

**EXH. PKW-34CT
DOCKETS UE-190529/UG-190530
UE-190274/UG-190275
2019 PSE GENERAL RATE CASE
WITNESS: PAUL K. WETHERBEE**

**BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION**

**WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION,**

Complainant,

v.

PUGET SOUND ENERGY,

Respondent.

**Docket UE-190529
Docket UG-190530 (*Consolidated*)**

In the Matter of the Petition of

PUGET SOUND ENERGY

**For an Order Authorizing Deferral
Accounting and Ratemaking Treatment
for Short-life IT/Technology Investment**

**Docket UE-190274
Docket UG-190275 (*Consolidated*)**

**PREFILED REBUTTAL TESTIMONY (CONFIDENTIAL) OF
PAUL K. WETHERBEE
ON BEHALF OF PUGET SOUND ENERGY**

**REDACTED
VERSION**

JANUARY 15, 2020

PUGET SOUND ENERGY

**PREFILED REBUTTAL TESTIMONY (CONFIDENTIAL) OF
PAUL K. WETHERBEE**

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PUGET SOUND ENERGY

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1 **PUGET SOUND ENERGY**

2 **PREFILED REBUTTAL TESTIMONY (NONCONFIDENTIAL) OF**
3 **PAUL K. WETHERBEE**

4 **I. INTRODUCTION**

5 **Q. Are you the same Paul K. Wetherbee who submitted prefiled direct**
6 **testimony on June 20, 2019, on behalf of Puget Sound Energy (“PSE”) in this**
7 **proceeding?**

8 A. Yes. On June 30, 2019, I filed the Prefiled Direct Testimony of Paul K.
9 Wetherbee, Exh. PKW-1CT, and thirty-two supporting exhibits (Exhibit PKW-2
10 through Exhibit PKW-33C).

11 **Q. What is the purpose of your rebuttal testimony?**

12 A. First, this rebuttal testimony presents PSE’s response to issues raised in the
13 prefiled response testimonies of Commission Staff. Specifically, the testimony
14 addresses:

- 15 (i) how best to utilize the full 80 year record of hydroelectric
16 generation data, by averaging the data and running Aurora
17 using the average of 80 years of data, or by running Aurora
18 separately for each water year and averaging the power cost
19 results from multiple runs;
- 20 (ii) which wind forecasts should be used to estimate power
21 costs; and
- 22 (iii) an adjustment to the availability of the Westcoast pipeline.

1 Next, the testimony addresses the estimated power cost impact of removing the
2 Skookumchuck and Lund Hill Power Purchase Agreements (“PPA”) from the rate
3 year portfolio, as proposed by Public Counsel witness Carla Colamonici.

4 The testimony then presents updated power costs for the rate year May 2020 –
5 April 2021. PSE’s proposed power costs in this rebuttal filing reflect (i) a limited
6 update incorporating only those changes specifically identified in the prehearing
7 conference and listed in Appendix B to Order 03, (ii) two corrections, and (iii) a
8 change based on Commission Staff’s recommendation.

9 Finally, the testimony provides an estimate of power costs including all known
10 changes since PSE calculated the power costs included in the Prefiled Direct
11 Testimony of Paul K. Wetherbee, Exh. PKW-1CT.

12 **Q. What level of power costs does PSE propose in this rebuttal filing?**

13 A. Projected rate year power costs in this rebuttal filing are \$771.0 million. This is

14 (i) a \$27.5 million (3.7 percent) increase from the
15 \$743.5 million of power costs presented in the Prefiled
16 Direct Testimony of Paul K. Wetherbee, Exh. PKW-1CT,
17 and

18 (ii) a \$71.8 million (10.3 percent) increase from the rates
19 approved in the contingent calculation version of the
20 2017 GRC settlement¹ and currently in place.

¹ *Wash. Utils. & Transp. Comm’n v. Puget Sound Energy*, Dockets UE-170033 & UG-170034 (consolidated), Order 08, Appx. B (Multiparty Settlement Stipulation and Agreement), Exh. H (Dec. 5, 2017).

1 Please see the First Exhibit to the Prefiled Rebuttal Testimony of Paul K.
2 Wetherbee, Exh. PKW-35, for a summary of proposed rate year power costs.

3 **II. PSE'S PROPOSED METHODOLOGY TO**
4 **AVERAGE 80 YEARS OF HYDRO DATA PREVENTS**
5 **AURORA MODEL CONSTRAINT VIOLATIONS, IMPROVES**
6 **FORECAST ACCURACY, AND REDUCES MODEL**
7 **COMPLEXITY AND COMPUTATIONAL RUN TIME**

8 **Q. How has PSE used the 80 years of historical hydroelectric generation data in**
9 **its proposed power costs in this proceeding?**

10 A. PSE proposes to use the full 80 years of available hydroelectric generation data in
11 its proposed power costs in this proceeding. The data set consists of 80 estimates
12 of energy production for each month of the year from each hydroelectric project,
13 based on 80 historical years of streamflow data. For each month, PSE calculates
14 normal hydro production by averaging the 80 generation estimates, then inputs
15 that data into Aurora. The Aurora database contains minimum and maximum
16 capacity constraints for each resource. PSE updates the maximum capacity
17 constraints for the Mid-Columbia and Upper Baker hydroelectric resources.

18 **Q. How many Aurora runs are required by PSE's proposed approach?**

19 A. PSE's proposed approach requires two Aurora runs. As discussed in the Prefiled
20 Direct Testimony of Paul K. Wetherbee, Exh. PKW-1CT, PSE first uses Aurora
21 to model the entire Western Interconnect. This model run (the "pricing run")
22 produces projected power prices. PSE then uses these Aurora-generated power
23 prices in a second Aurora run (the "two-zone run"), in which PSE's resources are

1 dispatched given those market prices to estimate PSE's rate year power costs.

2 Both model runs use the average of 80 years of estimated hydroelectric generation
3 in the Pacific Northwest as inputs to Aurora.

4 **Q. How does Commission Staff propose to use 80 years of historical**
5 **hydroelectric generation data?**

6 A. Commission Staff has recommended that

7 the Commission require [PSE] Company to restore its existing
8 practice [sic] of running the AURORA model for each year of the
9 available hydro record (80 hydro years in this GRC) and average the
10 power costs from all runs to estimate rate year power cost.²

11 In effect, Commission Staff's recommendation requires the following steps:

- 12 (i) model the Western Interconnect using the Aurora pricing
13 model 80 times, one for each of the 80 years of
14 hydroelectric generation data,
- 15 (ii) input the Aurora-generated market prices from each of the
16 80 pricing runs into the two-zone model,
- 17 (iii) run the Aurora two-zone model 80 times, one for each of
18 the 80 hydro years, and
- 19 (iv) average the power cost results from these 80 runs.

20 This requires 160 total Aurora runs.

² Liu, Exh. JL-1T, at 47:14-17.

1 **Q. Is Commission Staff’s proposal consistent with PSE’s approach in prior**
2 **proceedings?**

3 A. Yes. Commission Staff’s proposal is *partially* consistent with PSE’s approach in
4 prior proceedings. In prior proceedings, PSE ran the Western Interconnect model
5 80 times and used the average of PSE’s power costs from those runs as rate year
6 power costs. As described in the Prefiled Direct Testimony of Paul K. Wetherbee,
7 Exh. PKW-1CT, PSE added the two-zone run in this proceeding to enable
8 calculation of reserves costs in Aurora instead of relying on a post-Aurora
9 spreadsheet model to estimate those costs. PSE’s prior approach required
10 80 Aurora runs rather than the 160 required given Commission Staff’s proposed
11 approach in this proceeding.

12 **Q. How has the Commission addressed use of historical hydro data in prior PSE**
13 **proceedings?**

14 A. Discussions in previous PSE rate proceedings centered around the number of
15 years’ worth of hydrologic data to use when projecting power costs, rather than
16 the specifics of how to apply that data. In Docket UE-090704, the Commission
17 stated a clear preference for use of data spanning as long a period as possible.³ It
18 is not clear whether use of the longest record of hydro data, which has now grown
19 to 80 years, necessitates running the Aurora model separately for each year of
20 hydro data. Historically, PSE has done separate runs. In this proceeding, however,

³ See, e.g., *Wash. Utils. & Transp. Comm’n v. Puget Sound Energy*, Dockets UE-090704 & UG-090705, Order 11 at ¶¶ 124-125 (Apr. 2, 2010).

1 PSE proposes that using average hydro generation from all 80 years as an input
2 produces a better estimate of rate year power costs.

3 **Q. Why does PSE propose to change its approach to using average hydro as an**
4 **input?**

5 A. Initially, PSE proposed to use average hydro as an input for the sake of
6 computational efficiency. During the course of this proceeding, however, PSE
7 examined the data associated with both approaches and concluded that using
8 long-term average hydro as an input results in more realistic hydro output in the
9 model and, therefore, a better estimate of power costs.

10 Please see the Second Exhibit to the Prefiled Rebuttal Testimony of Paul K.

11 Wetherbee, Exh. PKW-36C, for a full and complete copy of PSE's Response to
12 WUTC Staff Data Request No. 202, which explains PSE's analysis.⁴

13 **Q. Why does using average hydro as an input provide a better estimate of power**
14 **costs?**

15 A. The Aurora model's hydro shaping logic causes it to relax maximum hydro
16 capacity constraints during some periods with extraordinarily high hydro
17 generation. These constraint violations allow the model to unrealistically shift
18 hydro generation from off-peak hours to on-peak hours. This process results in
19 artificially high off-peak prices, when PSE generally sells to the market, and

⁴ Attachment B to PSE's Response to WUTC Staff Data Request No. 202 includes hourly data. Due to the volume of data, this portion of PSE's response is omitted from Exh. PKW-3C and included in workpapers.

1 artificially low on-peak prices, when PSE generally purchases from the market.
2 Power cost results are thereby lower than they would be without constraint
3 violations in each year that violations occur. In actual operations, hydro resources
4 cannot generate above maximum capacity and would spill excess water or move
5 generation to lower value periods rather than operate at the unrealistic level
6 prescribed by the model.

7 PSE analyzed the hourly generation results from Aurora for the five Mid-
8 Columbia hydroelectric projects for all 80 separate hydro years and found
9 capacity constraint violations in 69 of the 80 years. On average, a capacity
10 constraint was violated 750 times per year, or in 1.7 percent of total hours. In the
11 most extreme year, a capacity constraint was violated 3,481 times, or in 8 percent
12 of total hours.

13 Every time a capacity constraint violation occurs during any of the 80 years,
14 PSE's modeled portfolio costs are artificially reduced. These constraint violations
15 do not happen in PSE's proposed approach, which uses average hydro production
16 from the 80 years as the model input. Use of 80-year average hydro as an input
17 eliminates the occurrence of impossibly high levels of Aurora hydro dispatch,
18 resulting in a more realistic power cost estimate.

19 **Q. Is the occurrence of capacity constraint violations a known issue with the**
20 **Aurora model?**

21 A. Yes. The help section of Aurora indicates that after Aurora shapes hydro on an
22 hour-by-hour basis, it checks against the minimum and maximum capacity

1 constraints and relaxes maximum capacity constraints if there is excess energy.
2 PSE has verified that the settings and capacity levels in the model are correct.

3 **Q. Why does Commission Staff object to using average hydro generation as an**
4 **input?**

5 A. Commission Staff presents the following arguments against using average hydro
6 as an input:

- 7 (i) “model forecast accuracy should not be sacrificed for the
8 sake of simplicity”;⁵
- 9 (ii) “the current design of the PCA sharing bands are based on
10 this observed asymmetrical relationship between hydro
11 conditions and power costs, and therefore, any proposal to
12 modify the established procedures for hydro normalization
13 needs to be supported by analysis which acknowledges this
14 reality”;⁶
- 15 (iii) the difference in power costs is a result of the addition of
16 1999-2008 hydro years to the record;⁷
- 17 (iv) use of average hydro as an input is akin to the hydro
18 filtering approach that was rejected by the Commission in
19 PSE’s 2009 general rate case, UE-090704;⁸ and
- 20 (v) averaging inputs ignores the distribution of power costs.⁹

⁵ Liu, Exh. JL-1CT, at 49:6-7.

⁶ *Id.* at 49:18 – 50:2.

⁷ *See id.* at 52:7-8.

⁸ *See id.* at 52:16 – 53:20.

⁹ *See id.* at 54:1-14.

1 **Q. Does use of average hydro as an input sacrifice model accuracy?**

2 A. No. As described above and in the Second Exhibit to the Prefiled Rebuttal
3 Testimony of Paul K. Wetherbee, Exh. PKW-36C, the use of average hydro as an
4 input improves model accuracy by eliminating hydro constraint violations in the
5 Aurora model.

6 **Q. Is asymmetry in the Power Cost Adjustment (“PCA”) sharing bands related**
7 **to an asymmetrical relationship between hydro conditions and power costs?**

8 A. No. The current asymmetry in the PCA sharing bands is the result of settlement
9 among many parties. In response to a data request requesting support for
10 Commission Staff’s assertion, Commission Staff pointed to settling parties’
11 testimony in the 2015 PCA settlement.¹⁰ That settlement testimony does reference
12 asymmetric risk of power cost under- and over-recovery, but it does not discuss
13 how power costs are determined or support Staff’s assertion that “[t]he current
14 design of the PCA sharing bands are based on this observed asymmetrical
15 relationship between hydro conditions and power costs”¹¹

16 Commission Staff’s data request response also points to testimony from a PSE
17 witness in Docket UE-111048. The purpose of that testimony was to examine
18 “whether there are asymmetrical risks in the distribution of power costs that may

¹⁰ *Wash. Utils. & Transp. Comm’n v. Puget Sound Energy*, Dockets UE-130583, *et al.*,
Settling Parties’ Joint Testimony in Support of PCA Modification Settlement (Apr. 3, 2015).

¹¹ Liu, Exh. JL-1T, at 49:18-19.

1 affect the sharing of risks and benefits accomplished by the PCA sharing
2 bands.”¹² Again, that study was focused on the sharing of risk between PSE and
3 customers given the PCA sharing bands, not the methods used to determine the
4 power costs themselves. However, the testimony did include an analysis of the
5 impact of hydro variability on power cost over- and under-recoveries, and
6 concluded that “neither the skewed nature of the distribution nor the fat tails of
7 the imbalance were significantly affected when hydro variability was removed.”¹³
8 Neither of the documents provided by Commission Staff support the argument
9 that asymmetry in PCA sharing bands reflects an asymmetric relationship
10 between hydro conditions and power costs.

11 **Q. Does the addition of 1999-2008 hydro years to the record account for the**
12 **difference in power costs between the two approaches?**

13 A. No. PSE has compared the Aurora total power costs from the two approaches,
14 with the years 1999-2008 excluded. The results are summarized in Table 1 below.

¹² *Wash. Utils. & Transp. Comm’n v. Puget Sound Energy*, Dockets UE-111048 & UG-111049, Prefiled Direct Testimony (Confidential) of Salman Aladin, Ex. SA-1T, at 2:14-16.

¹³ *Id.* at 12:14-16.

**Table 1. Aurora Power Cost Results with
70 Years vs 80 Years of Hydro Data (\$000)**

	70 Years (1929-1998)	80 Years (1929-2008)
Average Hydro Input	\$487,334	\$487,336
Average of Multiple Runs	\$480,692	\$481,087
Difference	\$6,642	\$6,249

1 When 70 years of hydro data are averaged and input, Aurora total power costs are
2 \$487.3 million. When Aurora is run separately for each water year, total Aurora
3 power costs are \$480.7 million. The difference between the two approaches is
4 \$6.6 million, even greater than the difference of \$6.2 million when 1999-2008 are
5 included. Thus, the addition of 1999-2008 does not account for the difference in
6 power costs between the two approaches as suggested by Commission Staff.
7 Indeed, the addition of 1999-2008 *reduces* the difference in power costs between
8 the two approaches.

9 **Q. Is the use of average hydro as an input akin to the hydro filtering approach**
10 **that was rejected by the Commission in PSE’s 2009 general rate case?**

11 A. No. The hydro filtering approach rejected by the Commission in 2009 involved “a
12 quasi-statistical filter to exclude from AURORA the water-years that fall outside
13 of one standard deviation above or below the mean water year in the 50-year
14 record.”¹⁴ Whereas the previously rejected hydro filtering approach excluded

¹⁴ *Wash. Utils. & Transp. Comm’n. v. Puget Sound Energy*, Dockets UE-090704 & UG-090705, Order 11 at ¶ 102 (Apr. 2, 2010).

1 some hydro years, uses of the average of 80 hydro years incorporates the full
2 hydro record, while also improving model accuracy compared to separate runs for
3 each hydro year.

4 **Q. Does averaging the hydro inputs ignore the distribution of power costs from**
5 **multiple hydro years?**

6 A. Yes. Commission Staff suggests that this is a flaw in PSE’s proposed approach,¹⁵
7 but the methodology proposed by Commission Staff that would average results
8 from multiple runs also ignores the distribution of power costs across all model
9 runs. Indeed, the nature of presenting a single number for total power costs is such
10 that no result will capture the distribution of potential power costs. PSE proposes
11 averaging 80 years of hydro data, rather than averaging power costs from separate
12 runs for each hydro year, because it prevents model constraint violations from
13 occurring and improves forecast accuracy, while also drastically reducing model
14 complexity and computational run time.

15 **III. THE 2016 VAISALA WIND FORECASTS ARE**
16 **THE MOST RECENT FORECASTS AVAILABLE**
17 **AND THE ONLY ONES THAT INCORPORATE DATA**
18 **FROM ACTUAL PROJECT OPERATIONS**

19 **Q. What wind forecasts does PSE use to calculate its proposed power costs?**

20 A. PSE uses forecasts that were developed by an outside expert on wind generation,
21 Vaisala Corporation (“Vaisala”), in 2016 for the resources owned by PSE, and a

¹⁵ Liu, Exh. JL-1T at 54:11-14.

1 2016 forecast provided by Avangrid Renewables, LLC, for the Klondike III Wind
2 power purchase agreement.

3 **Q. Does any party oppose use of the 2016 forecasts in PSE's calculation of rate**
4 **year power costs?**

5 A. Yes. Commission Staff witness David Gomez opposes PSE's use of the 2016
6 wind forecasts.¹⁶ In its last general rate proceeding in Dockets UE-170033 & UG-
7 170034 (consolidated), PSE proposed using the 2016 Vaisala forecasts but
8 ultimately agreed to revert to the older forecasts in the settlement.

9 **Q. What wind forecasts does Commission Staff propose?**

10 A. Commission Staff proposes use of preconstruction forecasts for Lower Snake
11 River, Wild Horse Expansion and Klondike III, and 2010 updates to
12 preconstruction forecasts for Hopkins Ridge and Wild Horse.¹⁷

13 **Q. Why does PSE propose using the 2016 Vaisala forecasts?**

14 A. The 2016 Vaisala forecasts provide the best, most current estimate of expected
15 energy production for each resource. These forecasts utilized data from the actual
16 operation of PSE's wind resources combined with 36 years of historical climate
17 data and current forecasting methodologies to project long-term average energy
18 output from each facility.

¹⁶ See Gomez, Exh. DCG-1CT, at 36:4 – 41:19.

¹⁷ See *id.* at 41:15-16.

1 In contrast, the old forecasts proposed by Commission Staff did not rely on any
2 data from actual project operations. Because they were prepared before the wind
3 projects were built, they relied on wind data collected at future project sites to
4 estimate potential production based on proposed project layouts, equipment
5 design specifications, and generic energy loss assumptions.

6 **Q. What are Commission Staff’s objections to use of the 2016 Vaisala forecasts?**

7 A. Commission Staff argues:

- 8 (i) lower forecasted output relative to prior forecasts is a
9 “derate” of the wind facilities;¹⁸
- 10 (ii) some historical data was excluded by Vaisala when
11 developing the forecast for Hopkins Ridge;¹⁹
- 12 (iii) the 2016 forecasts are stale;²⁰
- 13 (iv) wind forecast updates should include evidence that rules
14 out turbine degradation and maintenance practices as
15 factors that contribute to the lower forecast;²¹ and
- 16 (v) there is evidence that PSE’s wind resources underperform
17 relative to others in the western United States.²²

¹⁸ See Gomez, Exh. DCG-1CT, at 36:10-14.

¹⁹ See *id.* at 37:13-21.

²⁰ See *id.* at 39:17-20.

²¹ See *id.* at 41:8-12.

²² See *id.* at 40:7-15.

1 **Q. Is PSE proposing to derate wind resources in its power cost calculation?**

2 A. No. PSE proposes to use updated generation forecasts that are based on historical
3 production, not to limit the resources' generation capacities.²³

4 **Q. Did Vaisala exclude some historical data when developing the forecast for**
5 **Hopkins Ridge?**

6 A. Yes. Although Vaisala does exclude some historical data when developing the
7 forecast for Hopkins Ridge, the exclusions are not quite to the extent that
8 Commission Staff indicates. Commission Staff suggests that Vaisala removed 48
9 of the 128 months of production data provided by PSE.²⁴ Vaisala actually
10 excluded only 30 months of the Hopkins Ridge production data – the first 8
11 months of plant operation (the “break-in” period), another 15 months due to low
12 availability, and the seven months of 2016 data that were provided but not directly
13 utilized by Vaisala in the analysis. Some data were similarly excluded in the
14 development of forecasts for each of the PSE-owned wind facilities, and these
15 exclusions are explained in the study reports provided by Vaisala.

²³ “Derate” has a specific and technical meaning, as defined by the North American Electric Reliability Corporation (“NERC”). The NERC Generating Availability Data System (“GADS”) Reporting Instructions define the word as follows: “A derating exists whenever a unit is limited to a power level that is less than the unit’s net maximum capacity,” and “a derate starts when a facility is not capable of reaching 100% capacity.” North American Electric Reliability Corporation, *Generating Availability Data System Data Reporting Instructions*, available at https://www.nerc.com/pa/RAPA/gads/DataReportingInstructions/2019_GADS_DRI.pdf.

²⁴ See Gomez, Exh. DCG-1CT, at 37:13-21.

1 Please see the Third Exhibit to the Prefiled Rebuttal Testimony of Paul K.
2 Wetherbee, Exh. PKW-37C, for copies of the Vaisala forecast reports for each of
3 PSE's wind facilities.

4 **Q. Why is there a discrepancy between the numbers referenced in Commission**
5 **Staff testimony and those included in the Vaisala reports?**

6 A. Commission Staff's testimony appears to rely on a version of the Vaisala forecast
7 reports that PSE provided in response to a Commission Staff data request in
8 PSE's last general rate proceeding in Dockets UE-170033/UG-170034. This
9 version of the report contained errors that were later corrected.²⁵

10 **Q. Did PSE provide the amended 2016 Vaisala forecast report?**

11 A. Yes. Amended reports for each of PSE's wind facilities were provided as exhibits
12 to my Prefiled Rebuttal Testimony in Dockets UE-170033 & UG-170034
13 (consolidated).²⁶ These same reports were again provided to Commission Staff as
14 workpapers in this proceeding.

²⁵ Corrections were not made to forecast results. Amended reports contained edits only to the text describing the analysis inputs and methodology.

²⁶ See *Wash. Utils. & Transp. Comm'n v. Puget Sound Energy*, Dockets UE-170033 & UG-170034 (consolidated), Nineteenth Exhibit to the Prefiled Direct Testimony of Paul K. Wetherbee, Exh. PKW-20C.

1 **Q. Commission Staff characterizes the 2016 Vaisala forecasts as “a stale, nearly**
2 **four year old forecast.” Is this an accurate description?**

3 A. No. The Vaisala forecasts were completed and provided to PSE in October 2016,
4 making them less than two and a half years old at the time PSE prepared its power
5 cost calculation for this proceeding. They are the most recent forecasts available
6 and the only ones that incorporate data from actual project operations.

7 **Q. Does Commission Staff propose using more recent forecasts?**

8 A. No. As mentioned above, Commission Staff proposes using forecasts that were
9 prepared in 2010 or, in the case of Klondike III, 2007. These are at least six years
10 older than the 2016 forecasts PSE used in its power cost calculations.

11 **Q. What evidence does Commission Staff provide to support the suggestion that**
12 **insufficient maintenance is a cause of actual generation being below levels**
13 **presented in prior forecasts?**

14 A. Commission Staff provides no specific evidence supporting their suggestion that
15 lack of maintenance is a reason for lower wind output compared to prior forecasts.
16 Instead, Commission Staff references a Department of Energy wind resource
17 report to argue generally that PSE’s wind resources are underperforming.²⁷

²⁷ See Gomez, Exh. DCG-28 (providing the U.S. DOE, Office of Energy Efficiency & Renewable Energy, *2018 Wind Technologies Market Report*).

1 **Q. Does the Department of Energy report referenced by Commission Staff**
2 **provide evidence of “underperformance” of PSE’s wind resources?**

3 A. No. Commission Staff testimony references an average capacity factor of
4 36.6 percent reported for wind projects in the western United States and compares
5 that value to the average capacity factors of PSE’s wind facilities. This is not an
6 appropriate comparison. The 36.6 percent capacity factor is specifically for wind
7 projects built between 2014 and 2017 – projects that are all significantly newer
8 than PSE’s wind projects.²⁸ PSE’s wind projects were constructed between 2005
9 and 2012.

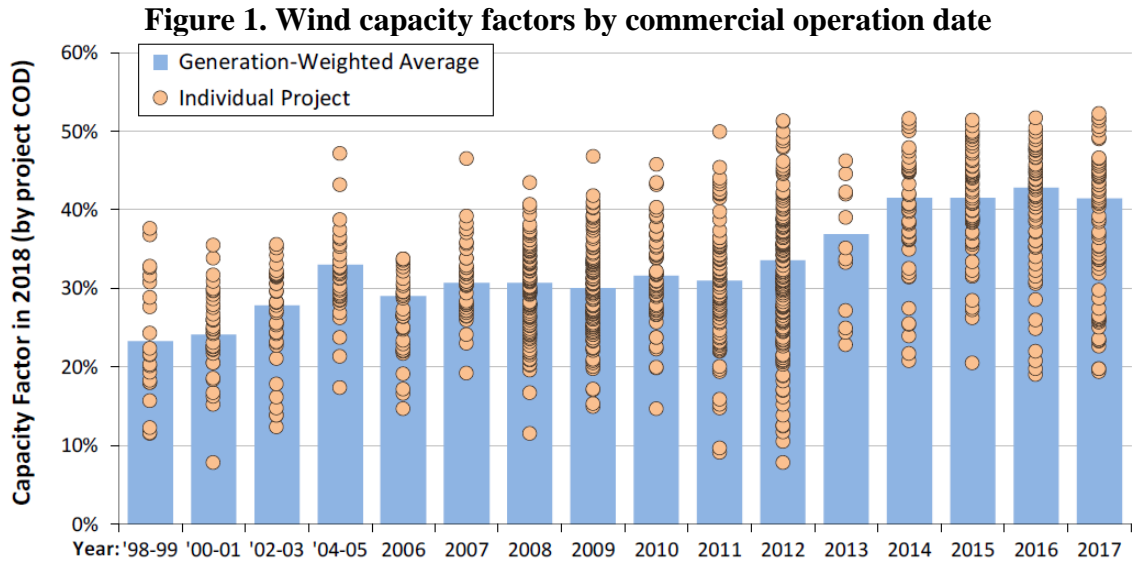
10 **Q. Why is it important to consider the age of a wind project when comparing**
11 **capacity factors?**

12 A. As discussed in the Department of Energy report, newer wind projects feature
13 larger rotor diameters, higher hub heights, and other advancements in turbine
14 design that allow them to capture more of the available wind resource and operate
15 at higher average capacity factors than earlier projects.²⁹ Figure 1, which was
16 extracted from the DOE report, indicates that newer resources generally have
17 higher capacity factors than older resources.³⁰

²⁸ See Gomez, Exh. DCG-28, at 56.

²⁹ See *id.* at 40-52 (discussing technology trends).

³⁰ See *id.* at 54.



1 **Q. Does the Department of Energy report provide wind performance data that**
 2 **is appropriate for comparison with PSE’s wind projects?**

3 A. The performance of any individual wind project is largely determined by the
 4 design of the project and site specific characteristics. Therefore, broad
 5 comparisons to regional averages provide only a very high level indication of
 6 relative performance. Nevertheless, the Department of Energy report does offer a
 7 more reasonable point of comparison than that provided by Commission Staff.
 8 The report contains average capacity factors by state for all wind projects built
 9 between 1998 and 2017.³¹ The reported average for projects in Washington
 10 is 29.4 percent.³² The average forecasted capacity factor for PSE’s wind resources
 11 is 28.8 percent.

³¹ See Gomez, Exh. DCG-28, at 57.

³² See *id.*

1 **Q. What actions does PSE take to ensure performance of its wind turbines?**

2 A. PSE's wind turbine operations and maintenance program mitigates for the
3 degradation of turbine physical condition. The operational condition of the
4 turbines is monitored and corrections are made as needed under the terms of long-
5 term maintenance agreements with the turbine manufacturers. These agreements
6 include (i) specific service obligations and performance incentives for the early
7 identification and resolution of performance-degrading conditions;
8 (ii) optimization of the timing and duration of maintenance outages;
9 (iii) warranty-like replacement coverage for mechanical, electrical, or control
10 system faults in each turbine; and (iv) select performance enhancements. PSE's
11 wind turbines have achieved an availability score (a measure of their readiness to
12 produce power) of 97 to 99 percent, which demonstrates the value of
13 comprehensive maintenance, close collaboration between PSE and the turbine
14 manufacturers, and a long-term operations strategy.

1 **IV. PSE ACCEPTS COMMISSION STAFF'S PROPOSAL**
2 **TO ASSUME 100 PERCENT AVAILABILITY OF WESTCOAST**
3 **PIPELINE CAPACITY IN THE CALCULATION OF RATE YEAR**
4 **PIPELINE OPTIMIZATION REVENUE**

5 **Q. What does Commission Staff propose with respect to the assumption of**
6 **Westcoast Pipeline capacity availability in the calculation of rate year power**
7 **costs?**

8 A. Commission Staff proposes that the Commission assume 100 percent availability
9 of Westcoast Pipeline capacity in the calculation of rate year power costs.³³

10 **Q. Does PSE accept Commission Staff's proposal to assume 100 percent**
11 **availability of Westcoast Pipeline capacity in the calculation of rate year**
12 **power costs?**

13 A. Yes. Although actual pipeline capacity is at times reduced due to maintenance or
14 unexpected events, PSE's proposed adjustment in this case relied on only one
15 year of historical actual availability data. PSE will continue to collect and analyze
16 pipeline data to establish a more comprehensive view of actual availability. In this
17 proceeding, however, PSE accepts Commission Staff's proposal to assume
18 100 percent availability of Westcoast Pipeline capacity in the calculation of rate
19 year pipeline optimization revenue.

³³ See Gomez, Exh. DCG-1CT, at 34:8-12.

1 **Q. Has PSE updated its calculation of gas pipeline optimization revenues?**

2 A. Yes. The updated power costs presented in this rebuttal testimony assume
3 100 percent availability of PSE's contracted capacity on the Westcoast Pipeline,
4 as recommended by Commission Staff. This update reduces projected rate year
5 power costs by approximately \$1.4 million relative to PSE's initially filed power
6 costs.³⁴

7 Please see the Fourth Exhibit to the Prefiled Rebuttal Testimony of Paul K.
8 Wetherbee, Exh. PKW-38, for the Westcoast Pipeline Capacity adjustment.

9 **V. PUBLIC COUNSEL OVERSTATES THE COST**
10 **REDUCTIONS ASSOCIATED WITH REMOVING**
11 **THE COSTS OF THE SKOOKUMCHUCK AND**
12 **LUND HILL POWER PURCHASE AGREEMENTS**
13 **FROM RATE YEAR POWER COSTS**

14 **Q. What does Public Counsel propose regarding Green Direct resources in**
15 **PSE's power cost update?**

16 A. Public Counsel proposes removing the costs of the Skookumchuck and Lund Hill
17 power purchase agreements, which PSE acquired to serve Green Direct
18 customers, from rate year power costs.³⁵ Public Counsel proposes reducing power
19 costs by \$20,816,000 based on the resource costs presented in the Twelfth Exhibit
20 to the Prefiled Direct Testimony of Paul K. Wetherbee, Exh. PKW-13C.³⁶

³⁴ The \$685 thousand reduction included in Commission Staff testimony was based on gas prices from PSE's initial filing. The larger reduction included here is the result of increased gas prices relative to those used in the initial filing.

³⁵ See Colamonici, Exh. CAC-1CT, at 12:3 – 16:6.

³⁶ See *id.* at 13:13-19.

1 **Q. If the Commission were to determine that the costs of the Skookumchuck**
2 **and Lund Hill power purchase agreements should be removed from rate**
3 **year power costs, would the cost reduction proposed by Public Counsel be**
4 **correct?**

5 A. No. Public Counsel's projected reductions neglect to account for replacement
6 power costs. If the Green Direct resources were not online, PSE must still provide
7 power to Green Direct customers. The resource costs identified by Public Counsel
8 should be netted against the cost of replacement power. Based on PSE's proposed
9 power costs in this rebuttal testimony, PSE estimates the net power cost reduction
10 would be \$13.1 million.

11 **VI. UPDATED POWER COSTS**

12 **Q. Has PSE provided an update to power costs in this proceeding?**

13 A. Yes. The First Exhibit to the Prefiled Rebuttal Testimony, Exh. PKW-35C,
14 presents updated rate year power costs of \$771.0 million, a \$27.5 million
15 (3.7 percent) increase relative to power costs included in the Prefiled Direct
16 Testimony of Paul K. Wetherbee, Exh. PKW-1CT.

17 Please see the Fifth Exhibit to the Prefiled Rebuttal Testimony, Exh. PKW-39C,
18 for a summary of updated power costs by resource.

1 **Q. What changes did PSE make relative to the power cost calculation presented**
2 **in the Prefiled Direct Testimony of Paul K. Wetherbee, Exh. PKW-1CT?**

3 A. Proposed power costs in this rebuttal filing incorporate updates to specific items
4 identified in the prehearing conference and listed in Appendix B to Order 03 in
5 this proceeding, as well as two corrections and a change recommended by
6 Commission Staff. For this updated power cost calculation PSE:

- 7 (i) updated forward gas prices in the Aurora model to the
8 three-month average as of December 5, 2019;
- 9 (ii) added new short-term rate year power hedges in effect as of
10 December 5, 2019;
- 11 (iii) updated the mark-to-model calculation for gas for power
12 contracts in place as of December 5, 2019, including the
13 basis differential on Westcoast Pipeline, based on three-
14 month average gas prices as of the same date;
- 15 (iv) added short-term power contracts with Avangrid
16 Renewables, Inc. and Morgan Stanley to replace winter
17 capacity previously provided by Colstrip Units 1 & 2;
- 18 (v) added a short-term power contract with Public Utility
19 District of Grant County, Washington (“Grant PUD”) for
20 4.33 percent of output from the Priest Rapids Hydroelectric
21 Project during 2020;
- 22 (vi) corrected fixed gas transportation rates for Cascade Natural
23 Gas as identified and discussed by Commission Staff;³⁷
- 24 (vii) corrected fixed gas transportation rates for Gas
25 Transmission Northwest (GTN) to incorporate a reduction
26 related to the Tax Cuts and Jobs Act of 2018;

³⁷ See Gomez, Exh. DCG-1CT, at 31:20 – 32:3.

1 (viii) removed the availability adjustment to PSE's contracted
2 capacity on Westcoast Pipeline as recommended by
3 Commission Staff and discussed above.³⁸

4 **Q. How do updated gas prices compare to those included in the Prefiled Direct**
5 **Testimony of Paul K. Wetherbee, Exh. PKW-1CT?**

6 A. The average rate year Sumas gas price included in this rebuttal update is \$2.17 per
7 million British Thermal Units (MMBtu) compared to \$2.06 per MMBtu in the
8 power costs presented in the Prefiled Direct Testimony of Paul K. Wetherbee,
9 Exh. PKW-1CT, an increase of approximately 5.5 percent. Gas prices at other
10 hubs relevant to the Western Interconnect, which are an input to the Aurora
11 model, are approximately 4.5 percent lower, on average, for the rate year.

12 Please see the Sixth Exhibit to the Prefiled Rebuttal Testimony of Paul K.
13 Wetherbee, Exh. PKW-40C, for a comparison of gas prices in this update with
14 those included in the Prefiled Direct Testimony of Paul K. Wetherbee,
15 Exh. PKW-1CT.

16 **Q. What short term power hedges are included in proposed power costs?**

17 A. This update includes fixed price power hedge contracts totaling 284 average
18 megawatts (aMW) during the rate year. These contracts are included in the
19 Aurora model at an average cost of \$[REDACTED] per megawatt hour (MWh). Total
20 premiums of \$\$[REDACTED] for physical, index based power contracts are
21 included as "Costs Not in Aurora" in the Seventh Exhibit to the Prefiled Rebuttal

³⁸ See Gomez, Exh. DCG-1CT, at 34:8-12.

1 Testimony, Exhibit PKW-41C. Power costs presented in the Prefiled Direct
2 Testimony of Paul K. Wetherbee, Exh. PKW-34T, included only 3.6 aMW of
3 fixed price power hedges and no physical, index-based contracts.

4 **Q. Why has the volume of short term power hedges increased in this update?**

5 A. PSE's hedging program actively manages portfolio exposure beginning
6 ██████ in advance of the month that energy is needed to serve load. The power
7 costs presented in the Prefiled Direct Testimony of Paul K. Whetherbee,
8 Exh. PKW-1CT, incorporated hedges that were in place as of January 31, 2019,
9 which was 15 months prior to the start of the rate year in this proceeding. At the
10 time of this update, ██████ of the rate year fall within the actively managed
11 hedge period. As more of the rate year rolled into this period PSE executed
12 additional hedge contracts to remain within the portfolio exposure limits of the
13 program.

14 **Q. Please describe the short-term power contracts that PSE entered to replace**
15 **Colstrip Units 1 and 2 winter capacity.**

16 A. In June 2019, PSE issued a request for proposals (RFP) for winter capacity to
17 mitigate, in part, the capacity reduction associated with closure of Colstrip Units 1
18 and 2. PSE received offers from six parties and ultimately executed contracts with
19 Avangrid Renewables, Inc. and Morgan Stanley. The Avangrid contract provides
20 ██████ MW during heavy load hours³⁹ from ██████ through ██████

³⁹ Heavy load hours include hour-ending 7:00 through 22:00 seven days per week.

1 and [REDACTED] MW from [REDACTED] through [REDACTED]. The contract price is
2 fixed at \$[REDACTED] per MWh during the [REDACTED] and \$[REDACTED] per MWh
3 during the [REDACTED]. The Morgan Stanley contract provides [REDACTED] MW during
4 heavy load hours in [REDACTED] and [REDACTED], [REDACTED] MW in [REDACTED]
5 [REDACTED], [REDACTED] MW in [REDACTED], and [REDACTED] MW in [REDACTED]. The contract
6 price is [REDACTED] plus a premium of \$[REDACTED] per kW-month.

7 Please see the Eighth Exhibit to the Prefiled Rebuttal Testimony, Exhibit PKW-
8 42C, for a copy of a memorandum that summarizes the short-term RFP process
9 that led to the acquisition of these contracts.

10 **Q. Please describe the short-term power contract with Grant PUD for output**
11 **from the Priest Rapids Hydroelectric Project.**

12 A. In August 2019, PSE executed a short-term contract with Grant PUD to purchase
13 4.33 percent of the output of the Priest Rapids Hydroelectric Project, or
14 47.5 aMW, during calendar year 2020. PSE will pay a fixed price of \$1.15 million
15 per month, or \$33.23 per MWh. PSE was able to enter into this short-term
16 contract because PSE's long-term contract with Grant PUD contains an option to
17 acquire additional capacity for a one-year term.

1 **Q. Has PSE provided other exhibits to support updated rate year power costs in**
2 **this proceeding?**

3 A. Yes. The following exhibits present specific input data and calculations for
4 proposed rate year power costs:

- 5 (i) Please see the Ninth Exhibit to the Prefiled Rebuttal
6 Testimony of Paul K. Wetherbee, Exh. PKW-43C, for
7 updated Aurora model cost and energy outputs.
- 8 (ii) Please see the Tenth Exhibit to the Prefiled Rebuttal
9 Testimony of Paul K. Wetherbee, Exh. PKW-44C, for
10 Skookumchuck wind balancing costs.
- 11 (iii) Please see the Eleventh Exhibit to the Prefiled Rebuttal
12 Testimony of Paul K. Wetherbee, Exh. PKW-45C, for day-
13 ahead wind integration costs.
- 14 (iv) Please see the Twelfth Exhibit to the Prefiled Rebuttal
15 Testimony of Paul K. Wetherbee, Exh. PKW-46C, for
16 Colstrip fixed fuel costs.
- 17 (v) Please see the Thirteenth Exhibit to the Prefiled Rebuttal
18 Testimony of Paul K. Wetherbee, Exh. PKW-47C, for
19 contract costs of Mid-C hydro resources, including the
20 costs of the short-term power contract with Grant PUD.
- 21 (vi) Please see the Fourteenth Exhibit to the Prefiled Rebuttal
22 Testimony of Paul K. Wetherbee, Exh. PKW-48C, for
23 Bonneville Power Administration (“BPA”) transmission
24 costs.
- 25 (vii) Please see the Fifteenth Exhibit to the Prefiled Rebuttal
26 Testimony of Paul K. Wetherbee, Exh. PKW-49C, for
27 updated gas mark-to-model and open transport values.
- 28 (viii) Please see the Sixteenth Exhibit to the Prefiled Rebuttal
29 Testimony of Paul K. Wetherbee, Exh. PKW-50C, for
30 corrected fixed gas-for-power transportation costs.

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- (ix) Please see the Seventeenth Exhibit to the Prefiled Rebuttal Testimony of Paul K. Wetherbee, Exh. PKW-51C, for updated incremental distillate fuel costs.
- (x) Please see the Eighteenth Exhibit to the Prefiled Rebuttal Testimony of Paul K. Wetherbee, Exh. PKW-52C, for an updated adjustment to remove non-fuel costs that are included in Aurora’s peaker start costs. These are not power costs, but they need to be removed because they are bundled with start fuel costs in Aurora output.
- (xi) Please see the Nineteenth Exhibit to the Prefiled Rebuttal Testimony of Paul K. Wetherbee, Exh. PKW-53C, for estimated costs of incremental transmission necessary to meet peak loads.
- (xii) Please see the Twentieth Exhibit to the Prefiled Rebuttal Testimony of Paul K. Wetherbee, Exh. PKW-54, for Other Power Costs chargeable to FERC account 557. These are actual costs from the test year ended December 31, 2018.

Q. Have there been known changes to power costs that are not included in the update described above?

A. Yes. As mentioned earlier, the power costs presented above reflect a limited update incorporating only those changes specifically identified in the prehearing conference and listed in Appendix B to Order 03 as well as two corrections and a change recommended by Commission Staff. In prior rate cases, PSE updated power costs for other known changes including:

- (i) routine updates to fixed costs associated with Mid-Columbia hydro power purchase contracts;
- (ii) updated transmission rates;
- (iii) additions to contracted transmission capacity;
- (iv) updated coal fuel costs;

- 1 (v) updated pipeline tariffs;
- 2 (vi) additions to contracted pipeline capacity;
- 3 (vii) updated volumes and prices in long-term power purchase
- 4 contracts;
- 5 (viii) additional long-term power purchase contracts;
- 6 (ix) updated maintenance outage schedules for PSE resources;
- 7 and
- 8 (x) Aurora dispatch inputs for PSE thermal resources.

9 **Q. What changes have occurred that are not included in PSE's updated power**
10 **costs in this case?**

11 A. There are several known changes that would have been included in PSE's updated
12 power costs absent the limitations agreed to in the prehearing conference. These
13 changes are:

- 14 (i) updates to fixed costs for Mid-Columbia hydro power
- 15 purchase contracts with Public Utility District No. 1 of
- 16 Chelan County, Washington, and Grant PUD to incorporate
- 17 new budgets provided by those counterparties;
- 18 (ii) updates to contract volumes and fixed costs for PSE's Mid-
- 19 Columbia hydro power purchase contract with Public
- 20 Utility District No. 1 of Douglas County, Washington, to
- 21 include final contract cost and volumes for 2020 and an
- 22 updated projection for 2021;
- 23 (iii) a new BPA transmission contract that PSE acquired from
- 24 Talen Energy in July 2019;
- 25 (iv) a new coal fuel supply agreement for Colstrip Units 3
- 26 and 4;
- 27 (v) a change to the start date for deliveries from the Lund Hill
- 28 power purchase contract;

- 1 (vi) a change to the contract price for the Point Roberts power
- 2 purchase agreement;
- 3 (vi) updated outage schedules for PSE's resources; and
- 4 (vii) updated variable operations and maintenance cost
- 5 assumptions for PSE's thermal resources, which are an
- 6 input to the Aurora model.

7 **Q. Have you quantified the impact to power costs of these additional updates?**

8 A. Yes. Total rate year power costs incorporating all of the changes above would be
9 \$785.9 million, or \$14.9 million (1.9 percent) more than the proposed power costs
10 included in this Prefiled Rebuttal Testimony of Paul K. Wetherbee, Exh. PKW-
11 34CT. Please see the Twentieth-First Exhibit to the Prefiled Rebuttal Testimony
12 of Paul K. Wetherbee, Exh. PKW-55C, for a summary of these costs.

13 **Q. Is PSE asking the Commission to include the full update in final power costs**
14 **in this proceeding?**

15 A. No. PSE's proposed power costs are based on the agreement that PSE made in the
16 prehearing conference. PSE provides this information to provide clarity as to the
17 contents of a full update using the most recent data. In Order 06 in Dockets UG-
18 15 040640, *et al.*,⁴⁰ the Commission expressly recognized an agreement among
19 the parties to the proceeding "that more recent data predicts the near and perhaps
20 even intermediate term better than older data."⁴¹ Additionally, the Commission

⁴⁰ *Wash. Utils. & Transp. Comm'n v. Puget Sound Energy*, Dockets UG-040640, *et al.*, Order 06 (Feb. 18, 2005).

⁴¹ *Id.* at ¶ 116.

1 expressly recognized in Order 08 in Dockets UE-111048 & UG-111049⁴² that
2 power costs should be determined based on costs that are reasonably expected to
3 be actually incurred during short and intermediate periods following the
4 conclusion of such proceedings:

5 We resolve the philosophical question raised by ICNU in favor of
6 the practical conclusion that power costs determined in general rate
7 proceedings and in PCORC proceedings should be set as closely as
8 possible to costs that are reasonably expected to be actually incurred
9 during short and intermediate periods following the conclusion of
10 such proceedings.⁴³

11 PSE is also concerned that exclusion of recent data from the power costs used to
12 set rates could lead to under-recoveries, which would be allocated between PSE
13 and customers in the PCA.

14 VII. CONCLUSION

15 **Q. Does this conclude your prefiled rebuttal testimony?**

16 **A.** Yes, it does.

⁴² *Wash. Utils. & Transp. Comm'n v. Puget Sound Energy*, Dockets UE-111048 & UG-111049, Order 08 (May 7, 2012).

⁴³ *Id.* at n.303.