Proposed Approach for Assessing Balancing and Flexibility Reserves in the Region

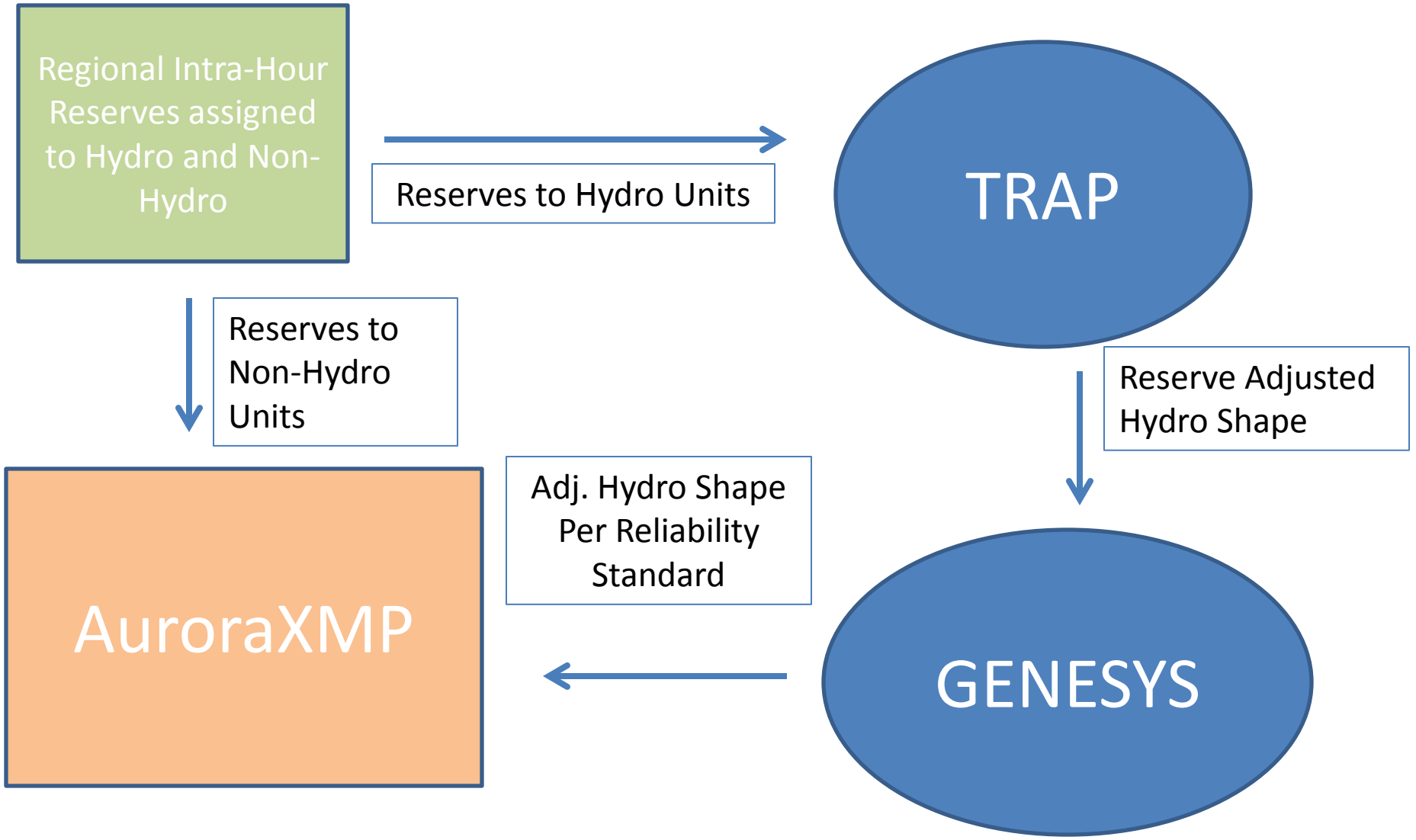
SAAC Meeting

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



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

  http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22877.pdf
- 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

Fuel Type	Percent of Capacity Available to meet Reserves
Hydro	80%
Natural Gas	50%
Coal	10%

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.

$$Hydro\% = \frac{HydroOperatingRange}{TotalOperatingRange}$$

$$NonHydro\% = \frac{NonHydroOperatingRange}{TotalOperatingRange}$$

Distribute Reserves Evenly Amongst Capable Resources: In Region

BA	Hydro	Non-Hydro
Avista Corporation	71%	29%
Idaho Power Company	73%	27%
Northwestern Montana	75%	25%
Pacificorp	59%	41%
Portland General Electric	44%	56%
Puget Sound Energy	72%	28%
BPA, Seattle City Light, Tacoma Power and other PUDs	100%	0%

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.