BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION,

Complainant,

v.

PUGET SOUND ENERGY,

Respondent.

Docket UE-22____
Docket UG-22____

TWENTIETH EXHIBIT (NONCONFIDENTIAL) TO THE
PREFILED DIRECT TESTIMONY OF

PAUL K. WETHERBEE

ON BEHALF OF PUGET SOUND ENERGY

JANUARY 31, 2022
Clearwater Wind Integration Study Report

Puget Sound Energy

December 2021
In 2020, Puget Sound Energy (PSE) contracted Energy and Environmental Economics, Inc. (E3) to determine how bringing new renewable plants online might affect their balancing area’s (BA) need for ancillary services.

PSE is a member of the real-time Western Energy Imbalance Market (EIM).¹² The EIM allows PSE to purchase and sell electricity with other Balancing Authorities (BAs) to reduce annual costs.³ In order to be able to purchase and sell electricity in the EIM, BAs are required to pass several real-time resource sufficiency tests. These tests include showing that the BA has sufficient flexibility on internal resources to manage unexpected changes in their net load (load minus wind minus solar) relative to what was forecast ahead of the hour, when entering the EIM. The EIM dictates the amount of flexibility that BAs must hold to cover net load forecast error via a flexibility product known as the EIM’s flexible ramping product (FRP).⁴ Forecast error can be affected by both net load changing rapidly within an hour and uncertainty, in that forecasts are imperfect in anticipating what load, wind and solar output will be for each minute of the upcoming hour. If a BA does not have enough flexibility to meet the FRP in a given EIM market interval, they are not allowed to buy or to sell in the EIM in that interval, thus reducing the BA’s potential net monetary savings.

¹ https://www.westerneim.com/Pages/About/default.aspx
³ https://www.westerneim.com/Pages/About/QuarterlyBenefits.aspx
PSE contracted with E3 to determine how the Clearwater Wind phase 1 project would affect PSE’s flexible ramping needs. E3 developed its RESERVE model\(^5\) to derive ancillary services needs in heavily renewable electricity systems. RESERVE can model the uncertainty component of the 15-minute EIM market FRP in an approximate fashion using load, wind and solar forecast data and actual data.

At the time E3 performed the study, the Clearwater Wind facility was not operational, and the Skookumchuck wind plant was under construction. Therefore, E3 developed simulated wind plant production data for all of PSE’s wind plants expected to be online in 2023 using a National Renewable Energy Laboratory (NREL) database.\(^6\) This simulated wind data included time-correlated values for PSE’s forecast and actual wind output at each project location, with actual data available in every 5-minute interval, as well as an hour-ahead forecast of hourly wind output. E3 benchmarked the NREL wind profiles to actual operational data for existing PSE plants and adjusted the capacity factor and mean average error of all the simulated wind plants to match observed and projected data provided by PSE. E3 also acquired historical PSE forecast and actual load for the same time window as the wind forecasts and scaled it to projected 2023 levels of load using the ratio of historical to 2023 annual energy consumption to account for expected PSE load growth.

\(^{5}\) https://www.ethree.com/tools/reserve-model/
\(^{6}\) https://www.nrel.gov/grid/wind-toolkit.html
E3 then ran two cases with this data to calculate PSE flexible ramping requirements using RESERVE: 1) the base-case portfolio of PSE wind resources (which excluded the Clearwater Wind facility, but included Skookumchuck, Vantage, and Wild Horse wind) and PSE load, and 2) this base case portfolio plus the Clearwater Wind facility. By comparing the two cases, E3 is able to assess the increase in FRP for each time interval that would occur as a result of adding Clearwater Wind.

At the time of the study, Clearwater Wind 1 was expected to be a 375 MW facility, though PSE is now planning to be an offtaker for only 350 MW of wind from Clearwater Wind 1. As a result, E3 scaled down the incremental reserves needs by the ratio of 350 MW over 375 MW. While the FRP is a net load-based product, there is generally minimal covariance between wind and load uncertainty. As a result, E3 believes this is not an approximation that will have a large effect on the results of planning analyses involving Clearwater Wind 1.

The scaled increase in FRP uncertainty component headroom and footroom needed to accommodate Clearwater is shown in Table 2 and Table 1 on a month-hour average basis. With the addition of the 350 MW Clearwater Wind plant, E3 estimated that annual average headroom needed for FRP uncertainty increased by 40 MW, and the annual average footroom increased by 45 MW. Together this result implies that the normalized total growth (headroom + footroom) is 24% of
the nameplate capacity of Clearwater Wind (40 MW average headroom + 45 MW footroom divided by 350 MW wind nameplate capacity). As the table indicates, the largest increase in modeled FRP headroom and footroom needs occurs in summer
months, but the overall increase is relatively evenly distributed throughout the year.