

**EXHIBIT NO. ___(EDH-1T)
DOCKET NO. UE-111048/UG-111049
2011 PSE GENERAL RATE CASE
WITNESS: EZRA D. HAUSMAN**

**BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION**

**WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION,**

Complainant,

v.

PUGET SOUND ENERGY, INC.,

Respondent.

**Docket No. UE-111048
Docket No. UG-111049**

**DIRECT TESTIMONY OF
EZRA D. HAUSMAN, PH.D.
ON BEHALF OF THE SIERRA CLUB**

DECEMBER 7, 2011

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EXHIBITS

- Exhibit EDH-2: Resume of Ezra D. Hausman Ph.D.
- Exhibit EDH-3: PSE's Response to Sierra Club Data Request 01.19 and Attachment A: Possible Impacts for PSE for Environmental Regulatory Requirements
- Exhibit EDH-4: Synapse Energy Economics, *2011 Carbon Dioxide Price Forecast*, White Paper, February 2011.

1 **1. INTRODUCTION AND QUALIFICATIONS**

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

3 A. My name is Ezra D. Hausman, Ph.D., and I am Vice President of Synapse Energy
4 Economics (“Synapse”), located at 485 Massachusetts Avenue, Cambridge,
5 Massachusetts, 02139.

6 **Q. Please describe Synapse Energy Economics.**

7 A. Synapse Energy Economics is a research and consulting firm specializing in
8 energy and environmental issues, including electric generation, transmission and
9 distribution system reliability, ratemaking and rate design, electric industry
10 restructuring and market power, electricity market prices, stranded costs,
11 efficiency, renewable energy, environmental quality, and nuclear power.

12 Synapse’s clients include state consumer advocates, public utilities commission
13 staff, attorneys general, environmental organizations, federal government
14 agencies, and utilities. A complete description of Synapse is available at our
15 website, www.synapse-energy.com.

16 **Q. Please summarize your relevant work experience and your educational
17 background.**

18 A. I have been employed by Synapse since July of 2005, and I have served as vice
19 president of Synapse since July 2009. While employed at Synapse I have
20 provided expert analysis and testimony in numerous cases involving electricity,
21 generating capacity, and ancillary service markets, electricity price forecasting,
22 resource planning, environmental compliance, and economic analysis. I have
23 prepared reports on these and other related topics for clients including federal and
24 state agencies; offices of consumer advocate; legislative bodies; cities and towns;
25 non-governmental organizations; foundations; industry associations; and resource
26 developers. I have also facilitated and served as an expert analyst for state-level

1 stakeholder and legislative processes related to electricity resource planning and
2 mitigation of greenhouse gas emissions.

3 From 1997 until 2005, I was employed as a Senior Associate with Tabors
4 Caramanis & Associates (TCA), now part of CRA International, performing a
5 wide range of electricity market and economic analyses and price forecast
6 modeling studies. These included asset valuation studies, market transition
7 cost/benefit studies, market power analyses, and litigation support. I have
8 extensive personal experience with market simulation, production cost modeling,
9 and resource planning methodologies and software.

10 I hold a B.A. from Wesleyan University, an M.S. in civil engineering from Tufts
11 University, an S.M. in applied physics from Harvard University and a Ph.D. in
12 atmospheric chemistry from Harvard University.

13 A copy of my current resume is attached as Exhibit EDH-1 to this testimony.

14 **Q. On whose behalf are you appearing in this proceeding?**

15 A. I am appearing on behalf of the Sierra Club.

16 **Q. Have you testified previously before the Washington Utilities and
17 Transportation Commission?**

18 A. No.

19 **Q. What is the purpose of your testimony?**

20 A. The purpose of my testimony is twofold: First, I provide context for the Puget
21 Sound Energy Inc. (PSE or the Company) cost recovery request for its share of
22 the Colstrip plant in Montana for this 2011 general rate case. I raise the question
23 of whether the four Colstrip units remain cost-effective resources for meeting
24 PSE's energy and capacity needs given the full range of environmental
25 regulations likely to affect the plant in the coming few years. I point out that, if
26 any or all of these units are not cost-effective on a going forward basis, the
27 Washington Utilities and Transportation Commission (the Commission) should be

1 wary of throwing good ratepayer money after bad to maintain and operate units
2 that have outlived their usefulness.

3 Second, I discuss the Company's selection process for new resources to meet their
4 Renewable Portfolio Standard (RPS) targets, which resulted in the selection of the
5 self-build option of the Lower Snake River (LSR) project, and the Company's
6 request for cost recovery for that investment.

7 **Q. What are your overall conclusions regarding the Colstrip plant?**

8 A. My overall conclusion regarding Colstrip is that the Company's request for cost
9 recovery in rate base must be viewed in the context of the future costs associated
10 with operating the Colstrip units. In the current proceeding, PSE requested a
11 significant revenue requirement increase for the Colstrip plant. By the Company's
12 own assessment, at least two (and possibly all four) of these units are likely to
13 require costly environmental retrofits in the near future, yet PSE did not
14 adequately consider these potential costs in evaluating the future cost
15 effectiveness of the resources.

16 The Commission should take into consideration a number of risks associated with
17 continued operation of the plant. In addition to the risks associated with the cost
18 of compliance with EPA emissions rules, there are significant risks associated
19 with continued and expanded use of storage ponds, at least some of which appear
20 to have serious containment failures, to dispose of combustion residuals. Another
21 major risk factor is the risk associated with future carbon emissions costs. The
22 failure to adequately address these costs and risks is and has been a serious
23 shortcoming in the Company's long-term resource planning, and raises serious
24 concerns about eligibility for rate recovery of any capital investment intended to
25 support future operation of the plant. Unless and until these costs and risks are
26 adequately considered and evaluated in comparison to the costs and risks of
27 alternative generation sources, the Commission cannot reasonably conclude that
28 the four Colstrip units are cost effective to maintain and operate. Should the costs
29 of complying with existing and pending regulations exceed the benefit of

1 maintaining units at the plant, units that are non-economic should be considered
2 for retirement or repowering, rather than kept in continued use as implied by the
3 Company's filing in this proceeding.

4 It is incumbent on any commission to ensure that costs requested in cases such as
5 the present one meet the standard that the resources they support are the most cost
6 effective choice for meeting consumers' requirements. To assure the Commission
7 that future costs will meet such a standard, the Company should promptly conduct
8 a thorough forward going cost and risk analysis prior to further investments in the
9 plant, and submit it for review and comment.

10 It is my understanding that this Commission has the authority to order the
11 Company to perform and submit such a study. As part of this study, the
12 Commission should require a comprehensive analysis of the full range of options
13 for addressing future regulations and electric reliability requirements, including
14 both supply- and demand-side resources, as well as alternatives to continued
15 operation such as retirement or repowering. Such a comparison of resource
16 options warrants that every resource be considered and evaluated on a level
17 playing field. Failing to consider such a wide range of alternatives, or artificially
18 limiting the resource options in any way, could *de facto* bias the analysis towards
19 the extended operation of a coal-fired power plant that the Company had
20 previously planned to retire—and such continued operation will subject ratepayers
21 to substantial ongoing costs and risks.

22 **Q. What are your overall conclusions regarding the Lower Snake River wind**
23 **procurement?**

24 A. I conclude that the Company served ratepayers well in electing to take advantage
25 of favorable market and regulatory conditions, and accelerate its investment in
26 renewable resources relative to the schedule required by Washington's Renewable
27 Portfolio Standard (RPS). I further find no reason to question the Company's
28 selection of the LSR project from among the available alternatives. However,
29 given the wide range of available alternatives, and the fact that, as described in the

1 testimony of PSE witness Aliza Seelig, PSE’s own analysis indicated that a larger
2 quantity purchase of wind is optimal, I believe that the Company should have
3 considered further accelerating its purchases of wind power, thereby further
4 avoiding fuel and emissions costs and reducing risk for consumers.

5 **Q. What are your recommendations for the Commission in this proceeding?**

6 A. I recommend the following action in this proceeding:

7 a. I recommend that the Commission issue an order requiring PSE to
8 conduct a thorough, forward-going cost and risk study of the Colstrip
9 plant, compared to a full range of supply and demand side alternatives.
10 The study should include a full analysis of the range of risks for future
11 costs at Colstrip from environmental retrofits due to state and federal
12 regulations, costs and risks associated with the rehabilitation,
13 maintenance, expansion, and continued operation of storage ponds for
14 combustion residuals, and the risks associated with future carbon
15 emissions costs.

16 b. Should the Commission choose not to issue an order requiring
17 submission of such a study, I recommend that the Commission find, in its
18 final order in this proceeding, that prior submission of such an evaluation
19 for review and comment will be a key consideration in all future prudence
20 reviews of the Company’s rate requests, particularly as they relate to any
21 upgrades, retrofits, of life-extension investments in the Colstrip units.

22 c. I recommend that for all future energy resources planning purposes the
23 Commission require PSE to plan its resource portfolio around the
24 Company’s prior assumption (as of the Company’s 2009 IRP¹) that
25 Colstrip units 1 and 2 will retire in 2019, and units 3 and 4 will retire in
26 2024 and 2026, unless PSE makes a showing that compelling economic
27 and engineering considerations warrant shortening or extending the life of
28 the plant relative to these dates.

29 d. Regarding renewable energy procurement, I recommend that the
30 Commission direct the Company to produce a detailed analysis of the
31 costs and benefits of wind investment at levels more consistent with those
32 indicated by its optimization model analysis, relative to the “self-build
33 only” levels currently proposed by the company.

34

¹ See Exhibit No. ___(RG-3) of PSE witness Roger Garrett in this proceeding, p. 87, Figure 5-8.

1 **2. THE FUTURE COSTS OF COLSTRIP AND IMPACT ON PSE RATEPAYERS**

2 **Q. What is the Company’s share of ownership of the Colstrip plant?**

3 A. According to PSE witness Michael L. Jones, Puget Sound Energy owns 50
4 percent of Units 1 and 2 (on-line dates of 1975 and 1976, respectively) as well as
5 25 percent of Units 3 and 4 (on-line in 1984 and 1986, respectively.)

6 **Q. Has the Company fully evaluated the potential costs of continued operation
7 of the Colstrip plant?**

8 A. No. The Company has not evaluated all potential costs for Colstrip because it has
9 not considered costs of compliance with current and pending environmental
10 regulations. The Company acknowledged regulatory risks in its own documents
11 as described below, yet it did not address the costs and risks associated with
12 compliance in this filing. These costs may well be significant and it is in the
13 ratepayers’ interest to give them full consideration in any regulatory proceeding
14 regarding the treatment of these resources.

15 Finally, in analyzing the future costs of continued operation of Colstrip, the
16 Company should more thoroughly consider risks of future reliability issues and
17 higher maintenance costs for each of the Colstrip units.

18 **a. ENVIRONMENTAL COMPLIANCE COSTS FOR PROPOSED EPA
19 RULES**

20 **Q. Has the Company indicated that the Colstrip units are likely to be subject to
21 future environmental compliance costs?**

22 A. Yes. The Company’s assessment may be found in a chart entitled “Possible
23 Impacts for PSE for Environmental Regulatory Requirements” provided as
24 Attachment A in response to Sierra Club Data Request 01.19. I have included this
25 Attachment as Exhibit EDH-3 to this testimony. This document discusses
26 proposed rules and regulations and their potential impacts for PSE, including the
27 “future of Colstrip.”

1 According to the above-referenced data response, there are at least four rules
2 either promulgated or proposed by the US EPA that could require significant
3 capital expenditures for environmental controls at Colstrip.

4 First, the EPA's 1999 Regional Haze rule requires that "Best Available Retrofit
5 Technology" (BART) be applied at eligible stationary sources to lower emissions
6 of pollutants that impair visibility in Class I areas such as national parks. The
7 targeted pollutants include fine particulates, oxides of nitrogen (NO_x, an ozone
8 precursor) and sulfur dioxide (SO₂). Exhibit EDH-3 confirms that Colstrip 1 & 2
9 are both BART eligible (this would be on the basis of their age) but also states
10 that, pending the EPA's BART findings, "future capital and O&M costs include
11 increase for some improvement from current controls/emissions levels." [sic]

12 Second, the proposed Mercury and Air Toxics Rule (MATS),² expected to be
13 finalized on December 16, 2011, sets strict limits on emissions of mercury (a
14 neurotoxin), other metallic pollutants, acid gasses, organic pollutants, and other
15 hazardous air emissions from soil and coal-fired steam generating units. Exhibit
16 EDH-3 suggests that "MACT would require compliance to be based on what top
17 plants are achieving nationwide and could require additional sorbent injection to
18 reduce HAPs."

19 Third, a series of National Ambient Air Quality Standard (NAAQS) for fine
20 particulates, NO₂, SO₂, and ozone are being proposed and promulgated by the
21 EPA. These NAAQS, designed to improve health, generally require states to
22 obtain minimum standards, and show that they can meet those standards through
23 reduced emissions. The Company recognizes that Colstrip may be a target for
24 emissions reductions: Exhibit EDH-3 states that "improvements may be needed if
25 modeling shows SO₂ cuts are needed" as a result of new standards. It is not clear
26 which NAAQS are the subject of this statement.

² The MATS rule has been known in most circles as the Maximum Achievable Control Technology (MACT) for Hazardous Air Pollutants (HAPS) rule. On March 16, 2011, the EPA formalized the proposal for this rule under the name Mercury and Air Toxics Standard (MATS). Generally, the use of MATS and the informal use of the "MACT rule" refer to the same standards.

1 Fourth, Exhibit EDH-3 notes that the EPA has proposed to regulate coal ash and
2 other wastes as hazardous substances under the Coal Combustion Residual Rule
3 from the EPA. If this takes effect, Exhibit EDH-3 notes that “reconfiguration of
4 ash handling and plus potential clean-up of existing ash ponds would be costly to
5 the facility.”

6 **Q. Does Colstrip have any post-combustion emission controls in place?**

7 A. Some. According to the company, all four units had flue gas desulfurization
8 (FGD), or scrubbers, installed for the control of SO₂ emissions when the units
9 were built. In my opinion, it is unlikely that the existing scrubbers on Units 1 & 2
10 will be sufficient to provide the control that the company would require under
11 either the regional haze rule or under NAAQS, given that their design and
12 installation predates numerous technological advances in SO₂ controls. In
13 particular, Venturi particulate scrubbers such as those used at Units 1 & 2 have
14 not been installed at coal-fired power plants since the 1970's due to these
15 advances.

16 **Q. Does Colstrip currently have state of the art controls for NO_x, particulates?**

17 A. No. PSE claims to have “upgraded low NO_x and overfire air systems” and
18 “mercury control systems” on all four units (response to Sierra Club Data Request
19 01.14). The low NO_x burners and overfire air systems are combustion controls
20 designed to reduce NO_x emissions, but according to an analysis conducted by
21 PPL Montana for the EPA regarding Colstrip, even if optimized, they can only
22 achieve 43% reductions at Colstrip.³ Selective non-catalytic reduction (SNCR), a
23 post-combustion control, provides additional reductions (estimated at about 47%
24 in the same document); selective catalytic reduction (SCR) is considered a state-

³ NO_x Control Update to PPL Montana’s Colstrip Generating Station BART Report. September, 2011.
Section 1.1. <http://www.epa.gov/region8/air/pdf/ColstripNOxupdate.pdf>

1 of-the-art control and, according to PPL, would achieve an 83% reduction in
2 NOx.⁴

3 The Colstrip units do not have any form of direct particulate control. To my
4 understanding, the Venturi scrubbers installed at the units may capture a large
5 fraction of primary particulates, but the units lack either electrostatic precipitators
6 or fabric-filter baghouses. As such, they are unlikely to qualify as BART in most
7 cases.⁵

8 **Q. Under what circumstances would the Regional Haze rule require additional**
9 **environmental controls at Colstrip?**

10 A. The Colstrip units are, as indicated by the Company in Exhibit EDH-3, subject to
11 a number of EPA regulations designed to protect human health and the
12 environment. The most pressing regulations likely to require additional or new air
13 emissions controls are the Regional Haze Rule requiring BART, and the Mercury
14 and Air Toxics Rule (MATS).

15 Colstrip units 1 & 2 are BART-eligible; i.e. emissions from these units must be
16 evaluated to determine if they impair visibility at Class 1 areas, and if they do,
17 must be remediated through “best available retrofit technology”, or BART. (Units
18 3 & 4 are not BART-eligible as they were built during a period when better
19 emissions control technology was available and required.) Most states have opted
20 to create their own plans to reduce visibility-impairing pollution at National Parks
21 and other Class 1 areas, but Montana has chosen to allow the EPA to promulgate
22 an implementation plan for the State’s sources, including Colstrip 1 & 2. PPL
23 Montana, the co-owner of Colstrip, produced an analysis of the plant’s

⁴ Authors calculations from baseline “Uncontrolled NOx Emissions” of 0.350 lbs/MMBtu (Table 2-1a), and reductions to 0.185 lbs/MMBtu for SNCR in Table 2-2b (presumably includes reductions from LNB and OFA) and 0.06 lbs/MMBtu for SCR in Table 2-3b (same assumption as SNCR).

⁵ According to technical comments submitted to the EPA by EarthJustice regarding BART considerations at Colstrip on August 22, 2011, “Venturi scrubbers are not typically included in best available control technology (BACT) analyses for new or modified coal-fired electric utility steam generating units,” and furthermore, “there is no question that the Venturi scrubber technology does not reflect the best system of continuous emission reduction for PM.” Comment letter available at <http://www.epa.gov/region8/air/pdf/Earthjustice.pdf>

1 contributions to visibility impairment in 2007, and recommended that potential
2 visibility improvements did not warrant particulate controls such as ESP or fabric
3 filter baghouses, improvements to the existing scrubbers, or additional reductions
4 in NOx from SCR or SNCR.⁶

5 **Q. Do you have any reason to question the Company's conclusion that**
6 **additional particulate controls will not be required?**

7 A. Yes. In fact, the U.S. EPA specifically disagreed with the Company's assertion in
8 its 2007 BART assessment, stating that "visibility modeling shows that for Class I
9 areas in Montana, and in particular U.L. Bend National Wildlife Refuge, Colstrip
10 Units 1&2 have the largest impact of any single stationary source in Montana."⁷

11 The final BART ruling from the EPA for Montana (and hence Colstrip) has not
12 yet been released, but EPA expects to make a final determination on BART in
13 mid-2012. Recently the EPA overturned other state plans that it found inadequate,
14 requiring SCR at the Four Corners plant (75 FR 64221) and SO₂ controls at a
15 number of Oklahoma plants (76 FR 16168). The EPA's 2008 comments on PPL's
16 analysis suggest that the agency could require significant NOx and SO₂ reductions
17 to achieve air quality improvements, and comments from EarthJustice reason that
18 the EPA should require additional controls for NOx, SO₂, and particulates. While
19 we cannot know exactly what the EPA will require, there is a marked risk that the
20 EPA will require a full suite of pollution controls at Colstrip to meet air quality
21 requirements in Montana.

22 **Q. Under what circumstances would the MATS rule require additional**
23 **environmental controls at Colstrip?**

24 A. The MATS rule is expected to be finalized in December of 2011. The proposed
25 rule sets fairly stringent limits for mercury and other toxic metals, organic air
26 pollutants that are byproducts of combustion, and acid gasses. The EPA has

⁶ PPL Montana, LLC. Best Available Retrofit Technology (BART) Assessment: Colstrip Generating Station. August 2007. Available at <http://www.epa.gov/region8/air/pdf/ColstripBARTReport.pdf>

⁷ US EPA. Memo Re: Best Available Retrofit Technology (BART) Assessment Colstrip Generating Station. <http://www.epa.gov/region8/air/pdf/colstrip.pdf>

1 suggested that combinations of FGD, baghouses, and activated carbon injection
2 (ACI) will be required to meet these standards. The Colstrip plant, as a whole, is
3 apparently now meeting a Montana mercury standard⁸ that is slightly more
4 stringent than the EPA standard for individual units (0.9 lbs/TBtu in MT vs. 1.0
5 lbs/TBtu in MATS⁹) through the use of a sorbent injection system, but it is not
6 clear if Colstrip 1 & 2 will individually meet the updated mercury or other
7 hazardous air pollution limitations. If they do not, the plant might require
8 additional or upgraded controls.

9 **Q. Has the Company indicated any intentions of installing new emission**
10 **controls such as SCR, SNCR or fabric filters?**

11 A. No. According to PSE's response to Sierra Club Data Request 01.15, "There are
12 no plans to install selective catalytic reduction systems, selective non-catalytic
13 reduction systems, or fabric filters" on any of the units.

14 **Q. Has the Company indicated any intentions of installing additional SO₂**
15 **controls or upgrading the existing FGD system?**

16 A. The Company has not explicitly stated that it expects to install additional SO₂
17 controls or upgrade the existing system, but they do acknowledge a risk in Exhibit
18 EDH-3 that the "BART/Regional Haze outcome may require lower SO₂ level for
19 Colstrip 1 & 2 (still waiting on final determination by EPA)".

20 **Q. Has the Company considered any of the potential costs of new emission**
21 **controls pursuant to this filing?**

22 A. No. Despite PSE's clear anticipation of impacts from new regulatory
23 requirements, the Company apparently has not considered any of the potential
24 costs. In fact, in several data responses they claim that they "cannot estimate if
25 any additional controls are required" (see Company's response to Sierra Club
26 Data Request 01.21). In fact, the Company is fully able to estimate the costs of

⁸ Montana Department of Environmental Quality. April 2009. Air Permit #0513-07

⁹ 76 FR 25027, Table 10.

1 controls, and has done so for the EPA for Regional Haze compliance.
2 Unfortunately, by dismissing these environmental regulations and their associated
3 costs, the Company is affirmatively underestimating significant compliance costs.
4 The Commission and ratepayers are poorly served by this oversight, and it is
5 germane to the question of whether any money spent on Colstrip is a reasonable
6 and prudent use of ratepayer funds.

7 **Q. Are the potential costs of new emission controls relevant in this proceeding?**

8 A. Yes. While the Company is not required to include future environmental upgrade
9 costs in this rate filing, and under traditional utility ratemaking may not request
10 recovery of these costs until after they are incurred, the Company's overall
11 ongoing resource planning should reflect the future expenses and investments that
12 would or could be needed for forward going operation. Failure to consider these
13 costs in the Company's resource planning process is a serious omission, as they
14 may be in the hundreds of millions of dollars. These modifications will also affect
15 the operating and maintenance costs of Colstrip, which could become a significant
16 burden to ratepayers, and they could undermine the economic viability of
17 maintaining the entire plant.

18 **b. REGULATION OF COAL COMBUSTION RESIDUALS**

19 **Q. Are there proposed federal regulations regarding coal ash?**

20 A. Yes, there is a proposed Coal Combustion Residual rule (CCR) by the EPA that
21 may regulate coal ash as a "hazardous" substance for the first time.

22 **Q. Has the Company acknowledged potential future costs of the proposed CCR**
23 **rule?**

24 A. Yes, the Company claims that if CCRs are declared as hazardous waste, the
25 "reconfiguration of ash handling plus potential clean-up of existing ash ponds,
26 would be costly to facility" (Exhibit EDH-3). Also, in the Company's "Briefing
27 Paper: PSE Perspective on EPA Coal Ash Regulations" (see Company's response

1 to Sierra Club Data Request 01.22, Attachment D) they project future costs of
2 compliance, claiming that “If the ash is classified by EPA as hazardous waste and
3 assuming that on-site ponds could be permitted and modified, it is estimated that
4 PSE's share of the remediation costs for the site could reach approximately \$30-
5 35 million plus increases to O&M costs of \$3-5 million per year.” Alternatively,
6 if coal ash has to be taken off-site then the Company’s annual cost escalates to
7 \$100 million (see Company’s response to Sierra Club Data Request 01.22,
8 Attachment D).

9 **Q. How are coal combustion residuals currently disposed of at Colstrip?**

10 A. The operators of Colstrip (including the Company) send coal ash to containment
11 ponds in the local area. PPL Montana maintains and operates a system of waste
12 impoundments at and near the plant that receive waste from various of the plant’s
13 operations, including sludge from scrubbers, bottom ash slurry, and coal-pile
14 runoff. All of these residuals can contain various levels of hazardous materials;
15 the scrubber sludge, in particular, is likely to contain high levels of pollutants. As
16 I understand it, there are approximately fifteen active impoundments associated
17 with Colstrip.

18 **Q. Are there health risks associated with coal ash containment ponds?**

19 A. Yes. The ash can contain arsenic, boron, lead, mercury, zinc, among other toxic
20 and non-toxic elements. The primary source of health risks is that the containment
21 ponds can leak and release the toxic elements into the local water supply, which
22 would harm the local population.¹⁰

23 **Q. To your knowledge, has such leakage occurred at the Colstrip plant leading**
24 **to local groundwater contamination?**

25 A. Yes. Recently, 57 residents sued the owners of Colstrip (including the Company)
26 alleging that their water supply was contaminated from coal ash pond leakage.

¹⁰ “Coal Ash: Its Origin, Disposal, Use, and Potential Health Issues,” EPRI, page 3.
http://www.uswag.org/epri-coal_ash-origin-disp-use.pdf

1 The plaintiffs also claimed that the operators were aware of the contamination but
2 chose not to report it for four years. This case was settled for \$25 million in
3 2008.¹¹

4 **Q. Did the Company recover the costs of this settlement from ratepayers?**

5 A. Yes, in part. In a 2010 general rate case, the Company recovered the portion of
6 the settlement that was not covered by insurance; this amounted to \$8.4 million
7 funded by ratepayers.¹²

8 **Q. Is there current litigation pending on the same issue?**

9 A. Yes, several local ranchers are suing the Colstrip operators (including the
10 Company) for water contamination at their ranches. According to the Company's
11 2010 10-K filing, the parties are in settlement talks¹³.

12 **Q. Will coal-ash disposal costs be incurred regardless of whether Colstrip
13 continues to operate?**

14 A. Yes, to a certain extent, but the costs are likely to grow substantially with
15 continued operation. It is true that much of the costs of coal ash disposal resulting
16 from new regulations cannot be avoided because they will result from the plant's
17 operations to-date. However, it is likely that the disposal issues are increasing and
18 will continue to increase with additional disposal.

19 Further, as the plant exhausts its current on-site storage options, disposing of the
20 ash off-site will be much more costly as mentioned above. Therefore, while much
21 of the costs of disposal may be seen as sunk costs, the prevention of additional ash
22 disposal is likely to provide significant cost and risk reduction benefits to
23 ratepayers.

¹¹ "PPL Montana, Rosebud Protective Association weigh in on proposed EPA coal ash regs," Billings Gazette, November, 16, 2010.

¹² Puget Sound Energy, Form 10-K, U.S. Securities and Exchange Commission, page 93.

¹³ Ibid.

1 **c. GREENHOUSE GAS EMISSIONS COSTS**

2 **Q. Are there other potential emission regulations that are not currently**
3 **proposed but that are likely to affect Colstrip in the future?**

4 A. Yes. Foremost among these is the potential for future federal regulation of CO₂
5 within the projected lifetime of these resources. There have been several pieces of
6 legislation that have proposed a form of CO₂ emissions regulation in the past but
7 have failed to pass both houses of Congress. However, it is still likely that the US
8 will have some form of regulation and/or taxation of CO₂ in the coming years that
9 would have drastic impacts on Colstrip's bottom line. According to a 2009 report
10 by Environment America, Colstrip was ranked 9th among the highest emitting
11 power plants for CO₂ in the US. Colstrip produced over 19 million tons of CO₂ in
12 2007--the equivalent of 3.4 million cars operating for a year.¹⁴ This substantial
13 externality has not yet been internalized by coal plant operators. However, many
14 states and utilities currently incorporate future CO₂ costs in their resource plan
15 (IRP), and PSE should do the same.

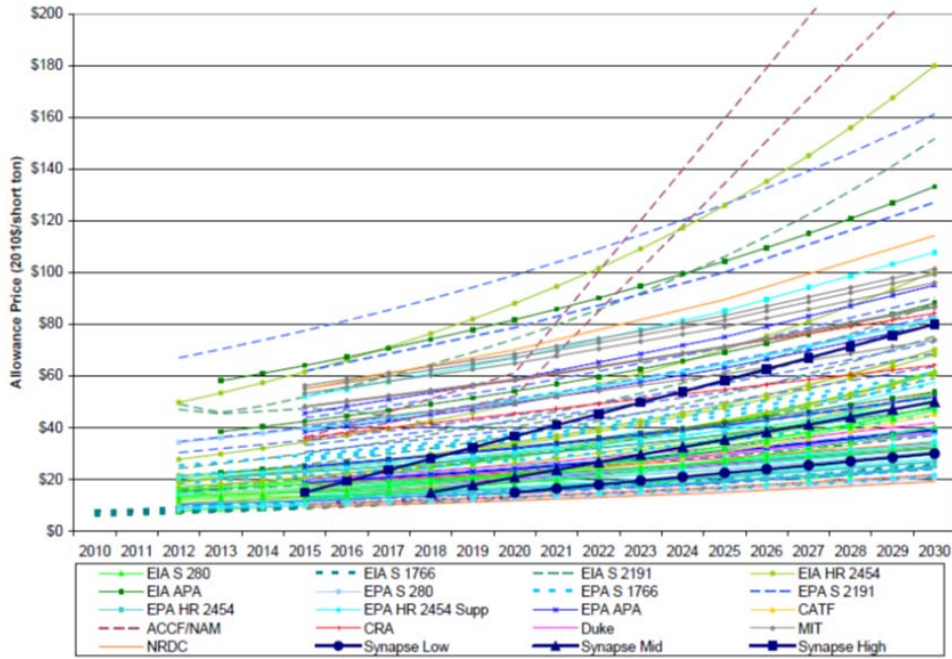
16 **Q. What would the consequences of future CO₂ regulation be for the Company**
17 **and its ratepayers?**

18 A. As a major emitter of CO₂ in the United States, the consequences of regulations
19 for the Colstrip plant would certainly be significant—which means that the
20 Company should be analyzing future costs of CO₂ at the very least as a risk to the
21 future economics of the plant. Exhibit EDH-4 (Synapse Energy Economics, 2011
22 Carbon Dioxide Price Forecast, White Paper, February 2011) presents and
23 describes Synapse's forecast of reasonable CO₂ prices in the future, including
24 low, mid and high scenarios. Synapse's mid-scenario estimates CO₂ prices of \$15
25 per ton in 2018 and ramping up to \$50 per ton in 2030 (a levelized cost of \$26 per
26 ton from 2015 to 2030). Using this levelized estimate, if Colstrip continues to
27 emit over 19 million tons of CO₂ per year, this would amount to a cost of
28 approximately \$500 million annually. It is important to note that these figures

¹⁴ "America's Biggest Polluters: Carbon Dioxide Emissions from Power Plants in 2007," Environment America, November 2009.

1 could be seen as conservative compared with other U.S. government agency,
 2 university, utility, and NGO CO₂ price estimates—see Figure 1 below that shows
 3 a compilation of other forecasts including those by Synapse.

4 **Figure 1: CO₂ Price Projections including Synapse Low, Mid and High Forecasts**



5
 6 Source: Synapse Energy Economics, 2011 Carbon Dioxide Price Forecast, White Paper, February 2011

7 **Q. Has PSE acknowledged the possibility of carbon dioxide regulation?**

8 A. Not in this proceeding, but the Company did address this issue in its 2011 IRP. In
 9 the supporting analysis the Company represented future CO₂ regulations in two of
 10 the scenarios (“Green World” and “Base + CO₂”) for planning their compliance
 11 with the Washington Renewable Portfolio Standard (RPS). In discussing carbon
 12 mitigation strategies, the IRP states that “No Northwest Coal increases the
 13 Company’s revenue requirement by about \$196 million over the Base Case;
 14 Green World increases the revenue requirement by about \$787 million. While
 15 both strategies achieve 1990 emissions levels, the costs are considerable.”¹⁵

¹⁵Puget Sound Energy, 2011 Integrated Resource Plan, Chapter 5, pages 5-40 and 5-41.

1 While the Company acknowledged that these are very significant, potential costs,
2 they did not then thoroughly assess the associated risks. However, the IRP
3 acknowledges a need “to investigate updating their analytical frameworks to
4 better address issues that may arise if regional coal plants are put out of
5 service.”¹⁶ Given the potential size and impact of costs and operational changes
6 associated with CO₂ regulation, a more comprehensive analysis would have been
7 appropriate in my opinion.

8 **d. OTHER COLSTRIP COSTS**

9 **Q. In addition to the environmental compliance costs discussed above, does the**
10 **Company face any other cost increases at Colstrip?**

11 A. Yes, and this is reflected in the operating costs as described in the testimony of
12 PSE witnesses David Mills and Mike Jones. The Company’s present rate filing
13 includes a substantial increase in production O&M costs over the test year for
14 Colstrip. PSE requested an increase of \$8,650,870 for Colstrip units 1 & 2 and an
15 increase of \$3,848,550 for Colstrip units 3 & 4 (See Prefiled Testimony of David
16 E. Mills, Exhibit No. __ (DEM-6)). Mr. Mills also outlines the changes in
17 projected power costs for the Company, including changes to costs of operating
18 Colstrip (see DEM-1CT, page 67 of 73). Over the next few years, PSE is also
19 likely to undertake several significant overhaul projects for major components
20 during the planned outages for Unit 1 in 2012 and Unit 4 in 2013 (see MLJ-1CT,
21 p. 7 of 12.)

22 **Q. According to the Company, what were the causes of this increase in power**
23 **costs at Colstrip relative to the test year?**

24 A. Mr. Mills summarizes the increases in power costs as being caused by “increased
25 Colstrip coal production costs” and “decreased Colstrip generation due to a higher
26 4-years average forced outage rate and two planned major outages” (see DEM-
27 1CT, page 67 of 73).

¹⁶ Ibid.

1 **Q. How does the Company’s witness Michael Jones explain the rise in coal**
2 **costs?**

3 A. Mr. Jones explains that the increases are “increasing strip ratios (the amount of
4 overburden that must be removed per ton of coal produced), as well as higher
5 collective bargaining agreement wage rates and increases in diesel fuel costs and
6 other commodities” (see MLJ-1CT, page 8 of 12).

7 **Q. How does the Company characterize the likely future trend in coal costs?**

8 A. The Company “anticipates that the increased cost of coal supplied to Colstrip will
9 continue to trend up in the future” (Response to Sierra Club Data Request 02.16).

10 **Q. Are there other factors that would contribute to coal cost increases that the**
11 **Company does not mention?**

12 A. Yes, the prices for Powder River Basin (PRB) coal are facing upward pressure
13 from several sources, mostly from increasing global and domestic demand;¹⁷ a
14 report by Barclays Capital Commodity Research claims “PRB coal demand to
15 surge 27%.”¹⁸ Previously dormant export markets are potentially opening up; for
16 example, a recent report discussed a planned coal export terminal in Bellingham,
17 Washington that, if built, would export large quantities of U.S. coal to China.¹⁹
18 On the domestic side, if the EPA’s CSAPR (Cross-State Air Pollution Rule) takes
19 effect then coal plants in the eastern US will need to switch to using more Powder
20 River Basin coal in order to comply, increasing competition for this resource and
21 putting upward pressure on the price.

¹⁷ Greg Boyce, Chairman and CEO Barclay’s, Presentation to Peabody Energy:
<http://www.peabodyenergy.com/mm/files/Investors/IR%20Presentations/Barclays%20Presentation%20Greg%20Boyce%20090811%20PDF.pdf>

¹⁸ <http://www.commodityonline.com/news/PRB-coal-demand-to-surge-27-on-CSAPR-Asian-exports-42938-3-1.html>. (I have not reviewed the original source, the *Barclays Capital Commodities Research* report, as it is not available to the public)

¹⁹ <http://www.npr.org/2011/10/26/141687537/in-northwest-town-a-local-fight-against-global-coal>

1 **Q. Does the Company discuss the source of Colstrip’s coal?**

2 A. Yes, according to the Company, “The fuel mix for each of the Colstrip units for
3 the past five years and the projected fuel mix for the next ten years is 100 percent
4 Rosebud seam coal from the Rosebud Mine” (see Company’s response to Sierra
5 Club Data Request 02.17).

6 **Q. Does the Rosebud mine face any risks to operation in the future?**

7 A. Yes, possibly. The Rosebud mine is under heavy scrutiny by environmental
8 groups for water contamination. A recent notice of violation and intention to sue
9 was filed by Sierra Club and Montana Environmental Information Center (MEIC)
10 over the lack of oversight of water quality near to coal mines in Montana
11 (including Rosebud).²⁰

12 **Q. What information does Mr. Jones provide regarding forced outages at
13 Colstrip?**

14 A. Mr. Jones discusses the additional forced outage days at Colstrip relative to what
15 they had anticipated in their previous rate case. Mr. Jones cites specific examples
16 of extended outages at the plant, such as when an independent contractor noticed
17 cracks in two rotors in Unit 4 which “delayed the Unit 4 restart for five months”
18 (see MLJ-1CT, page 6 of 12).

19 **Q. How did consideration of this extended outage affect generation from
20 Colstrip compared to the last general rate case?**

21 A. According to Mr. Jones, the forced outage rates from Unit 3 and 4 reduced
22 “available rate year generation by 135,000 MWh compared to PSE’s 2009 GRC”
23 (see MLJ-1CT, page 4 of 12).

²⁰ MEIC and Sierra Club, Notice to Sue Pursuant to 30 U.S.C. § 1270(a)(2) and M.C.A. § 82-4-252.
<http://meic.org/9-20-11%20NOI%20Final.pdf>

1 **Q. Is there reason to believe that Units 3 and 4 will continue to have high outage**
2 **rates?**

3 A. Yes, in fact Mr. Jones claims that the Company will calculate their forced outage
4 rate incorporating the 2009 incident at Unit 4 since if a major component “suffers
5 damage, it is impossible to generate any energy until the component is repaired or
6 replaced (see MLJ-1CT, page 6 of 12).

7 However, there is some evidence that the Company’s assumed outage rate may
8 not be high enough. A previous study of all Colstrip units done by UMS Group
9 found that Units 3 and 4 were showing “excessive EFOR’s [Equivalent Forced
10 Outage Rate] for their ages” and both units are “exhibiting early-in-life
11 availability problems with Unit 3 of particular concern” (see Company’s response
12 to Sierra Club Data Request 01.26, Attachment A.)

13 **Q. What are the implications for ratepayers if the availability of Colstrip is**
14 **significantly lower than the Company has projected?**

15 A. A lower unit availability not only means higher maintenance and repair costs, it
16 also means that these and other fixed costs for the units must effectively be spread
17 over a smaller number of kWh. Thus any comparison of the costs of Colstrip as a
18 resource relative to alternatives must include a realistic assessment of unit
19 availability.

20 **Q. How are these increased costs relevant to the Company’s current rate filing?**

21 A. In the current filing, the company is asking for an upward revision in its revenue
22 requirements due to the factors detailed by Mr. Jones and Mr. Mills. In addition to
23 these increased operating expense, I have identified several environmental
24 compliance costs that would likely result in hundreds of millions of dollars of
25 additional spending that customers will ultimately have to bear if the Company
26 continues to operate Colstrip. Under such circumstances, it is reasonable and
27 necessary to ask if it would be more economical to retire or repower coal-fired
28 power plants rather than invest in expensive life-extension retrofits.

1 If such is the case here, and the most cost-effective and risk-reducing course for
2 the owners of Colstrip is to plan for retirement of the plant, then the Company
3 should minimize or avoid altogether any investments or costs to ratepayers that
4 are inconsistent with preparing for retirement. As a condition of approving any
5 requested recovery in this proceeding, the Commission should require the
6 Company to fully evaluate all aspects of the future costs and risks at Colstrip
7 before it includes them in customers' rates. To do otherwise risks wasting
8 ratepayer dollars on unnecessary investments in long-term overhauls for benefits
9 that will never be fully realized.

10 **3. PROJECTED RETIREMENT OF COLSTRIP UNITS**

11 **Q. Did the Company change its assumptions regarding the operating lives of**
12 **the Colstrip units in its resource need scenarios for the 2010 RFP?**

13 A. Yes. The Company's most recent planning document, the 2009 IRP, assumed that
14 Colstrip would retire in the near term, with units 1 and 2 retiring in 2019 and units
15 3 and 4 retiring in 2024 and 2026. (Exhibit No. ___(RG-3), page 87 of 1396) The
16 Company changed these retirement dates for purposes of the 2010 RFP and
17 instead assumed that Colstrip would run indefinitely. (see AS-3HC, page 170 of
18 481).

19 **Q. Why did the Company extend the assumed operating life of Colstrip?**

20 A. In response to Sierra Club data request 02.07, the Company stated that it extended
21 the assumed operating life of Colstrip because of a settlement agreement reached
22 during the 2007 general rate case, Docket Nos. UE-072300 and UG-072301.

23 **Q. Did the Company consider the cost-effectiveness or engineering feasibility of**
24 **extending the assumed operating life of Colstrip?**

25 A. Not according to any documents I have seen. The settlement was based on the
26 electric depreciation rates for Colstrip: "The electric depreciation rates have been
27 adjusted from the Company's rebuttal filing to reflect Commission Staff's and
28 Public Counsel's proposed Colstrip depreciable life of 60 years." (Docket Nos.

1 UE-072300 and UG-072301, *Partial Settlement Re: Electric and Natural Gas*
2 *Revenue Requirements*, page 4.) Staff's witness in that proceeding, Mr. William
3 H. Weinman, recommended extending the assumed life of Colstrip to 60 years
4 rather than PSE's prior assumption of 40 years. (Docket Nos. UE-072300 and
5 UG-072301, Testimony of William H. Weinman, Exhibit __T (WHW-1T), page
6 8.) However, Mr. Weinman based his recommendation on a statistical comparison
7 of other coal plants in the United States. I have seen no evidence that he
8 conducted any type of economic analysis that assessed the cost effectiveness of
9 continuing to operate Colstrip for 60 years.

10 **Q. Do you agree with the decision to extend the assumed operating life of**
11 **Colstrip?**

12 A. A statistical analysis of other coal plants in the United States can be an
13 informative tool to evaluate and forecast the characteristics of a particular plant,
14 and I have no reason to doubt the accuracy of Mr. Weinman's testimony from
15 2008. However, in applying such an analysis in a forward-going manner, it is
16 crucial to consider how the future may differ from the past. In this case, there are
17 a number of factors that, in my opinion, render such an analysis inapplicable.
18 These include the environmental compliance requirements and costs discussed
19 above; the likely future cost of CO₂ emissions and the scientific certainty that
20 anthropogenic CO₂ will cause widespread economic and environmental damage
21 in the future; and the increasing availability and decreasing cost of lower- or zero-
22 emissions power generation alternatives.

1 It is also important to consider the individual aspects of a particular plant in
2 addition to the statistical comparison to similarly situated plants. As I testified
3 earlier, Colstrip faces myriad potential environmental retrofit and remediation
4 costs. It is also likely to experience higher than anticipated forced outage rates,
5 suggesting that continued operations at the plant will require higher maintenance
6 and repair costs. The Company should consider all of these factors in determining
7 the appropriate operating life of the Colstrip plant.

8 Given all of these factors, I believe that it is incorrect to conclude that retirement
9 ratios for 40 year-old coal plants will be low in the future, or that an extended
10 operating life for Colstrip is either reasonable or likely.

11 **4. PSE'S ANALYSIS OF ADDITIONAL ENERGY RESOURCES**

12 **Q. Does the Company intend to comply with the Washington state RPS goals?**

13 A. Yes, witnesses Seelig and Garratt both discuss how the Company plans on
14 complying with that state RPS 2012, 2016 and 2020 goals. PSE has further
15 decided to take advantage of favorable market conditions and comply early with
16 some RPS requirements.

17 **Q. Did the Company consider benefits of early investment in wind and other
18 renewables?**

19 A. Yes. According to the testimony of Ms. Seelig (Exhibit No. ___(AS-1HCT)), the
20 Company analyzed five scenarios to determine the optimal investment in new
21 wind resources under a range of market and regulatory conditions. Four out of
22 five of those scenarios indicated optimal investment levels of 744 to 987 MW.

23 **Q. Has PSE elected to pursue wind resource development at that level?**

24 A. Not at this point. It is true that the Company's resource choice complies with
25 some RPS requirements in advance in order to capture more economic benefits, in
26 part to take advantage of federal tax incentives (see AS-1HCT, page 28 of 63).
27 This serves ratepayers well by reducing risk of cost increases and/or a less

1 favorable federal incentive environment in the future; it also improves PSE's
2 overall emissions profile and reduces its exposure to environmental compliance
3 costs and fuel price volatility. Specifically, Ms. Seelig writes,²¹

4 The quantitative results of the Optimization Model indicate that it
5 would be economically favorable for PSE to acquire LSR Phase I,
6 [REDACTED PROJECT] (Unsolicited) and [REDACTED
7 PROJECT] (#10075-a), selecting them in a minimum of four of the
8 five scenarios. (AS-1HCT, p. 37 at 8)

9 However, the total planned investment in wind at this point, for the LSR Phase I
10 at approximately 343 MW, is far lower than the optimal level indicated by the
11 Company's analysis.

12 **Q. Did the Company adequately identify all of the benefits of early investment**
13 **in renewables?**

14 A. No. While the Company acknowledged some benefits of early investment, such as
15 the tax incentives, I do not believe that they adequately assessed the benefits and
16 costs of renewable resources in the context of future environmental regulations
17 such as those discussed earlier in my testimony, including a realistic range of
18 future CO₂ costs, costs of emissions controls and coal ash disposal. In the context
19 of a stricter regulatory environment, building even more renewables earlier would
20 likely prove to be an even more favorable investment strategy.

21 **Q. How does the Company describe their selection process for renewables**
22 **projects?**

23 A. As described by Ms. Seelig, after soliciting proposals through a 2010 RFP, the
24 Company "evaluated the proposals submitted in response to the 2010 RFP in two
25 phases based on criteria designed to take into account qualitative and quantitative
26 factors" (AS-1HCT, page 3 of 63). In evaluating the 2010 RFP, the Company
27 relied in part on some of the prior assumptions that it had made during the most

²¹ The names of specific projects evaluated by PSE was redacted from the public version of Ms. Seelig's testimony.

1 recent integrated resource plan (2009 IRP). PSE updated some of its models
2 during the 2010 RFP evaluation to reflect changes since the 2009 IRP.

3 **Q. According to Ms. Seelig, which 2009 IRP scenarios did the Company use for**
4 **analyzing renewable investments?**

5 A. Ms. Seelig states that the 2009 Business As Usual and 2009 Trends scenario were
6 used (see AS-1HCT, page 24 of 63).

7 **Q. Do these scenarios incorporate future CO₂ costs?**

8 A. Yes, according to the Company's IRP from 2009, the Trends 2009 scenario
9 "includes CO₂ costs of \$37 per ton in 2012 that rise to \$130 per ton by 2029"
10 while the Business As Usual scenario assumes a CO₂ cost of a "negligible \$0.32
11 per ton."²²

12 **Q. How did the Company treat CO₂ costs in the 2011 IRP?**

13 A. The Company's 2011 IRP incorporated CO₂ costs of \$0.32 per ton for "all
14 scenarios except Base + CO₂ and Green World" which assumed higher CO₂
15 costs.²³

16 **Q. Did the Company discuss the risks associated with fossil fuel resources in**
17 **selecting renewables?**

18 A. No.

19 **Q. Are there other renewable opportunities in absence of Colstrip?**

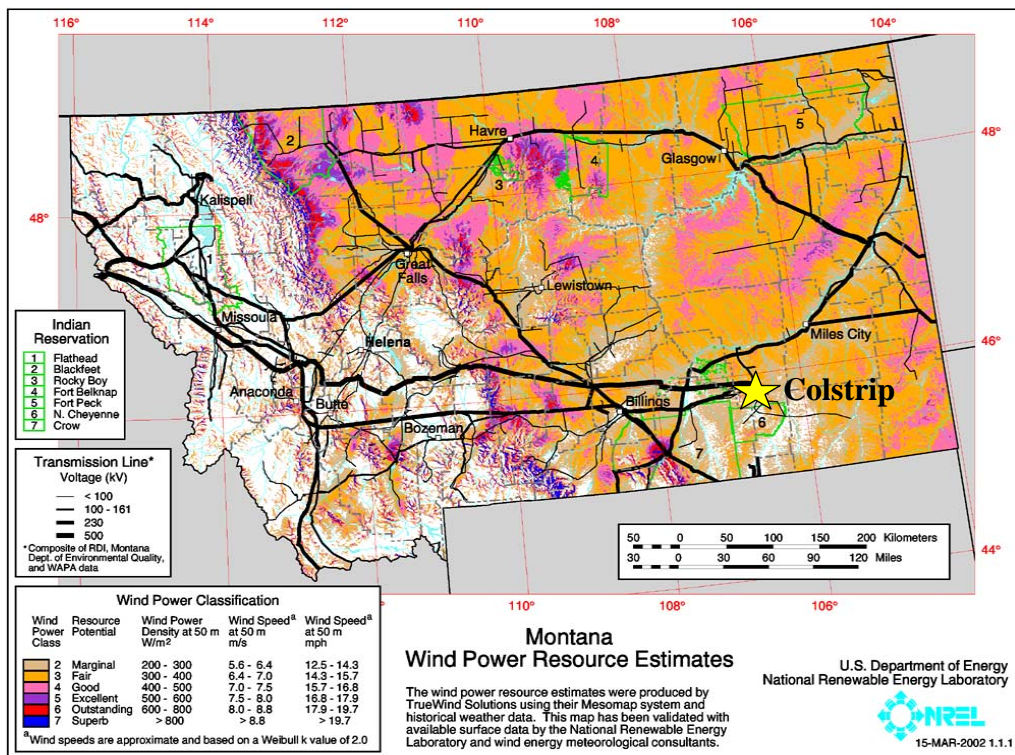
20 A. Yes, there are certainly opportunities for PSE to use more renewables in their
21 system. Witnesses Seelig and Garratt show that many bids that the Company
22 received would have positive net benefits (even under the context of their base
23 case). Should the Colstrip units retire on their original schedule or earlier, the
24 Company will have attractive opportunities to further procure renewable energy.

²² Puget Sound Energy, 2009 Integrated Resource Plan, Chapter 5, page 5-50.

²³ Puget Sound Energy, 2011 Integrated Resource Plan, Chapter 4, page 4-7.

1 In addition to the resources identified in PSE’s RFP process, potential resources
 2 in Montana may become available in Colstrip’s absence. The current transmission
 3 lines running from Colstrip run through a wind-rich area, as illustrated in Figure 2
 4 from the US Department of Energy (showing the wind power classifications for
 5 Montana, along with existing transmission lines.) The figure shows that there are
 6 several patches of “outstanding” and “superb” resource potentials for wind along
 7 the lines running from Colstrip.

8 **Figure 2: Montana Wind Power Resources**



9
 10 Source: NREL and DOE's Wind Powering America - Montana 50 meter Wind Resource Map; see
 11 http://www.windpoweringamerica.gov/maps_template.asp?stateab=mt. Location of Colstrip (yellow star)
 12 added by Synapse.

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

14 **A. Yes.**