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

June 7, 2016

MEMORANDUM

TO: **Power Committee**

FROM: **John Fazio, Senior Systems Analyst**

SUBJECT: **Briefing on Power Supply Adequacy for 2021**

BACKGROUND:

Presenter: John Fazio

Summary: In 2011, the Council adopted a methodology to assess the adequacy of the Northwest's power supply. The purpose of this assessment is to provide an early warning should resource development fail to keep pace with demand growth. The Council's standard defines an adequate power supply to have no more than a 5 percent chance of a resource shortfall in the year being assessed. This metric is commonly referred to as the loss-of-load probability (LOLP) and any future power supply with an LOLP greater than 5 percent is deemed to be inadequate.

The Pacific Northwest's power supply is expected to be adequate through 2020, however, by 2021 – with the loss of the Boardman and Centralia-1 coal plants (1,330 MW nameplate) – the LOLP rises to about 10 percent[1] and would lead to an inadequate supply without intermediate actions. These results assume that the region will continue to acquire energy

[1] Boardman and Centralia 1 coal plants are scheduled to retire in December of 2020. However, because the Council's operating year runs from October 2020 through September 2021, these two plants would be available for use during the first three months of the 2021 operating year. For this scenario, the LOLP is 7.6 percent. The Council must take into account the long term effects of these retirements and, therefore, uses the more generic study that has both plants out for the entire operating year.

851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204-1348
www.nwcouncil.org

Steve Crow
Executive Director

503-222-5161
800-452-5161
Fax: 503-820-2370

efficiency savings as targeted in the Council's Seventh Power Plan, which amount to 1,400 average megawatts of savings through 2021.

Actions to bring the 2021 power supply into compliance with the Council's standard will vary depending on the types of new generating resources or demand reduction programs that are considered. Designing a resource strategy to ensure an adequate power supply for 2021 is more appropriately done using the strategy outlined in the Council's Seventh Power Plan. In all likelihood, some combination of new generation and load reduction programs will be used to bridge the gap.

Northwest utilities, as reported in the Pacific Northwest Utilities Conference Committee's 2016 Northwest Regional Forecast have identified about 550 megawatts of planned generating capacity for 2021. However, these planned resources are not sited and licensed and are therefore, not included in the 2021 adequacy assessment. It is important to note that demand response programs could play a vital role in maintaining power supply adequacy, as reported in the Council's Seventh Power Plan.

Relevance: Besides being an early warning to ensure that the regional power supply remains adequate, the Council's adequacy standard is converted into Adequacy Reserve Margins (for both energy and capacity) that are fed into the Regional Portfolio Model to ensure that resource strategies developed by that model will produce an adequate supply.

Workplan: A.5. System Analysis: Complete Annual Adequacy Assessments

Background: Since the late 1990s, the Council has worked to develop a more robust method of assessing the adequacy of the region's power supply. In 2011 it formally adopted the loss-of-load probability (LOLP) metric as the measure to assess adequacy and set its maximum threshold at 5 percent. The Council reassesses this every year, looking at the adequacy of the power supply five years out, as an early warning to ensure that adequacy is maintained.

More Info: For more information please go to the Resource Adequacy Advisory Committee webpage:

http://www.nwcouncil.org/energy/resource/home/

2021 POWER SUPPLY ADEQUACY ASSESSMENT

Executive Summary

The Pacific Northwest's power supply is expected to be adequate through 2020. The Northwest Power and Conservation Council estimates that the likelihood of a power supply shortage in that year is just under the 5 percent standard set by the Council in 2011. By 2021, however, after the planned retirements of the Boardman and Centralia-1 coal plants (1,330 MW nameplate), the likelihood of a shortfall (also referred to as the loss-of-load probability or LOLP) rises to about 10 percent[1] and would lead to an inadequate supply without additional resource acquisition actions.

These results are based on a stochastic analysis that examines the operation of the power supply over thousands of different combinations of river flow, wind generation, forced outage, and temperature for the 2021 operating year. Since last year's assessment for 2021, which resulted in an 8 percent LOLP, the annual average load forecast for that year has dropped by about 1,500 average megawatts. However, the winter peak load forecast has increased by close to 3,000 megawatts. Also, last year's assessment only included the Bonneville Power Administration's share of balancing reserves. Applying regional balancing reserves to the analysis in combination with the higher winter peak load forecast raises the LOLP to the 10 percent level, in spite of the lower annual average load forecast.

For each simulation, the underlying demand was set to the Council's medium forecast and the availability of imports from the Southwest was also set to a fixed value. If demand growth were to vary from the medium forecast and if the availability of imports were to change, the LOLP could drop as low as 2 percent or rise as high as 26 percent. But those extreme cases are not likely to occur.

---

[1] Boardman and Centralia 1 coal plants are scheduled to retire in December 2020. However, because the Council's operating year runs from October 2020 through September 2021, these two plants would be available for use during the first three months of the 2021 operating year. For this scenario, the LOLP is 7.6 percent. The Council must take into account the long-term effects of these retirements, and therefore uses the more generic study that has both plants out for the entire operating year.

851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204-1348
www.nwcouncil.org

Steve Crow
Executive Director

503-222-5161
800-452-5161
Fax: 503-820-2370

These results also assume that the region will continue to acquire energy efficiency savings as targeted in the Council's Seventh Power Plan, which amounts to 1,400 average megawatts of savings through 2021. The region will also need to add between 1,000 to 2,300 megawatts of capacity, depending on load growth, to ensure an adequate supply.

Resource acquisition plans to bring the 2021 power supply into compliance with the Council's standard will vary depending on the types of new generating resources or demand reduction programs that are considered. In all likelihood, some combination of new generation and load reduction programs will be used to bridge the gap. It should be noted that developing a strategy to maintain an adequate, efficient, economical, and reliable power supply is beyond the scope of this analysis. Designing a resource strategy to ensure an adequate power supply for 2021 is more appropriately done using the strategy outlined in the Council's Seventh Power Plan.

Northwest utilities, as reported in the Pacific Northwest Utilities Conference Committee's 2016 Northwest Regional Forecast, show about 550 megawatts of planned generating capacity for 2021. However, these planned resources are not sited and licensed and are therefore not included in the 2021 adequacy assessment. As conditions change over the next few years, it is expected that utilities will revise their resource acquisition strategies to ensure that sufficient investments in new resources, which include energy efficiency and demand response, will be made to maintain an adequate supply.

Power Supply Adequacy for the 2021 Operating Year

Power Committee Meeting
June 14, 2016
Redmond, Oregon

Council's Adequacy Standard

- Future uncertainties to consider
  - River flows
  - Temperature
  - Wind generation
  - Forced outages
- Simulate power system operation for 2021 many times, each time selecting different combinations of uncertainties
- Calculate how many simulations had shortfalls divided by total number of simulations
- Power supply is adequate if that number is 5% or less

2021 Power Supply Adequacy

- NOT adequate, except in low load case (LOLP = 10%)
  - Counting existing and expected resources only, and
  - Seventh plan EE targets, and
  - Existing and 121 MW of planned DR only
- Primarily capacity short –
  1,040 to 2,230 MW of new capacity needed (over standby)
  (for medium and high load growth cases)
- Seventh power plan resource strategy should be used for resource acquisition plans.
- Part of needed capacity can come from demand response. Any amount of new DR will increase adequacy.

Comparison to last year's 2021 Assessment

(from 8.3 to 9.9% LOLP)

- 2021 Annual Load:
  - Last year's forecast 21,780 aMW
  - Current forecast[1] 20,250 aMW (range 19,580 to 20,900)
  - Net decrease - 1,530 aMW
- 2021 Average Winter Peak Load:[2]
  - Last year's forecast 30,865 MW
  - Current forecast 33,848 MW
  - Net increase 2,983 MW

Main reasons why LOLP is higher in this year's assessment

- Resources
  - Small amount of new solar capacity
  - Up to 2,000 MW less hydro peaking (from BPA-only to regional INC/DEC)
- Newer version of GENESYS (tends to show slightly higher LOLP)

[1]Load forecasting method was modified for a more accurate reflection of energy efficiency savings and the impacts of future codes and standards.
[2]Even though the current annual average load forecast for 2021 is lower than last year's, this year's winter peak load forecast is much higher. Council will continue to investigate this and also why off-peak loads in this year's forecast appear to be lower than expected.

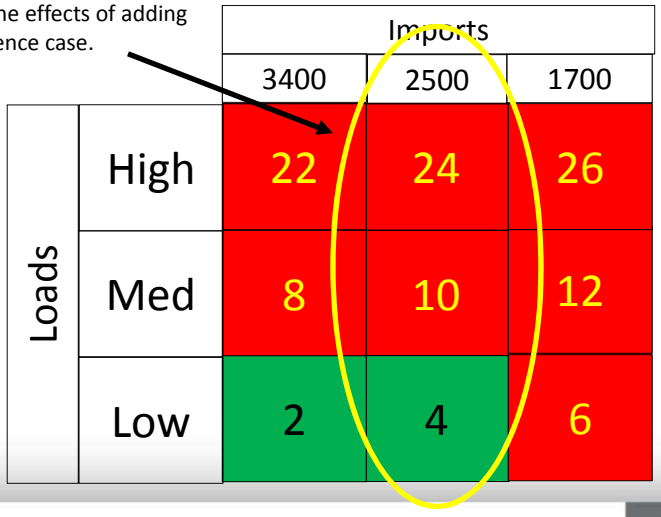
Comparison to Past Assessments

Year Analyzed	Operation Year	LOLP	Observations
2010	2015	5%	Was part of the Council's 6th Power Plan
2012	2017	7%	Imports deceased from 3,200 to 1,700 MW, load growth 150 aMW per year, only 114 MW of new thermal capacity
2014	2019	6%	Load growth 0.6%, over 600 MW new generating capacity, increased imports by 800 MW
2015	2020	5%	Lower load forecast, 350 MW of additional EE savings
2015	2021	8.3%	**Early estimate** (BPA INC/DEC only) Loss of Boardman and Centralia 1 (~1,330 MW)
2016	2021	10%	2021 loads lower than last year's forecast (~1,500 aMW) but winter peaks are higher (~3,000 MW), using regional INC/DEC reduces hydro peaking by as much as 2,000 MW

LOLP (%) Heat Map

(existing standby resources)

Let's examine the effects of adding DR to the reference case.



Effects of DR on LOLP
(2500 MW import)

Standby ➡ / ⬇ Loads	Exist	+ Minimum RPM DR	+ Average RPM DR
High Load	24	19	10
Med Load	10	8	5
Low Load	4	3	2

	Loss of Gas/Market Friction (Loss of 650 MW IPP, 2500 MW import)		
Standby ➡ / ⬇ Loads	Ref Case	Existing DR	+ Minimum RPM DR	+ Average RPM DR
High Load	24	30	23	13
Med Load	10	13	10	6
Low Load	4	6	5	3

Next Steps

- Council decision to release 2021 Adequacy Assessment at July meeting
- Staff prepares technical appendix
- RAAC recommends for next assessment
  - Review of hourly load shapes
  - Examine of other adequacy metrics – as part of lead-in to Action Item COUN-3
  - Keep tabs on import availability
  - Explore gas supply/market friction issues

Additional Slides (if needed)

2021 Reference Case

(see next 3 slides for more detail)

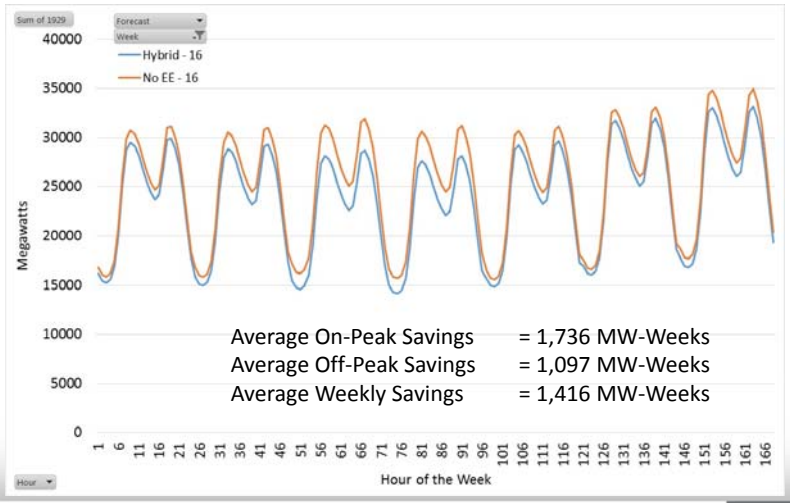
- Loads (from long-term model hybrid method)
  - Long-term model weather-normalized frozen-efficiency monthly loads
  - Add weather-normalized daily and hourly shapes
  - Add 7th plan EE targets by applying monthly effects
  - Add temperature variations from short-term model
- Demand Response: Existing + 121 MW planned DR
- Import availability
  - Spot (available all hours, winter only)
  - Purchase Ahead (available light-load hours, all year)
- IPP generation
  - Full availability (2,943 MW) winter
  - Limited availability (1,000 MW) summer
- Wind 4,896 MW nameplate (modeled as Columbia Gorge wind)
- Solar 396 MW nameplate, fixed generation pattern

Reference Case Assumptions

Item	Quarter 4	Quarter 1	Quarter 2	Quarter 3
Mean Load (aMW)	21,234	20,975	18,813	19,987
Peak Load (MW)	33,768	33,848	26,504	28,302
DSI Load[2] (aMW)	338	338	338	338
Mean EE (aMW)	1,545	1,574	1,274	1,208
Peak EE (MW)	2,660	2,660	1,680	1,680
Spot Imports (MW)	2,500	2,500	0	0
Purchase Ahead (MW)	3,000	3,000	3,000	3,000

[2]DSI load is 338 aMW in low, med and high load cases in 2021.

Example of Energy Efficiency Savings 2021 Hybrid Loads January (1929 Temp)



Scenarios

- Reference Studies (for heat map)
  - Reference Case (see previous slides)
  - Load Ranges (low, medium and high)
  - Import Ranges (1700, 2500, 3400 MW)
- Sensitivity Studies
  - Reference Case using STM loads
  - Fuel Limitation Case: Reduce winter gas IPP capability by 35% (650 MW), reduces all-fuel winter IPP cap by 22%
    - Reduces winter IPP total cap from 2943 to 2293 MW
    - Reduces summer IPP total cap from 1000 to 779 MW
  - Standby Resource Sensitivity
    - Existing + Planned DR and Emergency Generation
    - Existing + Planned + RPM Minimum DR (500 MW)
    - Existing + Planned + RPM Expected DR (1,257 MW)