MEMORANDUM

TO: Power Committee
FROM: Massoud Jourabchi
SUBJECT: Forecast of Hourly Regional Loads for 2020 Resource Adequacy Assessment

BACKGROUND:

Presenter: Massoud Jourabchi
Summary: Key conclusions from the proposed load forecast for the 2020 RAA are:

- Weather normalized annual energy loads (after energy efficiency) are forecast to grow by 0.6%/year for 2014 – 2020
- Proposed range of peak loads in 2020
  - Winter 30,000 - 43,000 MW
  - Summer 26,000 - 29,000 MW

Relevance: The first step in the Council’s preparation of its annual Resource Adequacy Assessment (RAA) is to develop a forecast of annual hourly electricity loads for five years in the future. At the September Power Committee meeting staff will present its proposed load forecast to be used in this year’s RAA for the year 2020. The metric used to assess resource adequacy in the “loss of load probability” or LOLP. In order to derive the LOLP the Council tests the adequacy of the region’s power system to meet a range of future loads under varying weather conditions. Therefore, the proposed forecast includes range of annual energy use and estimates for hourly
summer and winter peaks for the year 2020 based on the past 86 years actual daily temperatures experienced in the region.

Workplan: Not Applicable.

Background: The presentation will provide a review of recent trends in regional load growth under both normal and actual temperature conditions. It will describe the methodology used to forecast weather normalized annual loads and hourly peak loads. Staff will also describe improvements to the short-term load forecasting methodology implemented since the last RAA and plans for future enhancements.

More Info: NA
Forecast of Hourly Regional Loads For 2020 Resource Adequacy Assessment

Massoud Jourabchi
September 9, 2014

Today’s Topics

- Review actual annual and peak loads for 2007-2013
- Assess impact of year-to-year variations in temperature on annual and peak loads
- Review load forecast requirements for Resource Adequacy Assessment
- Propose a range of annual and peak load forecasts for the 2020 Resource Adequacy Assessment
- Describe improvements to the short-term load forecasting methodology
Actual and Normal Average Daily NW Temperatures - 2013

2013 Average Monthly Deviations from Long-Term Normal Temperatures
Regional Peak and Annual Loads Show No Statistically Significant Growth Trends Since 2007

Weather Normalized Annual Energy Loads Did Not Show A Statistically Significant Growth Trend from 2007-2013
Regional Peak Loads Are Driven by Annual Extremes in Temperature

In 2013, Regional Average Temperatures Reduced Annual Loads, While Extreme Temperatures That Year Increased Peak Loads.
Resource Adequacy Assessment
Load Forecast Inputs

- 86 forecasts of hourly regional loads for 2020
- Each forecast reflects daily average temperatures for each year from 1929-2013
- Forecasts for 2014-2020 are net of Sixth Power Plan energy efficiency targets

Information Flow Diagram for Short-Term Load Forecasting Model

1) Calculate load weighted average daily temperature for the PNW region using data for four representative cities*
2) Calculate PNW Normal Temperatures for each day of the year using 1928-2013 weighted average regional temperatures using data for four PNW
3) Using hourly loads by Balancing Area 1995-2013 calculate regional loads for each day
4) Estimate the relationship between change in temperature and change in load for each hour of year
5) Adjust load forecast so that 6th Plan conservation targets are netted from the gross load.
6) Estimate hourly loads for the region using the relationships from Step 4 and projected growth in employment in the region
7) Provide 86 different hourly load forecast for use in Resource Adequacy Assessment.

*Seattle, Portland, Spokane, Boise
Regional Employment is the Primary Driver for the Short-Term Load Forecast

Average Annual Growth Rate
2015-2020: 1.30%
2015-2035: 0.69%

Proposed Regional Annual Load Forecast for 2020
Average Energy and Peak Loads Across 86 Weather Years

Average Annual MWA
Summer peak
Winter Peak

Year of Temperature Condition
Proposed Range of Forecast Energy and Peak Loads Under Average and Extreme Temperatures Compared to NRF

<table>
<thead>
<tr>
<th></th>
<th>Energy</th>
<th>Summer Peak</th>
<th>Winter Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ext. Low temp.</td>
<td>21,567</td>
<td>26,063</td>
<td>29,720</td>
</tr>
<tr>
<td>Average Weather</td>
<td>22,095</td>
<td>27,312</td>
<td>28,542</td>
</tr>
<tr>
<td>Ext. high temp.</td>
<td>22,702</td>
<td>29,087</td>
<td>42,753</td>
</tr>
<tr>
<td>NRF 2014 *</td>
<td>21,642</td>
<td>29,551</td>
<td>33,500</td>
</tr>
</tbody>
</table>

Improvements for the Regional Adequacy Assessment Load Forecast

- Southern Idaho is modeled specifically
  - Idaho Power + PacifiCorp East + BPA

- Washington and Oregon loads will be divided into two zones:
  - Western Washington and Western Oregon
  - Eastern Washington and Eastern Oregon

PacifiCorp, BPA, and Idaho Power provided hourly load data
Planned Improvements for the Regional Adequacy Assessment Load Forecast

2020 Southern Idaho Load Forecast

With 84 Years of Temperature Conditions

<table>
<thead>
<tr>
<th>Range of Forecast</th>
<th>Low</th>
<th>Average</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer Peak</td>
<td>4,327</td>
<td>4,535</td>
<td>4,861</td>
</tr>
<tr>
<td>Winter Peak</td>
<td>3,202</td>
<td>3,611</td>
<td>4,549</td>
</tr>
<tr>
<td>Annual MWA</td>
<td>2,728</td>
<td>2,784</td>
<td>2,883</td>
</tr>
</tbody>
</table>
Key Points

- Weather normalized annual energy loads (after energy efficiency) are forecast to grow by 0.6%/year for 2014 – 2020
- Proposed range of peak loads in 2020
  - Winter 30,000 - 43,000 MW
  - Summer 26,000 - 29,000 MW