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PNW Coal Closure Study

Resource Adequacy Technical Committee Meeting

February 12th, 2015



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Outline

- Prior Closure Studies (2013 and 2014)
- 2015 Closure Study Update
- Replacement Plans
- Bookend Study – Solar PV
- Bookend Study – Wind
- Overgeneration
- South to North Transfer capability 2011 to 2014

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January 2013 Closure Assessment

- Fiscal Year Study for 2021
- Centralia 1 (670 MW winter capacity) and Boardman (580 MW winter capacity) retiring by end of 2020
- Even though the plants are available Oct to Dec 2020, they have not been included in closure assessments
- Based on the 2017 Resource Adequacy Assessment (published December 2012)
- LOLP assessment for 2021 was 15.3 percent without the plants
- 2,000 MW of new dispatchable resource capability required to bring the LOLP down to the 5 percent standard

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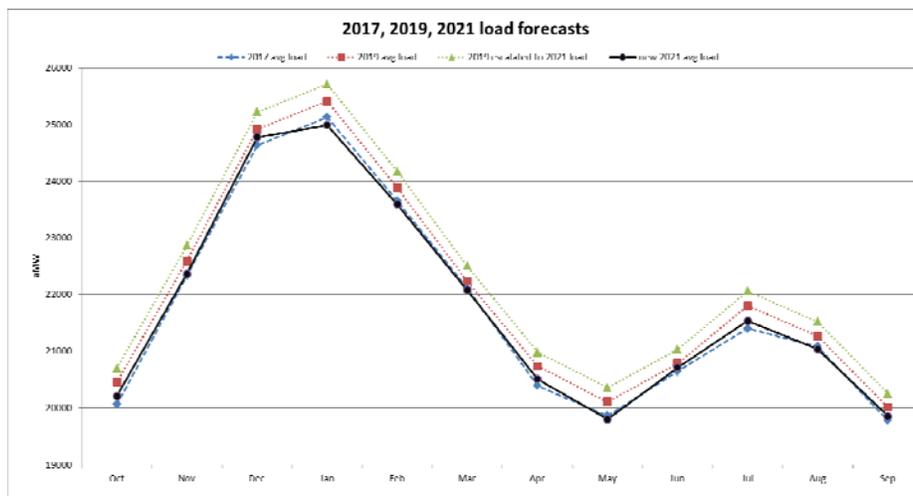
October 2014 Closure Assessment

- Based on the 2019 Resource Adequacy Assessment (published May 2014)
 - Includes all cost effective conservation of 6th Power Plan (loads grow 0.6% annually after conservation – total of 1.2% to 2021)
 - Port Westward 2 (220 MW) and Carty (440 MW) added
- 2021 LOLP is 10.9 percent without the plants
 - Compared to 15.3 percent of the 2013 Assessment for 2021
- It would take approximately 1,700 MW of dispatchable units reduce the LOLP to the 5 percent standard
 - Compared to the 2,000 MW of the 2013 Assessment for 2021
 - 1,700 MW is divided into four units at 400 MW each and one unit at 100 MW (for forced outage calculations)

February 2015 Closure Assessment

- 2021 Load Forecast prepared by Council staff (Jan 15)
 - Close to the 2017 RA Assessment load forecast
- Major Resource Changes since Oct 14
 - Big Hannaford IPP (248 MW winter capacity) decommissioned in 2014
- 2021 LOLP is 8.1 percent without the plants
 - Compared to 15.3 percent and 10.9 percent of prior studies
- It would take approximately 1,150 MW of dispatchable units reduce the LOLP to the 5 percent standard
 - Compared to the 2,000 MW and 1,700 MW of prior Assessments for 2021
 - 1,150 MW is divided into three units (400, 400, and 350 MW) for forced outage calculations)

Load Forecasts drops



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Coal Replacement Plans

- Boardman – 601 MW
 - The 2016 PGE IRP process will include the Boardman coal plant replacement (and any additional RPS resources required post 2020)
- Centralia – 730 MW
 - IPP plant and replacement is uncertain (can't recover costs in a rate process)
 - Existing gas plant on site (Big Hannaford) decommissioned last year
 - Expedited permitting available for a new gas-fired plant at site

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Bookend Studies

- Could solar PV or wind reduce the LOLP to 5 percent in 2021?
 - These studies are not power plans and only focus on meeting the LOLP reliability criteria
 - No assumptions are made about costs of these resources (including integration)
 - Energy storage not considered
 - Positive and negative environmental attributes not considered
 - Siting and permitting not considered

Bookend Studies - Solar PV

- 2021 LOLP assessment of 5 percent if the region adds 12.7 GW of solar PV
 - (current U.S. installed base is 15.9 GW of which 17.4 MW is PNW utility scale solar)
- Only a limited amount of *actual* hourly solar data was available for the study
 - Based on 26 months of actual data (monthly hourly averages)
 - Small set of solar projects in southern Oregon (15 percent west side and 85 percent east side)

Solar Capacity Factors

Capacity Factor Table for Solar (November 2012 to December 2014)

Hour Ending:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Oct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.26	0.43	0.49	0.49	0.46	0.47	0.47	0.47	0.38	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.17	0.25	0.29	0.32	0.34	0.31	0.27	0.14	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dec	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.19	0.22	0.22	0.23	0.23	0.20	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.13	0.28	0.30	0.30	0.31	0.32	0.33	0.22	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.25	0.35	0.37	0.39	0.38	0.36	0.36	0.28	0.12	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.30	0.46	0.51	0.54	0.55	0.53	0.49	0.48	0.40	0.24	0.06	0.00	0.00	0.00	0.00	0.00	0.00
Apr	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.23	0.48	0.55	0.61	0.64	0.65	0.66	0.62	0.58	0.54	0.42	0.20	0.02	0.00	0.00	0.00	0.00	0.00
May	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.40	0.54	0.59	0.63	0.64	0.65	0.63	0.60	0.58	0.53	0.46	0.30	0.09	0.00	0.00	0.00	0.00	0.00
June	0.00	0.00	0.00	0.00	0.00	0.01	0.19	0.45	0.58	0.62	0.66	0.68	0.67	0.68	0.66	0.64	0.61	0.54	0.42	0.19	0.01	0.00	0.00	0.00	0.00
July	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.44	0.61	0.67	0.70	0.72	0.71	0.67	0.65	0.63	0.61	0.53	0.37	0.14	0.01	0.00	0.00	0.00	0.00
August	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.26	0.50	0.59	0.63	0.65	0.64	0.62	0.59	0.57	0.52	0.45	0.26	0.04	0.00	0.00	0.00	0.00	0.00
Sept	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.41	0.53	0.54	0.55	0.54	0.54	0.53	0.51	0.47	0.34	0.11	0.00	0.00	0.00	0.00	0.00	0.00

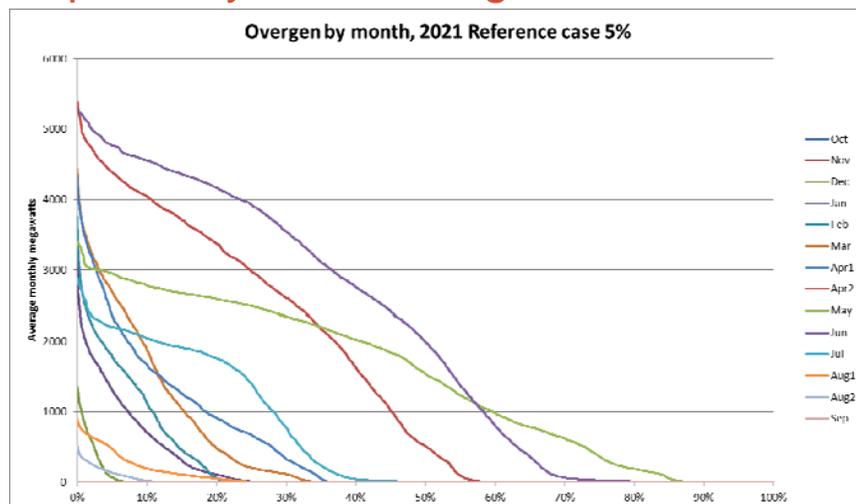
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Bookend Studies - Wind

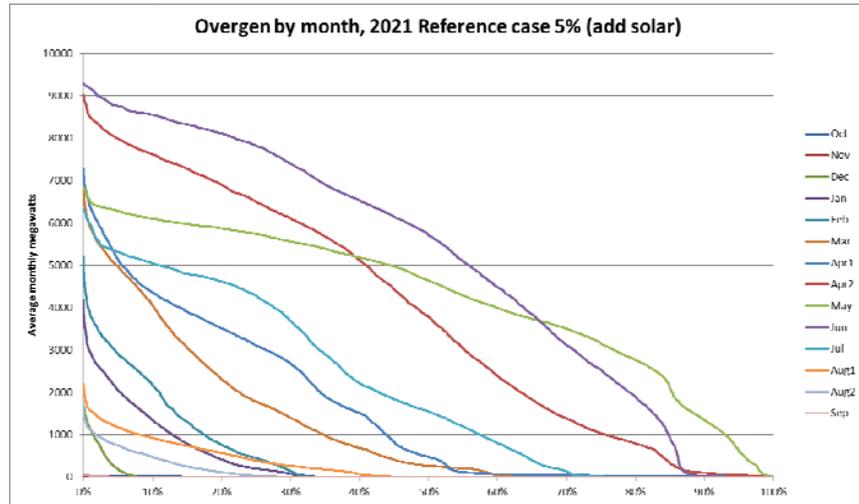
- A 2021 LOLP assessment of 5 percent could not be achieved with wind
 - 10 GW of wind lowered the LOLP to 6.9 percent
 - Larger or lower amounts of wind increased the LOLP
 - Study used existing wind capacity factors developed for RAAC based on relationship between load center temperature and BPA wind fleet generation
 - Because they are based on the existing BPA wind fleet, they do not reflect the capability of wind in other areas (Coastal, Idaho, Montana, and Wyoming)

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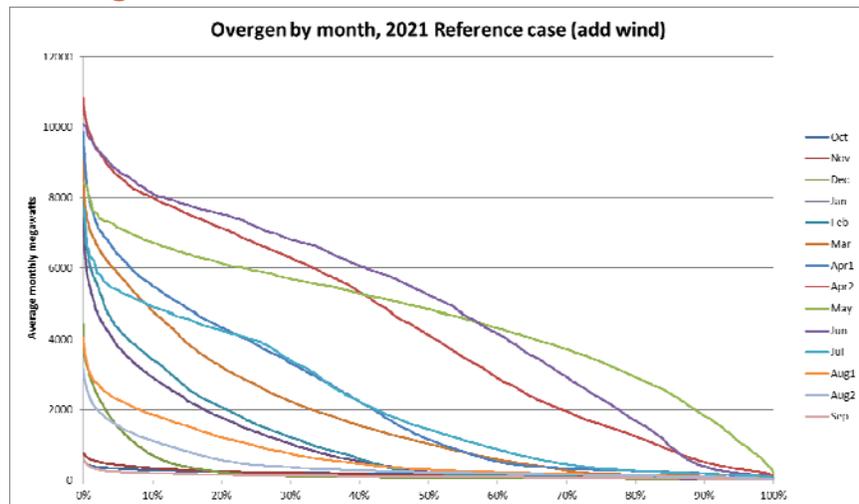
1.15 GW dispatchable generation added to power system – overgeneration



12.7 GW of Solar added to power system – overgeneration



10 GW of Wind added to power system – overgeneration



South to North Actual Transfer Capability

