

Central Oregon Long-Term Study Summary
Bonneville Power Administration
Transmission Planning - TPP
3/21/2017

EXECUTIVE SUMMARY

The Bonneville Power Administration (BPA) completed studies in January 2017 to determine main grid transmission upgrades needed to allow Central Electric Cooperative (CEC), PacifiCorp (PAC), and Midstate Electric Cooperative (MEC) to interconnect requested new large load additions. This study includes the amount of additional interconnection capacity and the timing for completing the proposed upgrades.

Prior to 2017, the total peak load in the central Oregon area served from the BPA transmission system was 686 MW in winter and 454 MW in summer. The large load additions requested in central Oregon in 2016 total 440 MW. That significant increase in load presents serious challenges for BPA and utilities in central Oregon because it has far outpaced what was expected for normal load growth in the area.

Long-Term Plan

Bonneville installed a second 500/230 kV transformer at its Ponderosa Substation in November 2012. The primary objective of the Ponderosa Substation upgrade was to maintain BPA's standard of service and meet future load growth in the area, particularly in Prineville, Bend and Redmond. However, this also enabled the interconnection of a 120 MW data center load on PAC's system in Prineville.

During summer peak loads, Bonneville's transmission system can feed up to 560 MW in the central Oregon area from the existing system and relying on operating measures. This includes PAC's 120 MW data center load addition in Prineville requested in 2012 plus reasonable load growth in the central Oregon area for the next 10 years. In 2016, three new interconnection requests for large load additions totaling 440 MW in the central Oregon area were studied, which corresponds to a total central Oregon summer peak load level of 1000 MW. In response to these interconnection requests, BPA has committed to installing a new series capacitor at Slatt substation in the Slatt – Buckley 500 kV line, as well as upgrading the series capacitors at Bakeoven in the John Day – Grizzly 500 kV No. 1 and No. 2 lines. This will increase the interconnection capability by 315 MW which corresponds to a central Oregon summer peak load level of 875 MW. This project is anticipated to be completed by June 2019.

When the central Oregon area load exceeds a summer peak of 875 MW, a remedial action scheme (RAS) to trip load for main grid contingencies, along with a local protection scheme would be required to provide additional interconnection capability. Preliminary studies show the main grid could support a central Oregon load level of up to 1145 MW during summer using the RAS and local protection scheme. These schemes will need to be further studied and would likely take about two to three years to implement. A major 500 kV system reinforcement, such as a new 500 kV line, would be required to provide interconnection capability beyond 1145 MW in the central Oregon area. This would be a significant challenge and take at least 6 years to complete.

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This long-term plan only addresses the ability of the main grid to support load interconnection and does not include any local 230 kV and 115 kV interconnection requirements. Furthermore, these results are based on current system conditions and assumptions. Physical changes and uses of the transmission system can change over time. BPA Transmission Planning assesses the system on an annual basis and updates area studies as needed when conditions change, based on expected system conditions.

The technical studies included in this document only address interconnection capacity for load additions in central Oregon. Transmission service for delivery of resources to serve the loads are not included. Transmission service must be requested and arranged for separately. These studies were conducted using the best available information at the time of the study. Findings and recommendations are based on assumptions, which could change. BPA reserves the right to modify any content in this report.

BACKGROUND

The central Oregon load area includes the area east of the Cascades Mountain range roughly from Maupin to La Pine, Oregon. It includes northeast Deschutes County, northwest Crook County, and southern Jefferson County. The transmission system in this area serves the cities of Redmond and Bend, as well as many outlying communities such as Madras, Prineville, Sisters and La Pine. The total area peak load in central Oregon has reached 686 MW in winter and 454 MW in summer. Customers served in this area include PacifiCorp (PAC), Central Electric Cooperative (CEC), Harney Electric Cooperative (HEC) and Mid State Electric Cooperative (MEC).

The central Oregon load area is served from three primary sources:

- BPA's Ponderosa Substation connected to BPA's Grizzly-Summer Lake 500 kV line and BPA's Grizzly-Captain Jack 500 kV line
- BPA's Big Eddy Substation over BPA's Big Eddy-Redmond 230 kV line
- Portland General Electric's (PGE) Round Butte-Redmond 230 kV line

The majority of the central Oregon load area is served from Ponderosa with the remaining served from Round Butte and Big Eddy. A large portion of the new requested load additions are in the Prineville area which will increase the percentage served from Ponderosa.

Bonneville's Redmond Substation also serves loads within the central Oregon area, including existing CEC load. Both BPA's Redmond and Ponderosa substations serve PAC's Prineville load, including their data center load addition. BPA's La Pine Substation serves MEC load.

Although both summer and winter are critical seasons for the local area, summer is the most limiting season for main grid issues. Winter loads are higher due to heating demands. However, facility ratings are lower in summer due to higher ambient temperatures. Normal incremental load growth in the central Oregon area has generally been around 1 - 2% per year. In the 2012

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timeframe multiple requests for new large load additions were made in Prineville, primarily for data center loads. At that time, studies showed that adding a second 500/230 kV transformer at Ponderosa would allow up to 400 MW of additional load (beyond existing loads) to be interconnected in central Oregon. Of those interconnection requests made to BPA, 120 MW is moving forward.

In 2016, three new requests for large load additions totaling 440 MW in the central Oregon area were studied. These studies showed that the existing transmission system is capable of feeding 560 MW peak load in the summer, which includes PAC's 2012 load addition of 120 MW in Prineville plus reasonable load growth in the central Oregon area for the next 10 years. These studies also showed main grid reinforcements are needed before any new large load requests can be interconnected to the transmission system.

Certain assumptions about BPA equipment and southern Oregon power generation resources resulted in main grid limitations occurring sooner than the 2012 studies anticipated. These include assumptions about the following:

- Slatt Thyristor Controlled Series Capacitor (TCSC)
 - The Slatt TCSC was retired from service in 2014 due to the aging condition of the equipment. The removal of this equipment results in more flow across the John Day – Grizzly No. 1 and No. 2 500 kV lines, which decreases the interconnection capability to central Oregon. BPA assumed the series capacitor was in service in the 2012 studies but out of service in the 2016 studies.
 - Replacing the TCSC when it was retired would have been a costly project and at that time Planning did not identify a need to replace the TCSC or add series compensation in that part of the system.
- Southern Oregon generation resources
 - The studies completed in 2012 assumed the Klamath cogeneration project was generating power. However, historical data since then shows this project can't always be counted on to be generating power during summer peak loads. Therefore, the 2016 studies assumed this project was not generating power resulting in more limiting conditions.
 - In addition, other generators in southern Oregon were assumed on-line in the 2012 studies. These were assumed off-line in the 2016 studies to better reflect expected conditions.

PURPOSE

The purpose of this study was to determine main grid upgrades needed to support interconnection requests for new large load additions in central Oregon. This study includes the amount of additional interconnection capacity and the timing for completing the proposed system upgrades.

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This study only addresses main grid impacts and does not include any local 230 kV and 115 kV interconnection requirements. Furthermore, these results are based on current system conditions and assumptions. Physical changes and uses of the transmission system can change over time. BPA Transmission Planning assesses the system on an annual basis and updates area studies as needed when conditions change, based on expected system conditions. Additionally, these studies only address the main grid ability to support interconnection capacity in central Oregon and do not address transmission service to deliver generating resources to load. Transmission service must be requested and arranged for separately.

BPA's long-term plan of service is described below.

LONG-TERM PLAN OF SERVICE

Slatt Series Capacitor Addition and Bakeoven Series Compensation Upgrade

This project involves adding a new 14 ohm series capacitor at Slatt substation in the Slatt – Buckley 500 kV line and upgrading the existing series capacitors at Bakeoven in both John Day – Grizzly #1 and #2 500 kV lines by reducing the size from 25 ohms to 21.25 ohms. This will increase the load interconnection capability in central Oregon by 315 MW which corresponds to an overall central Oregon load level of 875 MW in the summer. This project is currently going through the project scoping process. It is estimated this project can be in-service by June 2019.

Although the estimated in-service date is June 2019, it is possible for the first 90 MW of the large load additions to be added prior to this date. From a main grid perspective, BPA can allow the first 90 MW to interconnect to BPA's system as long as it is after October 1, 2018 after expected summer peak use and assuming energization of the series capacitor project is prior to the 2019 summer season. However, it should be noted that the large load requests also require local 230 kV and 115 kV interconnection requirements which are being addressed in the interconnection study process being conducted in response to the individual interconnection requests. If the local interconnection requirements require a longer schedule to implement, those schedules could drive the interconnection schedule.

Remedial Action Scheme and Local Protection Scheme

A Remedial Action Scheme (RAS) would include tripping the new large load additions for double contingency outage combinations of any two of the three 500 kV lines north of Grizzly substation or any two of the three 500 kV lines south of Grizzly substation. The local protection scheme would involve adding protection to trip both ends of a 500 kV line if only one end were to open south of Grizzly substation. Preliminary studies show this could increase the load interconnection capability in central Oregon by an additional 270 MW corresponding to an overall central Oregon load level of 1145 MW in the summer. These schemes will need to be further studied and would likely take about 2-3 years to implement.

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NEXT STAGES OF MAJOR REINFORCEMENT

Major 500 kV Reinforcement

A major 500 kV system reinforcement, such as a new 500 kV line, would be required to provide interconnection capability beyond 1145 MW in the central Oregon area. This would be a significant challenge and take over 6 years to complete. Once interconnection requests in the central Oregon area result in interconnection capacity needs beyond a total central Oregon load of 1145 MW, a detailed system study would be required to determine the transmission expansion required. Close coordination with the other joint owners of the California - Oregon Intertie (COI) would also be required.

Interconnection Facilities

Additional interconnection facilities required in the local area for new line and load interconnection requests depend on the size, type and location of the new load. These facilities could include additional 115 kV or 230 kV transmission lines, 230/115 kV transformation, as well as possible shunt capacitor additions for voltage support. It can also include special protection schemes to address N-1-1 contingencies. Interconnection facility requirements will be identified during the interconnection study process for new requests.

SUMMARY

- The existing transmission system is capable of serving a central Oregon load level of 560 MW (summer peak), which includes PAC's 2012 load addition request (120 MW) in Prineville plus reasonable load growth in the central Oregon area for the next 10 years.
- The Slatt series capacitor addition and Bakeoven series capacitor upgrade project will increase the interconnection capability by 315 MW which corresponds to an overall central Oregon load level of 875 MW. This project is anticipated to be completed by June 2019.
- A RAS along with a local protection scheme would be required to increase the load interconnection capability in central Oregon by an additional 270 MW which corresponds to an overall central Oregon load level of 1145 MW. These schemes would need to be further studied and would likely take about two to three years to implement.
- A major 500 kV system reinforcement, such as a new 500 kV line, would be required to provide interconnection capability beyond 1145 MW in the central Oregon area. This would be a significant challenge and take 6+ years to complete.
- This long-term plan only addresses the ability of the main grid to support load interconnection and does not include any local 230 kV and 115 kV interconnection requirements. Furthermore, these results are based on current system conditions and assumptions. Physical changes and uses of the transmission system can change over

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