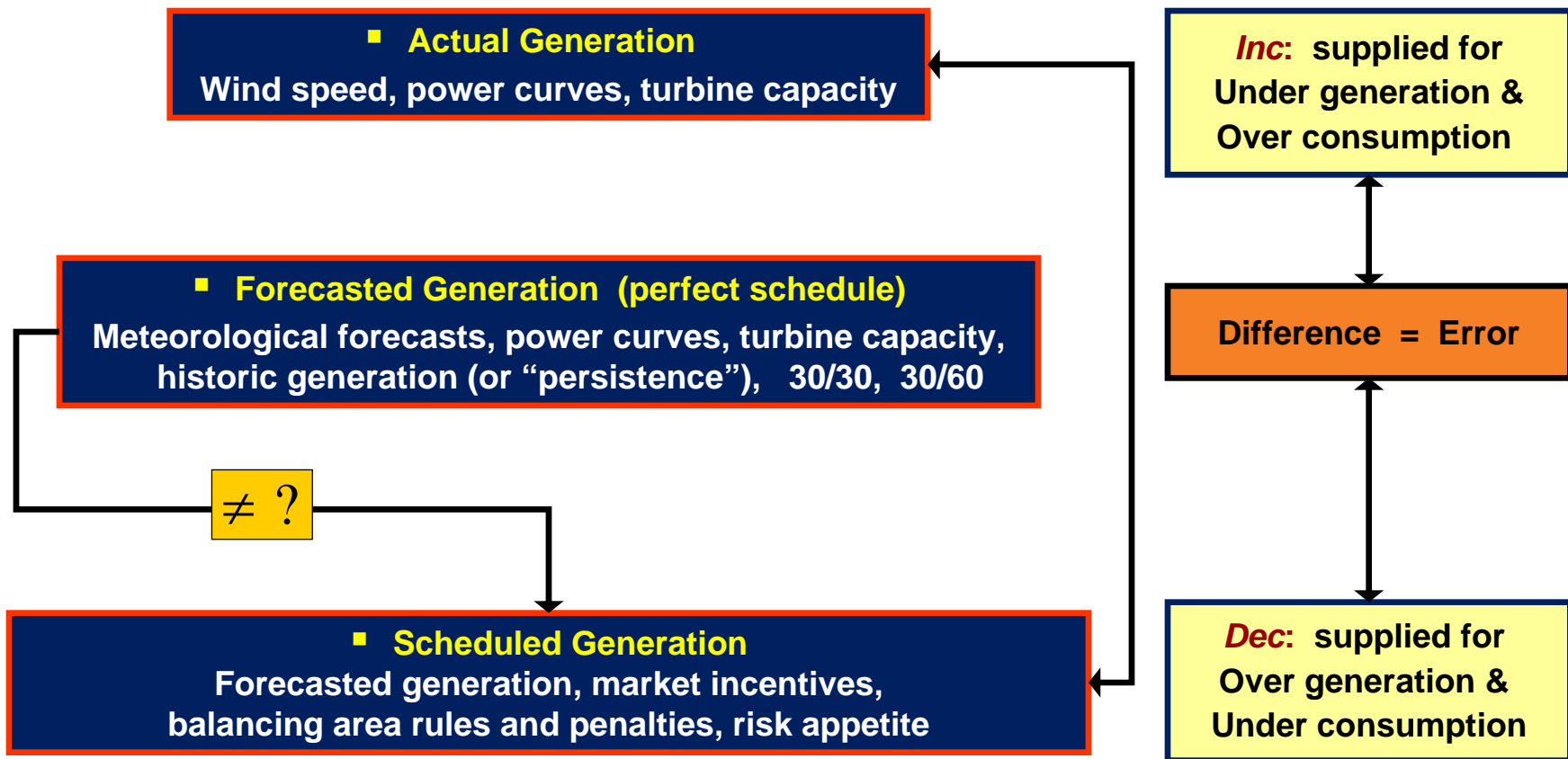


Balancing Reserves and AGC (continued)

- Balancing reserves are deployed via BPA's Automatic Generation Control (AGC) system (continued)
 - When there is not a contingency on the system, AGC will deploy balancing reserve by moving the generators on control.
 - AGC does not continuously move generators on control, there are dead bands and timers in the AGC software that keeps it from over-deploying the on-control generators.
 - Once a dead band is exceeded by ACE, a timer starts counting down.
 - Once the timer reaches zero, control signals are sent to generators that are on control.
 - The generators respond bringing ACE back toward zero.



Terminology



Reserve Service Elections

- Determine a Balancing Reserve quantity (MW) and level of service (99.5%)
 - A rate case decision based on:
 - Assumed scheduling accuracy behavior for the wind fleet (currently 30/60 forecast accuracy for the aggregated wind fleet)
 - Customer appetite for risk, cost, value decision (99.5%)
 - Acknowledged uncertainty in hydraulic conditions, cost causation principles, and statutory obligations
 - Quantity defines capacity requirement and DSO 216 limits
 - DSO 216 limits reserve deployments to the quantity and level of service agreed upon in rate case negotiations



Reserve Service Elections (Continued)

- Quantify the cost (cost-based pricing):
 - Quantify the resulting system impacts of carrying and deploying Balancing Reserves:
 - Embedded costs
 - Energy shift impacts
 - Efficiency gains and losses
 - Unit cycling



Managing Reserves

- **Stand Ready:** Reserves are planned for in advance of the operating hour
 - Planning hydraulics to meet agreed upon quantity and level of service.
 - Setting project response characteristics in AGC.
 - Plans take into account past events and future hydraulic objectives.

- **Deployment:** Reserves are deployed within the operating hour
 - Balancing signal is sent to response projects via AGC.
 - AGC moves projects within agreed upon Reserve Quantity (DSO 216).
 - Hydro plans are adjusted as needed to maintain hydraulic objectives.

- **System Impacts:** Reserves affect project discharge
 - *Inc* forces a increase in project outflow.
 - *Dec* forces a decreases project outflow and/or increase in spill.
 - *Incs* and *Decs* over time can cause accumulated, unplanned storage or withdrawals, if Imbalance actions are not managed appropriately.



Managing Risk

- On a planning basis, BPA offers a quantity of balancing reserve capacity that is relatively certain to be available on an annualized basis.
- Balancing Service is subject to occasional reductions due to the nature of a complex, storage limited, interconnected hydro system.
- The FCRPS cannot maintain balancing reserve service and meet statutory obligations through any foreseeable water condition (there is a great deal of uncertainty around water supply in the Pacific Northwest).
- During rare hydraulic events the balancing reserve service is reduced.
- Reductions in balancing reserve service can be followed at:
 - <http://transmission.bpa.gov/business/operations/Wind/windlim.aspx>



When Reserve Service is Limited

- Balancing reserve service is limited in real-time to the level of service elected in the rate case process:
 - This dispatch order has two effects:
 - Limit Generation to schedule plus reserve allocation (over generation – action mitigates *dec* risk)
 - Limit Schedule to actual generation plus reserve allocation (under generation – action mitigates *inc* risk)
- Despite DSO 216, reserve deployments occasionally exceed 100% of the allotted capacity.



When Reserve Service is Limited (Continued)

- Are there more reserves available during DSO 216 events?
 1. Additional capacity was not purchased through the Balancing Service.
 2. Apparent capacity in real time is a misleading metric:
 - May be the result of previous or accumulated imbalance (operations now are the result of events many hours in the past).
 - May be needed for a longer-term hydraulic objective (operations now extend many hours or weeks into the future).



Hydro Operations 101

See “Hydro 101, the Subtleties of River Operations”



Update on Planning Base Level of Service



Update on Planning Base Level of Service

- Topic for future workshop (most likely in July)
- For current discussion assume Federal Columbia River Power System (FCRPS) reserves will be limited and that balancing capacity requirements for FY 2014-15 rate period may exceed available FCRPS reserves.



Update on Planning Base Level of Service (continued)

- Two related discussion topics:
 - How to reduce reserve requirements
 - Self-supply of imbalance reserves
 - Adjusting 99.5% assumption for *decs*
 - Scheduling to centralized forecast 30/60
 - Possible FERC decision on scheduling intervals
 - Customer desire to have more flexible source of reserves/shorter term acquisition (reduce FCRPS reserves and increase non-FCRPS reserves)
 - How to include non-FCRPS reserves
 - Acquisition process (who, when, how)
 - Deployment process
 - Cost allocation process



Customer Feedback on Mapping Supply to Need



Follow-Up from Previous Workshops: Customer Feedback on Mapping Supply to Need

- Method for Mapping Supply to Need:
 - Northwest Requirements Utilities – Megan Stratman
 - PNGC Power – Aleka Scott



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 Initial Proposal.**
 - **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.



Next Steps

- Next Generation Inputs discussion workshops planned:
 - 23 May 2012, 1:00-4:00
 - 14 June 2012, 9:00-12:00
 - Tech Forum announcement will be sent to confirm dates and times

