June 6, 2017

MEMORANDUM

TO: **Power Committee**

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

SUBJECT: **Briefing on Adequacy Assessment for 2021-22**

BACKGROUND:

Presenter: John Fazio

Summary: The Pacific Northwest's power supply is expected to be adequate through 2020. However, with the retirement 1,457 megawatts of capacity by 2021 and an additional loss of 352 megawatts in 2022, the power supply becomes inadequate unless additional actions are taken.

For the regional power supply to be deemed adequate under the Council's standard, its Loss of Load Probability (LOLP) must be 5 percent or less. The current adequacy assessment projects the 2021 LOLP to be just under 7 percent and the 2022 LOLP to be just over 7 percent. These results assume the Council's energy efficiency targets through 2022 will be achieved. However, the region will additionally have to acquire an estimated 400 megawatts of new effective capacity[1] by 2021 in order to maintain adequacy.

Major changes and new information since last year's assessment include:

- Updated load forecasts show a general decline in winter peak loads and a general increase in summer peak loads.

[1] "Effective capacity" in this context is that portion of a resource's nameplate capacity that can be counted on during any shortfall hour in the year. Wind resources, for example, typically have very low effective capacity values.

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- Changes in Canadian hydroelectric operations result in higher US hydro generation in late summer but lower generation in October.
- Adding October as a month in which the region has access to the California market supply.
- The Council's 2022 targeted energy efficiency savings are 317 average megawatts.
- Federal codes and standards are projected to save about 100 average megawatts in 2022.

It should be noted, however, that the LOLP for both years can change significantly if either demand or market conditions change. For example, the 2022 LOLP can range from a low of less than 2 percent to a high of nearly 24 percent depending on future conditions (although those cases would be extremely rare). The need for additional capacity to maintain adequacy ranges from zero (low load and high market) to 2,100 megawatts (high load and low market).

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.5.2 Complete Annual Adequacy Assessments

Background: 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 Council makes this assessment every year, investigating the adequacy of the power supply five years into the future.

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

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

Pacific Northwest Resource Adequacy Assessment for 2021-22

Executive Summary

Last year, the Council reported[1] that the Northwest power supply would become inadequate by 2021, primarily due to the retirement of the Centralia 1 and Boardman coal plants (1,330 megawatts combined). We estimated the loss-of-load probability (LOLP) in 2021 to be 10 percent, which is above the Council's adopted maximum of 5 percent. However, many changes have occurred to alter that assessment.

The updated assessment for 2021 shows an LOLP of just under 7 percent and the projected LOLP for 2022 is slightly higher at just over 7 percent. These results assume the Council's energy efficiency targets through 2022 will be achieved. To comply with the Council's adequacy standard, the region will need to add an estimated 400 megawatts of new effective capacity[2] by 2021.

Keep in mind that LOLP values are very sensitive to both the load forecast and Southwest market supply assumptions. For example:

- Decreasing the Southwest market supply by 500 megawatts increases the 2022 LOLP to about 8.5 percent, whereas increasing the available supply from the market by 500 megawatts decreases the LOLP to about 6 percent.

- Reducing the 2022 load forecast by 0.8 percent[3] brings the LOLP down to the Council's 5 percent standard and has roughly the same effect as adding 400 megawatts of effective capacity.

- Increasing the load forecast by 0.6 percent[4] raises the 2022 LOLP to about 9 percent and doubles the amount of effective capacity needed (from 400 to 800 megawatts) to bring the LOLP down to the Council's 5 percent standard.

Key updates since last year's assessment include:

- The revised load forecasts for 2021 and 2022 project a general trend toward lower winter peak loads and higher summer peak loads. This lowers the likelihood of winter shortfalls but increases the likelihood of summer problems.

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[1] The Council's 2016 Adequacy Assessment Report can be found at the following link: https://www.nwcouncil.org/media/7150591/2016-10.pdf

[2] "Effective capacity" in this context is that portion of a resource's nameplate capacity that can be counted on during any shortfall hour in the year. Wind resources, for example, typically have very low effective capacity values.

[3] This means multiplying the load in each hour of the year by 0.992.

[4] This means multiplying the load in each hour of the year by 1.006.

- The Canadian hydroelectric operation for 2021 under the Columbia River Treaty shows a shift in the timing and amount of inflows into the United States. The projection is for increased US hydro generation in summer but decreased generation in October. This lowers the likelihood of summer problems but significantly increases the probability of shortfalls in October.

- For past adequacy assessments, the Council assumed that the regional power supply had no access to the Southwest market during October. However, after reviewing current data, and with input from the Resource Adequacy Advisory Committee, this assumption has been modified to allow for some access. This offsets the effects of the anticipated shifts in hydroelectric generation due to Canadian operations and significantly decreases October shortfalls and the overall LOLP.

- The recently announced retirement of the North Valmy 1 coal plant (127 megawatts dedicated to regional service) in 2019 has the effect of increasing LOLP assessments by about 1 percent.

- Expected energy savings in 2022 from the Council's energy efficiency target (317 average megawatts) and from state codes and federal standards (about 100 average megawatts) effectively offset the loss of generation from the expected retirement of the Colstrip 1 and 2 coal plants (308 megawatts dedicated to regional service).

While we did not analyze the adequacy of today's power supply, planners generally agree that we currently have an adequate system. However, the planned loss of 1,457 megawatts of generating capacity by 2021 and of an additional 352 megawatts by 2022 would lead the region's power supply to a state of inadequacy unless additional actions are taken. The good news is that continued implementation of the Council's energy efficiency targets (1,570 average megawatts of cumulative savings from 2017 through 2022) and the energy savings from state codes federal standards go a long way to offset the loss of generating capability.

To ensure the continued adequacy of the power supply, we project that the region will need to acquire about 400 megawatts of new effective capacity by 2021, in addition to the targeted energy efficiency savings. Of course, this estimated need for new capacity is sensitive to both load and resource assumptions and that is why the Council updates its adequacy assessment every year.

Regional utilities are aware of this potential capacity need and have identified in their integrated plans over 1,200 megawatts of capacity-providing resources, 200 megawatts of demand response and over 500 megawatts of wind and solar capacity, which could be brought online by 2021, pending regulators' approvals.[5] These resources were not included in this analysis because they are not sited and licensed, but it is important to note that utilities are poised to acquire new capacity, if needed. It should also be noted that this analysis reflects the adequacy of the aggregate power supply. Individual

[5] Source: Pacific Northwest Utilities Conference Committee's 2017 Northwest Regional Forecast.

utilities within the Northwest have different resource mixes and different load shapes and, therefore, must evaluate their own need for new resources.

Pacific NW Power Supply Adequacy Assessment for 2021-22

NW Power and Conservation Council
Power Committee Meeting
June 13, 2017
Corvallis, Oregon

Northwest Power and Conservation Council

2021-22 Adequacy Summary[1]

- **2021 LOLP = 6.9%**
  - Boardman, Centralia 1 and N Valmy 1 plants retire (1,457 MW)
  - New load forecast shows lower winter peaks
  - New Canadian operation increases US hydro generation in summer but lowers hydro generation in October
  - New assumption – add spot market access in October
  - Reduced balancing reserves slightly increase hydro sustained peak
- **2022 LOLP = 7.2%**
  - Colstrip 1 and 2 and Pasco plants retire (352 MW)
  - 317 aMW of EE and 100 aMW of codes & standards savings
- **Effective Capacity Needed in 2021 ≈ 400 MW**
  (adding 400 MW in 2021 also covers the adequacy need in 2022)

[1]LOLP values and needed capacity can change significantly depending on future demand and Southwest market availability.

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2022 LOLP Heat Map

	Winter Spot Market			
Load	3400	3000	2500	2000
High	18.1	19.0	21.0	23.6
Med	5.8	6.2	7.2	8.6
Low	1.8	2.1	2.7	3.4

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2022 Capacity Needed (MW)

	Winter Spot Market			
Load	3400	3000	2500	2000
High	1500	1600	1830	2100
Med	115	200	385	650
Low	0	0	0	0

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RAAC Action Items

1. Review and update the availability of California market supplies for all months and over all hours.

2. Incorporate the effects of energy-efficiency savings and of codes-and-standards savings directly into the short-term load forecasting model for future adequacy assessments.

Additional Slides

LOLP Summary

Year	LOLP	Notes
2021	10%	Assessed in 2016

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Updated Forecast for 2021

+ **74** aMW in annual average load
– **300** MW in average winter peak
+ **870** MW in average summer peak

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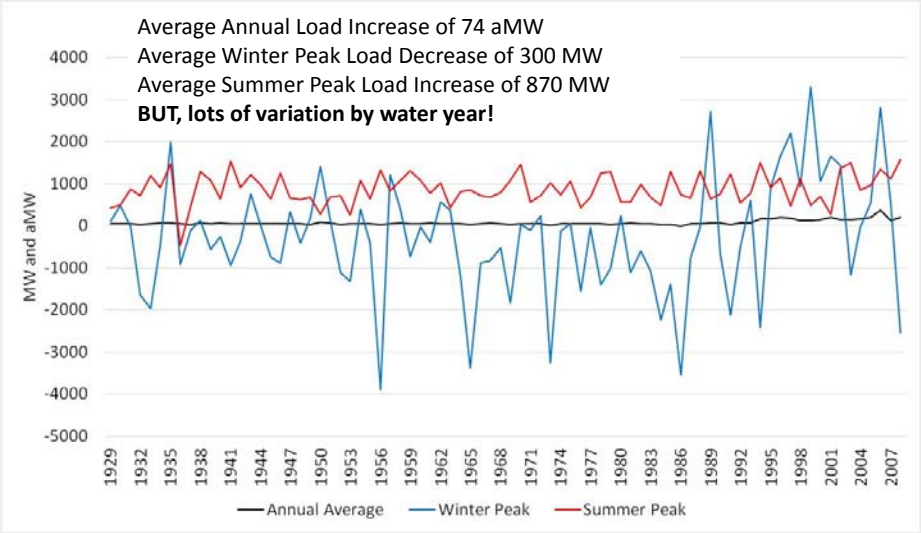
2021 Loads: 2017 vs. 2016 Forecast



New Load Forecast for 2021

Year	LOLP	Notes
2021	10%	Assessed in 2016
2021	**9%**	**Use new load forecast for 2021**

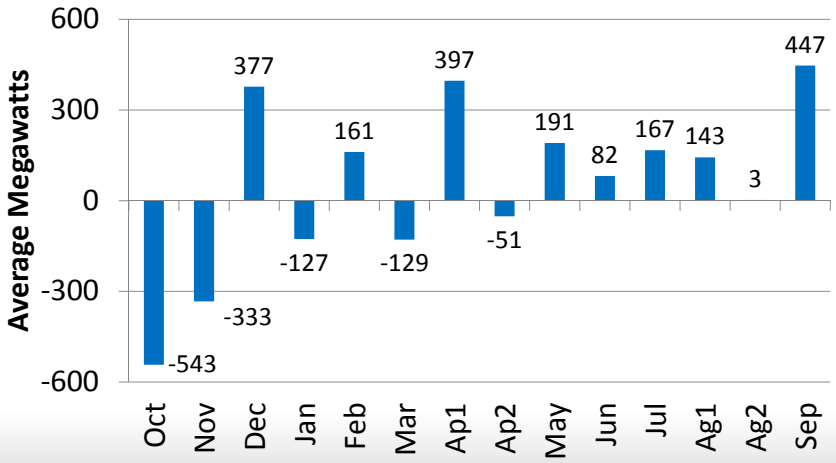
New Hydro Regulation

1. Change in Canadian monthly outflows
   - October inflows are reduced significantly (leads to lower hydro generation in October)
   - Summer inflows are increased (helps to reduce summer shortfalls)

2. Reduction in balancing reserves (INC/DEC)
   - Leads to an increase in sustained peaking capability in most months
   - Smaller effect overall than inflow change

Difference in Hydro Generation

(Due to Change in Canadian Outflows)



Effect of New Hydro Regulation

Year	LOLP	Notes
2021	10%	Assessed in 2016
2021	9%	Use new load forecast for 2021
2021	**10.2%**	**Add new hydro regulation**

Spot Market in October

- Use 50% of the winter spot market availability in October
- For this step, the October spot market is set to 1,250 MW

Effect of Spot Market in October

Year	LOLP	Notes
2021	10%	Assessed in 2016
2021	9%	Use new load forecast for 2021
2021	10.2%	Add new hydro regulation
2021	**5.9%**	**Add Oct spot market**

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Removing North Valmy 1 Coal

Year	LOLP	Notes
2021	10%	Assessed in 2016
2021	9%	Use new load forecast for 2021
2021	10.2%	Add new hydro regulation
2021	5.9%	Add Oct spot market
2021	**6.9%**	**Remove N Valmy 1 coal plan (127 MW) – 2021 Ref Case**

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Moving from 2021 to 2022

- Already have new hydro regulation
- Two additional changes required:
  1. Resource retirements
     - Colstrip 1 and 2 retire (308 MW)
     - Pasco gas plant removed (44 MW)
  2. New load forecast for 2022

Effect of Removing Resources

Year	LOLP	Notes
2021	10%	Assessed in 2016
2021	9%	Use new load forecast for 2021
2021	10.2%	Add new hydro regulation
2021	5.9%	Add Oct spot market
2021	**6.9%**	**Remove N Valmy 1 coal plan (127 MW) – Ref Case**
2021	**9.5%**	**Remove Colstrip 1 and 2 coal plants (308 MW)**

Changes in Load 2021 to 2022

- **175** aMW in annual average load
- **219** MW in average winter peak
- **89** MW in average summer peak

EE and codes-and-standards savings incorporated into 2022 loads:

- **317** aMW additional EE energy savings
- **100** aMW additional codes and standards savings

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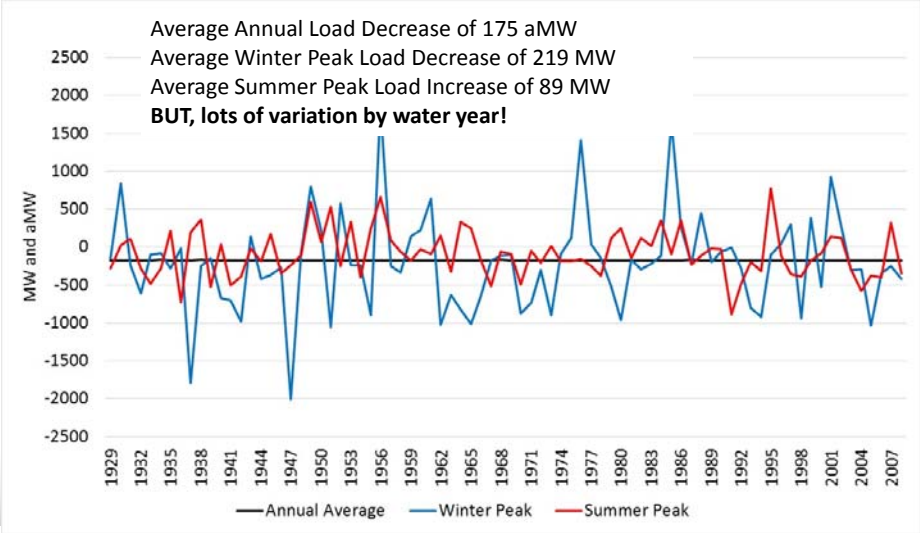
2022 vs. 2021 Loads



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Effect of Loads for 2022

Year	LOLP	Notes
2021	10%	Assessed in 2016
2021	9%	Use new load forecast for 2021
2021	10.2%	Add new hydro regulation
2021	5.9%	Add Oct spot market
2021	**6.9%**	**Remove N Valmy 1 coal plan (127 MW) – 2021 Ref Case**
2021	9.5%	Remove Colstrip 1 and 2 coal plants (308 MW)

2022	**7.2%**	**Replace 2021 with 2022 load forecast – 2022 Ref Case**

Effect of STM Load Forecast

Year	LOLP	Notes
2021	10%	Assessed in 2016
2021	9%	Use new load forecast for 2021
2021		Add new hydro regulation
2021	5.9%	Add Oct spot market
2021	6.9%	Remove North Valmy 1 coal plan (127 MW) – 2021 Ref Case
2021	9.5%	Remove Colstrip 1 and 2 coal plants (308 MW)

2022	**7.2%**	**Replace 2021 with 2022 load forecast – 2022 Ref Case**
2022	**6.9%**	**Use 2022 short-term model load forecast**
		RAAC members wanted to see the effects of using the STM
		forecast instead of the hybrid load forecast