Northwest **Power** and **Conservation** Council

February 3, 2015

MEMORANDUM

TO: **Power Committee**

FROM: **Council Staff**

SUBJECT: **Demand Response Methodology in RPM**

BACKGROUND:

Presenter: John Ollis, NWPCC (jollis@nwcouncil.org, 503-222-5161)

Summary: The updated Regional Portfolio Model (RPM) explicitly analyzes the need for peak capacity. Therefore, a new resources' capability to provide both system support for peak capacity as well as satisfying energy adequacy requirements can be tested. This enhanced capability is the basis for the proposed methodology to model new Demand Response (DR) resources in the RPM. While DR resources can be characterized by many attributes (e.g., automated vs. price signal driven), for modeling purposes in the RPM the primary attributes are seasonal shaping and pricing. Specifically, the Staff proposes that three types of DR resources, delineated by price bins, should be made available to the RPM to option and build as new resources to supply peak capacity needs.

To develop the inputs necessary for DR analysis using the RPM, Staff commissioned a contractor (Navigant) to complete a regional DR potential study. This study's scope was limited to a review of information from previous potential studies and surveys from Investor Owned Utilities. Staff released the initial results of the study for stakeholder review and integrated the results of the study and stakeholder responses to develop the cost and potential for new DR for use by the RPM. At Staff's request, Navigant updated its initial study to provide data on the seasonality of DR resources. This data was used to identify DR resources most likely to be

selected by the RPM based on regional peak capacity need. Staff will use information from Navigant and stakeholder comments to assign each new DR resource a seasonal shape, fixed and variable costs, an associated energy value and capacity value.

The RPM is expected to acquire DR based on the need to meet regional peak capacity adequacy requirements, rather than being the least cost energy resource. The Council's most recent regional adequacy assessment, the Pacific Northwest Power Supply Adequacy Assessment for 2019, found that most of the seasonal need for peaking capacity resources occurs during winter months.
While it would appear that characterizing DR resources by seasonal shape is necessary, currently available data does not indicate that it is the most important attribute for purposes of the RPM analysis. Based on analysis of the current information from Navigant and stakeholders, the concept of sorting by price has three main advantages to sorting by seasonality:

(1) In new resource selection in the RPM, cost delineations will likely matter more than summer and winter shape. Seasonal bins of DR resources have less cost differential than price bins.

(2) Less cost variation in bins makes new resource selection more representative. Seasonal bins of DR resources have significantly more cost variation in each bin than price bins.

(3) More even depth in bins makes new resource selection more representative. There is significantly less summer and winter only peaking DR potential than year-round peaking DR potential. This creates a less even binning of the total potential than would a price binning regime.

Ideally, many different types of DR resources would be characterized and available to be tested by the RPM for acquisition. This would to allow for better fidelity on what the resource acquisition implies about meeting system need. However, each new resource adds significantly to RPM run times. Thus, Staff proposes only three new DR resources, delineated by cost, be made available for the RPM to option and build.

Relevance: Similarly to the discussion on the methodology for capacity and flexibility, Council's resource strategy cannot be considered comprehensive to simply plan to meet the region's energy needs, without also considering capacity needs. Potential new resources and energy efficiency acquisitions must be evaluated by their impacts on the system requirements for both energy and capacity.

Workplan: 1.D. Prepare for Seventh Plan and Maintain Analytical Capability. Develop Capacity Analysis Method.

Background: In previous Power Plans, the Council included narratives, a cost/benefit analyses, and the results of a more limited capability RPM to acquire DR resources based on the annual energy supplied by the resource. Since DR resources are primarily acquired for peak capacity periods, a methodology targeting peak capacity need would have been necessary to better represent DR resource acquisition. The RPM used in past plans had a simplified assessment of capacity needs, but did not yet have the capability to explicitly identify peak capacity requirements, nor value resources that provided primarily peaking capacity. This made a more sophisticated method of modeling DR not feasible within the model structure. However, with the RPM redevelopment in Analytica, a modeling enhancement has allowed peaking capacity adequacy to be recognized as an explicit system need. This new capability has allowed development of a modeling methodology to define new Demand Response resources that the model can acquire to meet peak capacity needs.

More Info: See attached resources.

Draft Demand Response Modeling Methodology in RPM

February 10, 2015

Northwest Power and Conservation Council

SEVENTH NORTHWEST POWER PLAN

Review of Demand Response

From the 6th Plan:

The Council's definition of demand response (DR) is voluntary and temporary change in consumers' use of electricity when the power system is stressed. The change in use is usually a reduction, but there could be situations in which an increase in use would relieve stress on the power system and would qualify as DR.

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SEVENTH NORTHWEST POWER PLAN

Are Demand Response Programs Needed?

- Does a retail customer have vision of wholesale electricity prices?
- Are load serving entities exploring the least cost/risk options for meeting peak demand by building supply resources?

Demand Side Management Categorizations

- Firm
  - *This class of DR resources allows either interruptions of electrical equipment or appliances that are directly controlled by the utility or are scheduled ahead of time.*
- Non-firm
  - *This class of DR resources are outside of the utility's direct control and are controlled by pricing.*

Demand Side Management Categorizations

Firm Resource Examples

- Fully dispatchable resources:
  - Direct Load Control of air conditioning, space heating and commercial energy mgmt. system coordination.
- Scheduled Firm Load Reductions:
  - Irrigation load curtailment
  - Thermal energy storage

Demand Side Management Categorizations

Non-Firm Resource Examples

- Time-Varying Prices
  - Real-Time Pricing
  - Critical Peak Pricing
- Demand Buyback
- Demand Bidding

Other Demand Side Management Categorizations

Supply Sources

- Residential
- Commercial
- Agricultural/Industrial

Dispatch Method

- Basic
- Automatic (*Smart*)

Seasonal Capabilities of Demand Response

Summer Peaking

- Irrigation Pumping
- Space Cooling

Winter Peaking

- Space Heating

Year-Round Peaking

- Water Heating
- Lighting Controls
- Curtailable/Interruptible Tariffs
- Load Aggregators

Review of Demand Response in 6th Plan

Estimates of Demand Response Potential

- Survey of potential studies conducted by BPA and IOU's.
- Researched current DR programs nationwide including distributed standby generation (DSG).
  - At least 6.4% (winter) and 6.9% (summer) of peak load could be reduced in 20 years by various utilities and system operators.
  - Includes DR already achieved and announced acquisition plans by regional utilities.

Demand Response Inputs in RPM

- Leverage Navigant Demand Response Potential study and stakeholder responses to the study for cost and potential .
- Generate DR Supply Curves/Resources that address *peak demand* uses of DR for selection in RPM.
  - *Demand response used for other purposes not easy to model without further RPM enhancement.*

Acquisition Methodology in RPM

How will the RPM acquire DR?

- New DR resources will be acquired similarly to a new supply-side resource in the RPM.
- One or more DR resources can be designated as new resource types.

  Each new resource adds to model solution time.

Situations to Acquire DR in RPM

When will the RPM likely acquire DR?

- When it is economic and least cost

But more likely…

- When there is insufficient peak capacity to meet system peak demand

Focusing the Analysis…

Simplifying assumptions in the RPM

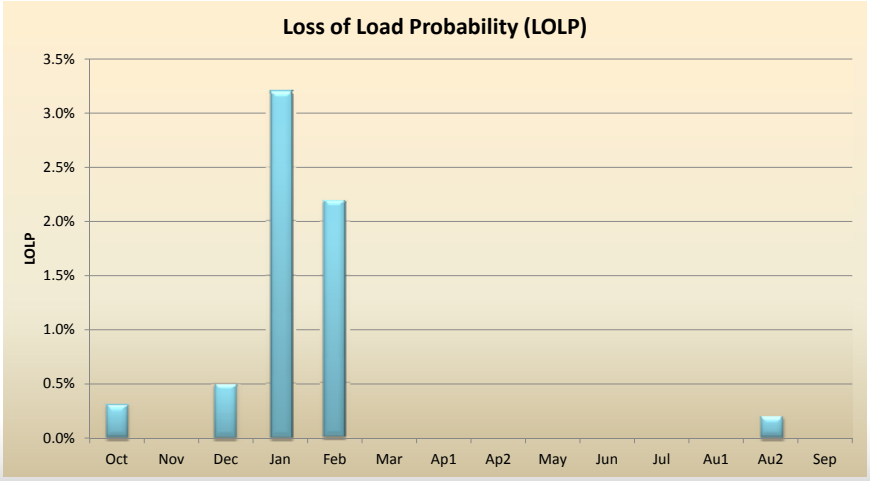
- The expectation is DR will be dispatched in RPM based on average energy content only
- Distributed Standby Generation (DSG) only acquired opportunistically.
- Discuss DR for Balancing (regulation, load/wind following) in action plan.

Distinguishing New DR Resources

Main Drivers in RPM for New DR Acquisition

- Distinct Summer and Winter shapes
- Cost

Resource Adequacy as a Guide



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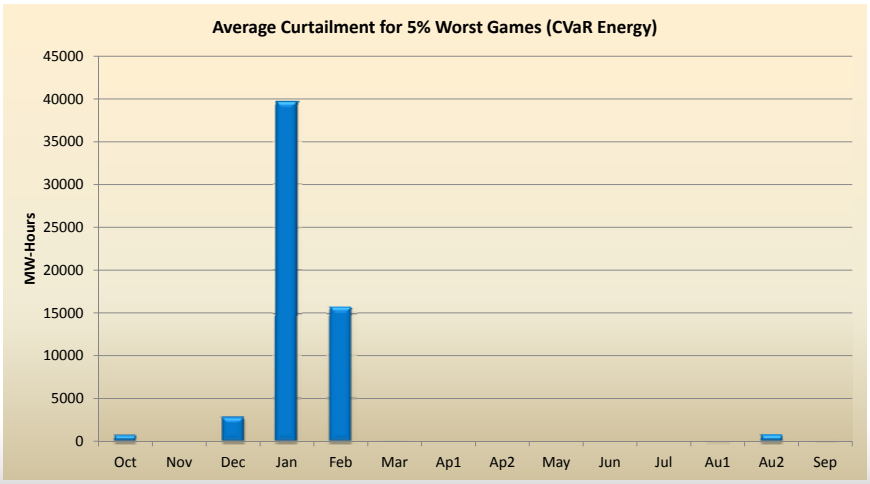

Seasonality Matters

Reliability Assessment tells us…

- More of a need for additional winter peak capacity will address a majority of the resource adequacy issues in 2019.

Should new DR resources delineated by seasonality?

Sorting by Seasonality

Preliminary Observations

- Of the DR potential available, over 56% is year round, 24% winter-peaking, and 20% summer-peaking resources.
- Seasonally sorted DR bins have *some* cost difference, but *large* variation in costs within the bin.
- Year-Round DR generally less expensive than summer or winter peaking DR.

Sorting by Cost

- Cost bins can be designed so the potential is split into three bins of almost the same size.
- Cost sorted DR bins have *significant* cost difference and *small* variation in costs within the bin.
  - *The high cost bin has a little more variation, but significantly less than seasonal bins.*
- Seasonal shapes balanced in cost bins.
  - *Slightly more winter capability in high priced cost bin.*

In the RPM, Cost Matters More…

Recommend Sort by Costs

1. In new resource selection in the RPM, cost will likely matter more than summer and winter shape.
2. Less cost variation in bins makes new resource selection more representative.
3. More even depth in bins makes new resource selection more representative

Questions?