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March 31, 2015

MEMORANDUM

TO: Council Members

FROM: Ben Kujala and John Ollis

SUBJECT: Proposed Approach to Balancing and Flexibility for Draft Plan

BACKGROUND:

Presenter: Ben Kujala

Summary: Staff proposes to employ multiple models to test flexibility of the existing regional power system. If this approach proves workable it will be then be used to test potential changes to the existing regional power system resource mix based on the resource acquisitions and/or retirements that might occur under resource strategies drawn from the Regional Portfolio Model (RPM). In general, this modeling approach will test a resource portfolio's capability to simultaneously provide both intra-hour and inter-hour flexibility needs, while still meeting the regional resource adequacy standard.

The proposed first modeling step is to determine what reasonable intra-hour flexibility requirements are for the region. The intra-hour flexibility reserve requirements considered will be load following, regulation, spinning and non-spinning reserves. The load following and regulation reserves will be estimated by using stakeholder input to help guide the creation of a reasonable regional dataset. In accordance with the WECC balancing standard (BAL-002) spinning and non-spinning contingency reserves are currently estimated to cover three percent of load and three percent of generation resources or the largest, single contingency.

Once the amount of regional resources with sufficient capability to meet regional system intra-hour flexibility needs has been established, inter-hour ramping capability can be analyzed. This will be estimated by determining whether the remaining capabilities of regional resources are able to satisfy the inter-hour ramping requirements. If the resource portfolio being tested does not result in insufficient remaining ramping capability, then the regional portfolio being tested would be judged as adequate for flexibility purposes.

This approach will be applied to resource portfolios which have resource strategies that would likely increase regional flexibility requirements through the addition of variable generation resources.

Relevance: Since the RPM and GENESYS do not consider balancing and flexibility needs of the system, a methodology is needed to evaluate whether the region will need to consider modifying proposed resource strategies to ensure that system ramping and reserve needs can be met on an intra-hour basis. The proposed approach seeks to address this problem.

Workplan:

1. B. Develop Seventh Power Plan and maintain analytical capability
 - Define resource portfolio

Background: The RPM is used to examine the cost and risk of regional resource strategies at a quarterly time granularity. The GENESYS model was developed by the Council and over time has been modified with the advice of the Resource Adequacy Advisory Committee. The GENESYS model is used to assess regional power supply adequacy at an hourly granularity. The Council does not currently have a model that explicitly models intra-hour operations.

Intra-hour information can be used to inform hourly models by limiting the capability or range of a dispatch of plants by assigning reserve requirements to a particular plant or set of plants. Once this reserve requirement has been accounted for the remaining capability on those plants can then be assumed to be available for inter-hour ramping or economic dispatch. Hourly models like Aurora and/or GENESYS can be used to analyze inter-hour resource portfolio ramping capability under particular intra-hour reserve assumptions because the intra-hourly information has been accounted for by the assignment of intra-hour reserve requirements.

Draft Approach to Balancing and Flexibility for 7th Plan

Power Committee Meeting

April 7th, 2015

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.

Examples of Reserve Types

- Intra-Schedule Reserves

- Operating Reserves

- Regulation
 - Load Following

- Contingency Reserves

- Spinning Reserves
 - Supplemental Reserves

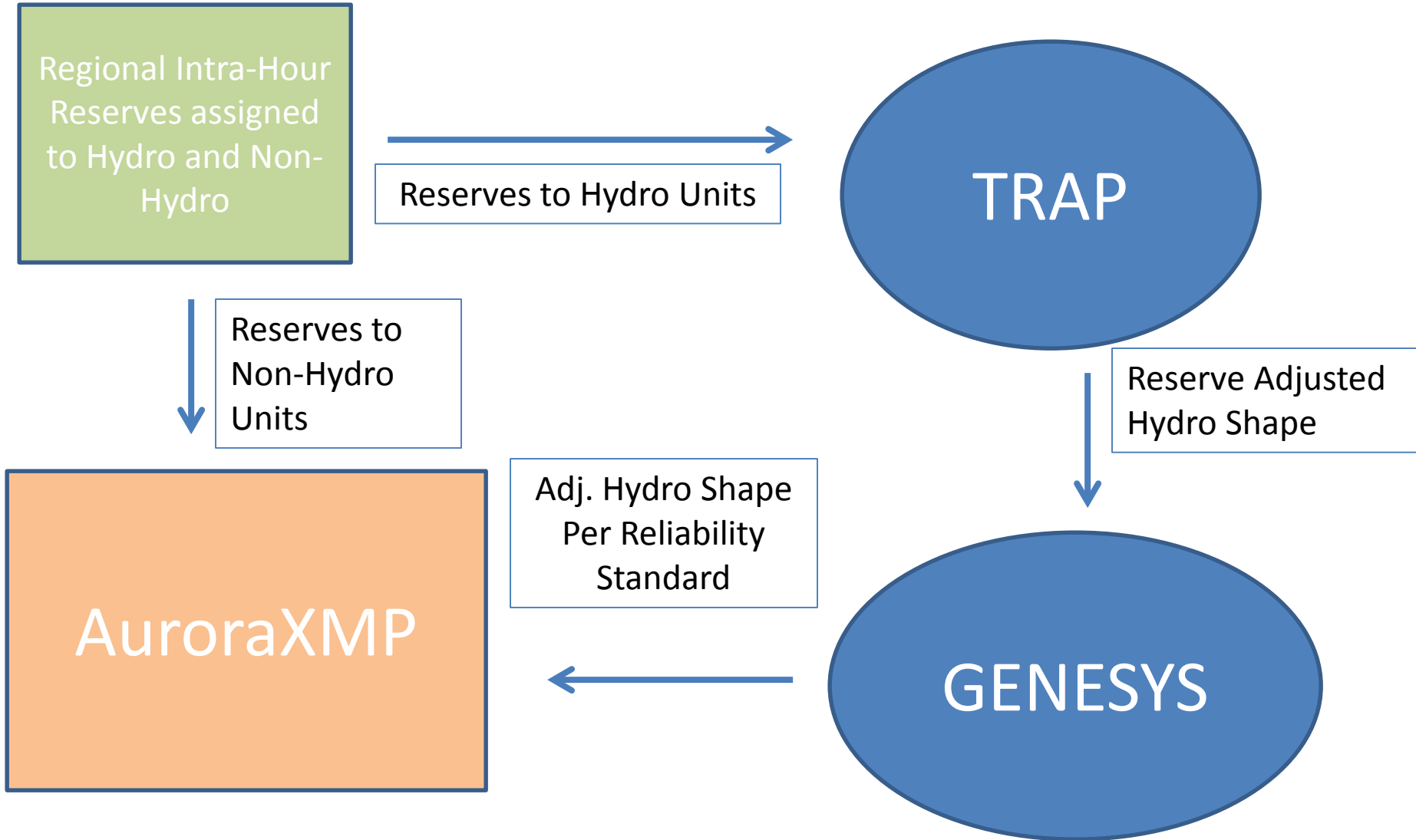
- Inter-Schedule Reserves

- 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

Proposed Methodology



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.