

Exhibit No. ____ (YKGM-1TC)
Docket UE-070565
Witness: Yohannes K.G. Mariam
REDACTED VERSION

BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

**WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION,**

Complainant,

v.

PUGET SOUND ENERGY, INC.

Respondent.

DOCKET NO. UE-070565

TESTIMONY OF

Yohannes K.G. Mariam

**STAFF OF
WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION**

Power Cost Adjustment for Colstrip Forced Outages

June 15, 2007

CONFIDENTIAL PER PROTECTIVE ORDER

REDACTED VERSION

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1 **I. INTRODUCTION**

2 **Q. Please state your name and business address.**

3 A. My name is Yohannes K.G. Mariam. My business address is the Richard Hempstad
4 Building, 1300 S. Evergreen Park Drive S.W., P.O. Box 47250, Olympia, WA
5 98504.
6

7 **Q. By whom are you employed and in what capacity?**

8 A. I am employed by the Washington Utilities and Transportation Commission as a
9 Regulatory Analyst (Economist).
10

11 **Q. How long have you been employed by the Commission?**

12 A. I have been employed by the Commission since September 1999.
13

14 **Q. Please describe your relevant educational background and professional**
15 **employment experience.**

16 A. I hold Masters of Science (M.S.) and Doctor of Philosophy (Ph.D) degrees from
17 McGill University in Montreal, Canada. My areas of specialization were quantitative
18 economics (econometrics and operations research) and resource economics.

19 From 1993 to 1995, I was a fellow of the Natural Science and Engineering
20 Research Council (NSERC) of Canada. From 1995 to 1997, I worked as a regulatory
21 and socio-economic consultant for Environment Canada. In 1998 and 1999, I worked
22 as a staff economist for the Canadian Federal Department of the Environment
23 (Environment Canada). In those positions, I worked on a wide variety of projects and

1 wrote several manuscripts dealing with economics, the environment, agriculture,
2 development, and regulatory issues. I was a reviewer for the Journal of the Air and
3 Waste Management, and an occasional lecturer at McGill University.

4 Since September 1999, I have been employed by the Commission as an
5 economist in the Energy Section of the Regulatory Services Division. In that
6 capacity, I have analyzed purchased gas adjustments, incentive mechanisms, and
7 integrated resource planning. In the following general rate cases and other rate
8 proceedings, I have analyzed new resource prudence, power costs, rate spread, hydro
9 and weather normalization, and cost of service: Docket Nos. UE-031725 and UE-
10 040640/UG-040641 (Puget Sound Energy, Inc.); Docket Nos. UE-991832 and UE-
11 050684 (PacifiCorp); Docket Nos. UG-031885 and UG-000073 (Northwest Natural
12 Gas, Inc.); and Docket No. UE-011595 (Avista Corp.).

13 I have contributed to the Commission's analysis of the impacts of proposed
14 rules on small businesses in the railroad, telecommunication and energy industries. I
15 also collaborate with other Staff members on issues relevant to economic disciplines
16 and I write technical papers dealing with regulated energy industries.

18 II. SCOPE AND SUMMARY OF TESTIMONY

19 **Q. What was your role in the Staff investigation in this proceeding?**

20 A. My role was to analyze Puget Sound Energy's ("PSE" or the "Company") proforma
21 power supply costs for the rate year, as updated by the Company on May 23, 2007. I
22 also assisted Staff team member Mr. Douglas Kilpatrick in evaluating PSE's

1 quantitative analyses for the acquisition of the Goldendale Generating Station. Mr.
2 Kilpatrick is responsible for presenting the results of Staff's evaluation.

3
4 **Q. Please summarize your recommendation regarding the Company's rate year**
5 **proforma power costs.**

6 A. Staff accepts PSE's proforma net power supply cost for the rate year, except for the
7 method used to determine average forced outage rates for Colstrip Units 1 to 4. Staff
8 proposes to change the Company's method, which reduces proforma rate year power
9 costs by \$5.587 million.

10
11 **Q. Have you prepared any exhibits in support of your testimony?**

12 A. Yes, I have prepared two exhibits:

13 Exhibit No. ____ (YKGM-2), Proforma Power Cost

14
15 Exhibit No. ____ (YKGM-3C), Statistical Analysis of Outage Rates for Colstrip 1, 2,
16 3 and 4.

17
18 **III. DISCUSSION**

19 **A. Pro Forma Power Costs**

20 **Q. Please summarize how PSE determined power costs for the rate year.**

21 A. PSE used the AURORA model to estimate the variable production costs for the rate
22 year. A general description of this model is presented in Company witness Elsea's
23 Exhibit No. ____ (WJE-1HCT) at pages 5-10 and witness Mill's Exhibit No.
24 ____ (DEM-1CT) at pages 10-11.

25 PSE also estimates power costs that are not included in the AURORA model.

26 These non-AURORA costs include contract costs for the Mid-Columbia

1 hydroelectric projects, transmission expenses, fixed pipeline charges, amortization of
2 regulatory assets, mark-to-market for fixed-price contracts, fixed coal supply costs,
3 peaking capacity and exchange costs, fixed capacity charges, wind integration and
4 other power supply costs.

5 The sum of the non-AURORA costs and the costs from the AURORA model,
6 plus any disallowances from prior Commission's orders, produce the rate year
7 proforma net power cost. Exhibit No. ____ (YKGM-2) compares the Staff and
8 Company calculations of rate year proforma net power costs. Again, the only
9 difference relates to Staff's adjustment for Colstrip forced outage rate.

10
11 **Q. Please describe the key assumptions used by AURORA to estimate rate year**
12 **proforma power production costs.**

13 A. There are two essential assumptions used to estimate production costs using the
14 AURORA model. These are: (1) 50 years (1928-1977) of Mid-Columbia streamflow
15 history to estimate hydro generation; and (2) three-month average of daily forward
16 natural gas market prices. Specific characteristics of the resources included in the
17 AURORA model were developed by EPIS, the company that created the model.

18
19 **Q. What was the result of the updated power cost estimate for the rate year?**

20 A. The result is shown on Exhibit No. ____ (YKGM-2). PSE's net power cost estimate
21 for the rate year is \$1.061 billion. This is approximately \$127 million higher than the
22 power costs included in PSE's Power Cost Baseline Rate in Docket No. UE-060266.
23 Staff's adjustment for Colstrip forced outages, which is explained below, reduces
24 PSE's rate year net power cost estimate to \$1.055 billion.

1 **Q. Do you have any general comments regarding the estimation of rate year power**
2 **costs?**

3 A. Yes. In the Company's last general rate case, Docket No. UE-060266, the joint
4 testimony of Staff, Public Counsel and ICNU recommended the use of forward
5 market electric prices, rather than the market prices determined by AURORA, to
6 estimate spot market power prices. This recommendation reflects PSE's actual
7 practices in power purchases and sales. Furthermore, the recommendation allows the
8 Company to align the determination of gas prices used in AURORA with the
9 determination of power prices.

10 The Commission did not adopt the joint parties' proposal, but it did reserve
11 the issue for further investigation in a subsequent proceeding:

12
13 We do not close the door on the possibility that forward market electric prices
14 might be useful in determining power costs, but additional analysis is
15 required before we could take such a step. As a threshold matter, an analysis
16 is needed to support the statistical validity of using an average of three-
17 months of Mid-C market prices to project power costs. The Company has
18 expressed a willingness to "investigate this idea further." We accept this offer
19 and expect to hear more about this subject in PSE's next general rate
20 proceeding, if not before.
21

22 *WUTC v. Puget Sound Energy, Inc.*, Order 08 at ¶ 114, Docket Nos. UE-060266 and
23 UG-060267 (January 5, 2007). The expedited nature of a PCORC does not lend itself
24 to the detailed analysis needed for this issue. Therefore, Staff expects to address the
25 issue in the Company's next general rate case to be filed next year.
26

27 **B. Adjustment for Colstrip Forced Outages**

28 **Q. You indicated at the outset that Staff proposes an alternative method to**
29 **measure Colstrip forced outages in determining rate year power costs. Please**
30 **explain.**

1 A. Forced outages refer to the fraction of time (in hours or days) that a generating unit is
2 expected to be unavailable due to random failures or unexpected breakdowns.
3 Ratemaking seeks to determine average outage rates expected to prevail under
4 normal operating conditions during the rate year.

5 The Company developed its average forced outage rates for the Colstrip units
6 in a work paper entitled "DEM-WP(C) Colstrip1-4 FOR 01192007.xls" that covered
7 the period 2000-2006. However, the trend in forced outage rates presented in that
8 work paper indicates unusually high rates for the period 2000-2002, especially for
9 Colstrip Units 3 and 4. PSE's inclusion of these unusually high outage rates (or
10 outliers) in determining average outages biases the result. Therefore, Staff
11 recommends using the mean of outage rates only from 2003-2006 because that
12 period is more recent and the data more stable.

13
14 **Q. What analyses did Staff perform that support the proposed change for**
15 **determining Colstrip forced outage rates.**

16 A. Staff conducted two kinds of analyses. In the first analysis, the data contained in Mr.
17 Mill's work paper were divided into two time periods. Period 1 covered 2000 to
18 2002. Period 2 covered 2003 to 2006. The reason for this division was that Colstrip
19 Units 3 and 4 experienced unusually long forced outages from 2000-2002 (e.g., XXXX
20 hours in 2002 compared with less than XXXX hours per year since 2003), while from
21 2003 to 2006 the same Units showed approximately similar outage rates. Colstrip
22 Units 1 and 2 exhibited similar outage rates for the entire seven-year period (2000-
23 2006). The last page of Exhibit No. __ (YKGM-3C) is a graphical representation of
24 these relationships.

1 Staff then performed generally accepted statistical analyses to determine
2 whether there is a significant structural difference between the outage rates in the
3 two time periods. The results of these analyses are presented in Exhibit No. __
4 (YKGM-3C). The analyses showed that for Colstrip Units 1 and 2 there was not a
5 statistically significant structural change between the time periods. However, the
6 analyses for Colstrip Units 3 and 4 indicate that the structural change between the
7 time periods is statistically significant. Therefore, combining the time periods, as
8 PSE did to compute an average forced outage rate, does not produce a credible
9 result.

10
11 **Q. Please describe the second analysis Staff performed that supports its**
12 **adjustment for Colstrip forced outages.**

13 A. The second analysis, also summarized in Exhibit No. __ (YKGM-3C), involved a
14 two-sample t-test of variance and mean for each sample period. The two-sample t-
15 test (assuming equal variances) determines whether the two data sets came from
16 distributions with the same variances. A test of means determines the equality of the
17 population means underlying each sample (Period 1 and Period 2). The tests for
18 equality of variance and mean were rejected at 5% level of significance. In other
19 words, the mean and variance of outage rates in Period 1 (2000-2002) were
20 statistically different from the mean and variance of outage rates in Period 2 (2003-
21 2006) for all Colstrip plants.

22 The conclusion from this analysis, again, is that the two periods cannot be
23 combined. Therefore, rather than basing forced outage rates on the entire period
24 2000-2006, as proposed by PSE, Staff recommends using the mean of the more
25 recent and relatively stable outage rates from 2003-2006 to determine an average for
26 ratemaking purposes.

1

2 **Q. What is the impact on net power costs of Staff's recommendation for forced**
3 **outage rates?**

4 A. Staff's recommendation reduces net power costs by about \$5.587 million, as shown
5 on Exhibit No. __ (YKGM-2).

6

7 **Q. Does this conclude your testimony?**

8 A. Yes.