

PORTLAND AREA
TRANSMISSION SYSTEM STUDY
2011-2015

Executive Summary

The focus of this study is the 230 kV, 115 kV, 69 kV and 57 kV transmission system, including transmission and distribution substations, in the Portland area. The study area also encompasses the Lewis River hydroelectric generation and transmission system, located in southwestern Washington. The purpose of this study is to identify system constraints and local reinforcement needs to meet area load growth for the period from the 2011 summer through the 2015-2016 winter season.

The non-coincidental PacifiCorp load in the study area is projected to peak at 456 MW during summer and 472 MW during winter of 2011. Based on historical load data, the annual load growth rate is 1.0% in both summer and winter. At this rate, non-coincidental peak load in the area is anticipated to reach 477 MW and 491 MW, respectively for summer 2015 and winter 2015-2016 season. The overall load factor for the Portland Area is 62.4%.

The more significant system deficiencies identified in the study include the following:

230 kV Birdsedale Lines Capacity

The section of the 230 kV Birdsedale Lines between PacifiCorp Troutdale and PGE Gresham and Linneman is limited in capacity by substation equipment at the PGE termination of these lines. The Troutdale-Gresham line #2 is limited in winter, while the Troutdale-Linneman line #1 is limited both in summer and in winter. Single contingency events on these lines with reduced ratings result in violation of the NERC Category B reliability requirement as early as winter 2011-2012. However, transmission conductor and Troutdale Substation equipment ratings are not exceeded for single contingencies through the study period. The recommended approach is to request PGE to upgrade the limiting equipment at Gresham and Linneman substations to facilitate full utilization of the conductor rating and ensure compliance with reliability standards.

230 kV Birdsedale Line #2 Switching and Operability Deficiency

There is presently no capability to properly de-energize the 230 kV Birdsedale Line #2 between PacifiCorp Troutdale and PGE Gresham. There is a plain disconnect switch at Troutdale and a breaker at the Gresham end of the line. Dropping the line produces line charging that significantly exceeds the capability of the existing switch 1P39 at Troutdale. De-energizing the line requires opening the 115 kV loop and disconnecting both transformers from the second line at Troutdale, opening the 230 kV loop at BPA Troutdale, dropping the entire line at Gresham, and then restoring Troutdale. The recommendation is to add a 230 kV breaker at Troutdale, building toward an ultimate 230 kV breaker and a half scheme. In addition to correcting a significant switching limitation, the breaker will improve system reliability by keeping the transformers and the 115 kV

loop connected at Troutdale for a single contingency on the PacifiCorp Troutdale-Gresham line and mitigating system deficiencies resulting from the double-circuit contingency between PacifiCorp Troutdale and Gresham/Linneman.

Troutdale 115 kV Bus Configuration

The 230-115 kV transformer T-3790 at Troutdale does not have a low side breaker. The 115 kV line breakers 2P112 and 2P113 provide 115 kV line and transformer protection as well as isolate a 115 kV source for a fault on the 230 kV line. This results in opening of the 115 kV loop between Sifton and Knott for transformer and 230 kV line faults. The 115 kV connection is beneficial during these outage events as it maintains a source into Knott and reduces loading on the remaining circuits. It is recommended to install a third 115 kV breaker at Troutdale, forming a 115 kV ring bus. This project will improve system reliability and operability, while alleviating loading during contingencies.

East Side 11.7 kV System Capacity

The existing 11.7 kV infrastructure supplied from Knott is exceeding summer capacity. The backup for the 15 MVA, 57-11.7 kV transformer at Knott is provided by a 10 MVA spare, limiting the load carrying capability. In addition, transformer T-3799 loading at Holladay exceeds the contractual capacity reserve for a nearby large customer load. Following the expansion of this load in 2011-2012, transformer normal loading will exceed capacity as early as 2011. Continued load growth is also projected to exceed the redundant capacity of Albina transformers supplying the critical 11.7 kV downtown Portland load by 2013 summer. The recommended solution to address the 11.7 kV east side capacity problems also considers a number of pressing issues including the condition of aging 11.7 kV and 57 kV equipment, relaying and control building issues at Knott, switching deficiencies on the Knott-Holladay 115 kV line, the outage exposure for the Albina-Knott, Knott-Holladay and the 12.5 kV distribution substation at Knott. The recommended project is the 11.7 kV capacity increase and addition of 115 kV breakers at Knott.

69 kV Sundial Line N-1 Capacity

Due to the general load growth in the northeast Portland area, the projected current year summer load exceeds the capacity of either end of the Sundial Line. By 2015 summer, an outage event on the Albina-Vernon section will result in 10 MVA of load shedding and an outage on the Troutdale-Alderwood section will leave 14 MVA of load out of service. Two of the substations supplied by the Sundial Line are the primary source for the Portland International Airport. To provide load relief and resolve the single contingency issues on the Sundial Line, the study proposes the NE Portland Voltage Upgrade Project. The project converts Vernon and Parkrose substations to 115 kV, forms a 115 kV path between Albina, Vernon and Parkrose, and creates a 69 kV path between Killingsworth and Columbia. In Addition to resolving the Sundial Line contingency issues, the proposed project also mitigates all 57 kV system normal and contingency overloads, while addressing the general condition and operability issues at Albina and Parkrose substations. The project achieves significant cost savings by utilizing existing 57 kV and

69 kV line routes and re-using four existing distribution transformers and two transmission transformers.

Albina 11.7 kV Breakers

Breakers 5P40 and 5P60 at Albina Substation are overdutied by 16.5% and 7.2%, respectively. The 20 kA oil filled breakers protect the transformer tertiary windings and the 11.7 kV bus. Whenever transformer T-3605 is out of service, the interrupting capability of 5P60 is exceeded by 19.5%, while 5P40 is overdutied by 29.7% whenever T-901 is out of service. The study recommends replacing both breakers with new 2000 A, 40 kA breakers.