Proposed Approach for Assessing Balancing and Flexibility Reserves in the Region

SAAC Meeting
August 4, 2015
Review of Balancing and Flexibility Characteristics of the Power System

• Ability of the system to respond to changes in supply and demand of power both inside the scheduling time period (intra-schedule flexibility) and between multiple hours (inter-schedule flexibility).

• LSE’s and wind producers must often contract for balancing services and/or hold back reserve capacity to account for intra-schedule variability when a market is not available to alleviate any supply and demand differences.

• Definitions can be varied around US because scheduling time periods are varied and different regions have slightly different definitions.
Review of Proposed Methodology

Regional Intra-Hour Reserves assigned to Hydro and Non-Hydro

Reserves to Hydro Units

Reserves to Non-Hydro Units

Adj. Hydro Shape Per Reliability Standard

AuroraXMP

TRAP

Reserve Adjusted Hydro Shape

GENESYS
Determine Amount of Reserves Required by Balancing Authority

• Used the 95% Confidence Interval load following and regulation requirements for each of the 28 not generation-only BAs (Base Case for the PNNL NWPP EIM Study).

• The data set is described in more detail in the following report

• This is not the only dataset available, but seemed most reasonable to Council Staff based on data needs:
  1. Monthly and daily reserve requirement data for all WECC BAs.
  2. Current regional portfolio conditions.
Assigning Reserves to Hydro/Non-Hydro Units

• Assumption:
  
  Total reserve requirements for each BA can be met by resources within each BA (with exception of Mid-C hydro contracts).

• Identify resources that CAN provide reserves, and assign one of two ways:
  
  (1) Distribute reserves evenly amongst capable resources.
  
  (2) Distribute all reserves first to hydro units, and the remainder to non-hydro.
Range Available on Resources to Meet Reserve Requirements

- Hydro and Thermal units have a wide variety of operational capabilities including ramping, fuel supply/constraints, available transmission, and operating range of the generator.

- Since this Staff is trying to test whether the region has SUFFICIENT balancing resources, the focus will be on determining reasonable operating ranges
  - Crudely accounting for min and max generation levels, emissions constraints, etc.
# Operating Range Capability

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Percent of Capacity Available to meet Reserves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydro</td>
<td>80%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>50%</td>
</tr>
<tr>
<td>Coal</td>
<td>10%</td>
</tr>
</tbody>
</table>
Convert Ranges Into Hydro/Non-Hydro Resource Reserve Assignment

• Take the capacity reserve capable units in each BA multiplied by the operating range capability percentage by fuel type, and sum hydro and non-hydro operating ranges separately.

\[
\text{Hydro} \% = \frac{\text{Hydro Operating Range}}{\text{Total Operating Range}}
\]

\[
\text{NonHydro} \% = \frac{\text{NonHydro Operating Range}}{\text{Total Operating Range}}
\]
Distribute Reserves Evenly Amongst Capable Resources: In Region

<table>
<thead>
<tr>
<th>BA</th>
<th>Hydro</th>
<th>Non-Hydro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avista Corporation</td>
<td>71%</td>
<td>29%</td>
</tr>
<tr>
<td>Idaho Power Company</td>
<td>73%</td>
<td>27%</td>
</tr>
<tr>
<td>Northwestern Montana</td>
<td>75%</td>
<td>25%</td>
</tr>
<tr>
<td>Pacificorp</td>
<td>59%</td>
<td>41%</td>
</tr>
<tr>
<td>Portland General Electric</td>
<td>44%</td>
<td>56%</td>
</tr>
<tr>
<td>Puget Sound Energy</td>
<td>72%</td>
<td>28%</td>
</tr>
<tr>
<td>BPA, Seattle City Light, Tacoma Power and other PUDs</td>
<td>100%</td>
<td>0%</td>
</tr>
</tbody>
</table>
Known Issues

• Reserve Distribution: In Region
  – *Based on anecdotal information in IRP’s and judgement.*

• Reserve Assignment: Out of Region, in WECC
  – *Probably mostly assigned to Non-Hydro except certain BAs like SMUD that have hydro resources.*

• Seasonality
  – *In operations, reserves are probably assigned differently by season (Spring Runoff considerations, etc.)*
Next Steps

• Take balancing reserve assignment for hydro units and use TRAP and GENESYS to determine a reserve constrained hydro dispatch for AURORA.

• Input balancing operating reserve assignment for non-hydro units, hydro dispatch for 80 water years and the corresponding loads from GENESYS, into AURORA.

• Use AURORA to test the existing and potential regional portfolio for all 80 hydro/load conditions for balancing resource sufficiency.
Questions/Comments?
Examples of Reserve Types

- **Intra-Schedule Reserves**
  - Operating Reserves
    - Regulation
    - Load Following
  - Contingency Reserves
    - Spinning Reserves
    - Supplemental Reserves

- **Inter-Schedule Reserves**
  - Ramping Reserves
  - Imbalance Reserves
Capability of Current Models

• **AuroraXMP – Hourly Dispatch**
  – Limited intra-hour reserve accounting capability.
  – Extremely limited hydro dispatch capability

• **GENESYS – Hourly Dispatch**
  – Limited intra-hour reserve accounting capability.
  – Uses shapes from TRAP

• **TRAP – Hydro Shaping Algorithm**
  – Accounts for reserves held on hydro
Analysis of Aurora Dispatch

• Intra-hour reserve information input to Aurora via explicit assignment to plants and hydro shaping.

• Observing Aurora dispatch of non-hydro resources will then show how inter-hour flexibility requirements interact with economic dispatch and intra-hour flexibility.

• Complete the analysis for 80 different wind, hydro and load conditions.