

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF NORTH DAKOTA

In the Matter of the Application by Otter Tail Power Corporation, d/b/a Otter Tail Power Company for an Advance Determination of Prudence for the Big Stone II Generating Plant)
And)
In the Matter of the Application of Montana-Dakota Utilities Co., a Division of MDU Resources Group, Inc. for an Advance Determination of Prudence of Montana-Dakota's Participation & Ownership Interest in the Big Stone II Generating Station)

Case No. PU-06-481

and

Case No. PU-06-482

Direct Testimony of
David A. Schlissel
Synapse Energy Economics, Inc.

On Behalf of
Mark Trechock
and
Dakota Resource Council

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Direct Testimony of David A.
Schlissel (initially requested trade secret)
Public Service Commission

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LIST OF EXHIBITS

- Exhibit DAS-1 Resume of David A. Schlissel.
- Exhibit DAS-2 EIA Natural Gas Price Forecasts 1990-2006.
- Exhibit DAS-3 Descriptive Slide Prepared by Big Stone II Co-owners.
- Exhibit DAS-4 Synapse Report: *Climate Change and Power: Carbon Dioxide Emissions Costs and Electric Resource Planning.*
- Exhibit DAS-5 Summary of Senate Greenhouse Gas Cap-and-Trade Proposals in Current U.S. 110th Congress
- Exhibit DAS-6 Scenarios and Carbon Dioxide Emissions Costs from the *Assessment of U.S. Cap-and-Trade Proposals* recently issued by the MIT Joint Program on the Science and Policy of Global Change

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1 **I. QUALIFICATIONS**

2 **Q. Mr. Schlissel, please state your name, position and business address.**

3 A. My name is David A. Schlissel. I am a Senior Consultant at Synapse Energy
4 Economics, Inc, 22 Pearl Street, Cambridge, MA 02139.

5 **Q. On whose behalf are you testifying in this case?**

6 A. I am testifying on behalf of Mark Trechock and the Dakota Resource Council.

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

8 A. Synapse Energy Economics ("Synapse") is a research and consulting firm
9 specializing in energy and environmental issues, including electric generation,
10 transmission and distribution system reliability, market power, electricity market
11 prices, stranded costs, efficiency, renewable energy, environmental quality, and
12 nuclear power.

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

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

18 A. I graduated from the Massachusetts Institute of Technology in 1968 with a
19 Bachelor of Science Degree in Engineering. In 1969, I received a Master of
20 Science Degree in Engineering from Stanford University. In 1973, I received a
21 Law Degree from Stanford University. In addition, I studied nuclear engineering
22 at the Massachusetts Institute of Technology during the years 1983-1986.

23 Since 1983 I have been retained by governmental bodies, publicly-owned utilities,
24 and private organizations in 28 states to prepare expert testimony and analyses on
25 engineering and economic issues related to electric utilities. My recent clients
26 have included the New Mexico Public Regulation Commission, the General Staff

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1 of the Arkansas Public Service Commission, the Staff of the Arizona Corporation
2 Commission, the U.S. Department of Justice, the Commonwealth of
3 Massachusetts, the Attorneys General of the States of Massachusetts, Michigan,
4 New York, and Rhode Island, the General Electric Company, cities and towns in
5 Connecticut, New York and Virginia, state consumer advocates, and national and
6 local environmental organizations.

7 I have testified before state regulatory commissions in Arizona, New Jersey,
8 Connecticut, Kansas, Texas, New Mexico, New York, Vermont, North Carolina,
9 South Carolina, Maine, Illinois, Indiana, Ohio, Massachusetts, Missouri, Rhode
10 Island, Wisconsin, Iowa, South Dakota, Georgia, Minnesota, Michigan and
11 Florida and before an Atomic Safety & Licensing Board of the U.S. Nuclear
12 Regulatory Commission.

13 A copy of my current resume is attached as Exhibit DAS-1.

14 **Q. Have you previously submitted testimony before this Commission?**

15 A. No.

16 **II. SUMMARY AND PURPOSE OF TESTIMONY**

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

18 A. Synapse was retained by the Dakota Resource Council to review the applications
19 and supporting testimony and exhibits submitted by Otter Tail Power Company
20 ("Otter Tail" or "OTP") and Montana-Dakota Utilities ("Montana-Dakota" or
21 "MDU") and to evaluate whether the participation of these companies in the Big
22 Stone II Generating Project is prudent. This testimony presents the results of our
23 investigations of these issues. The Big Stone II Project would include a
24 generating facility in South Dakota and transmission lines and associated facilities
25 in South Dakota and Minnesota.

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1 **Q. Please summarize your conclusions.**

2 A. A. Our conclusions are as follows:

3 1. OTP and Montana-Dakota have not adequately considered the risks
4 associated with building a new coal-fired generating unit in their modeling
5 analyses.

6 2. The most significant uncertainties and risks associated with the proposed
7 Big Stone II Project are the potential for further increases in the project's
8 capital cost; the potential for fuel supply disruptions that could affect plant
9 operating performance; and fuel costs future restrictions on CO₂
10 emissions.

11 3. In particular, it is vitally important for OTP and Montana-Dakota to justify
12 its participation in the Big Stone II Project in light of coming federal
13 regulation of greenhouse gas emissions. It would be imprudent for each
14 Company to continue its participation in the Project without doing so or
15 by merely using a single set of very low CO₂ prices in such analyses.
16 Instead, each Company should use a range of possible CO₂ prices such as
17 the forecasts presented by Synapse in this proceeding.

18 4. OTP and Montana-Dakota have not shown that their demand for
19 electricity cannot be met more cost effectively through alternatives
20 including renewable energy resource, energy conservation and load-
21 management measures than through the Big Stone II Project.

22 5. The economic and modeling analyses prepared by OTP and Montana-
23 Dakota are biased in favor of the Big Stone II Project.

24 For these reasons, the Commission should reject OTP and Montana-Dakota's
25 request for an Advance Determination of Prudence for their participation in the
26 Big Stone II Project.

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1 **Q. Please explain how you conducted your investigations in this proceeding.**

2 A. We have reviewed the testimony and exhibits filed by OTP and Montana-Dakota
3 in this proceeding and by the Big Stone II Co-owners in Minnesota Public
4 Utilities Commission Dockets Nos. CN-05-619 and TR-05-1275 and in South
5 Dakota Public Utilities Commission Case No. EL05-022. We also have reviewed
6 the IRP filings made in Minnesota by OTP.

7 In addition, we have participated in discovery in this proceeding, the Minnesota
8 Public Utilities Commission Dockets, the South Dakota Public Utilities
9 Commission case, and the Minnesota IRP Dockets. As part of that work, we have
10 prepared information requests that were submitted to OTP, Montana-Dakota, and
11 the other Big Stone II Co-owners and have reviewed the responses to those
12 information requests and to the discovery submitted by other parties including the
13 Commission Staff in this proceeding, the Department of Commerce in Minnesota
14 and the South Dakota Public Utilities Commission Staff in Case No. EL05-022.

15 Finally, we have rerun the Strategist model for Montana-Dakota.

16 **Q. Please identify the Synapse staff who participated in these reviews of the Big
17 Stone II Project.**

18 A. Our reviews of the Big Stone II Project involved a collaborative group
19 assessment. I was the Synapse project manager for these reviews. The other
20 Synapse staff who participated in the reviews were Bruce Biewald, Anna
21 Sommer, Dr. David White, Dr. Ezra Hausman, Lucy Johnston, Bob Fagan, Tim
22 Woolf, and Michael Drunsic. Individually, and as a group, our project team has
23 extensive experience and expertise in environmental, resource planning and
24 related modeling analyses. Information on the other project team members is
25 available on the Synapse website at [www.synapse-](http://www.synapse-energy.com/expertise/staff.shtml)
26 [energy.com/expertise/staff.shtml](http://www.synapse-energy.com/expertise/staff.shtml).

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1 **Q. Did you file testimony and testify in South Dakota Public Utilities**
2 **Commission Case No. EL05-022?**

3 A. Yes. I filed testimony on greenhouse gas regulation issues in Case No. EL05-022
4 on May 19, 2006 and testimony on other issues related to the proposed Big Stone
5 II Project on May 26, 2006. In addition, I filed rebuttal and surrebuttal testimony
6 on June 9 and June 22, 2006. I testified before the South Dakota Commission on
7 June 29, 2006.

8 **Q. Did you file testimony and testify in Minnesota Public Utilities Commission**
9 **Dockets Nos. CN-05-619 and TR-05-1275?**

10 A. Yes. I filed testimony in Dockets Nos. CN-05-619 and TR-05-1275 on November
11 17 and 29, 2006 and testified on December 15 and 21, 2006.

12 **III. OTP AND MONTANA-DAKOTA HAVE NOT ADEQUATELY**
13 **CONSIDERED THE RISKS ASSOCIATED WITH BUILDING A NEW**
14 **COAL-FIRED GENERATING UNIT**

15 **Q. Why is it important that OTP and Montana-Dakota consider risk when**
16 **evaluating the economics of building the Big Stone II Project?**

17 A. Risk and uncertainty are inherent in all enterprises. But the risks associated with
18 any options or plans need to be balanced against the expected benefits from each
19 such option or plan.

20 In particular, parties seeking to build new generating facilities and the associated
21 transmission face of a host of major uncertainties, including, for example, the
22 expected cost of the facility, future restrictions on emissions of carbon dioxide,
23 and future fuel prices. The risks and uncertainties associated with each of these
24 factors needs to be considered as part of the economic evaluation of whether to
25 pursue the proposed facility or other alternatives.

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1 **Q. Have you seen any evidence that OTP and Montana-Dakota have adequately**
2 **considered risks and uncertainties in the economic evaluations of the Big**
3 **Stone II Project?**

4 A. No. The OTP and Montana-Dakota modeling analyses that we have examined do
5 not include any assessment of the uncertainty or risks associated with higher
6 capital costs or regulation of greenhouse gas emissions. Instead, their models
7 optimize for lowest costs based on a defined, predictable future.

8 For example, only the levelized analysis presented as Exhibit No. MR-2 by Mark
9 Rolfes even attempts to present a break-even analysis for future CO₂ prices, one
10 of the most important of the risks and uncertainties facing owners of proposed
11 fossil-fired generating facilities. However, as I will discuss later in this testimony,
12 that analysis is significantly flawed and its results cannot be relied upon.

13 **Q. Is it reasonable to expect that OTP and Montana-Dakota could reflect**
14 **uncertainty and risk in their economic analyses of whether to pursue the Big**
15 **Stone II Project or alternatives?**

16 A. Yes. There are a number of ways that OTP and Montana-Dakota could have
17 considered uncertainty and risk. The most simple way would have been to
18 perform sensitivity analyses reflecting engineering type bounding in which the
19 key variables would be expected to vary by X% above or below their projected
20 values. In my experience, utilities regularly consider risk in this way.

21 **Q. Have OTP or Montana-Dakota previously performed any such sensitivity**
22 **analyses regarding the proposed Big Stone II Project?**

23 A. Yes. For example, OTP witness Morlock discussed in his Direct Testimony
24 before the Minnesota Public Utilities Commission that under Minnesota law,
25 Otter Tail Power was required to examine a number of alternate resource plan
26 scenarios to satisfy regulatory requirements.¹ Consequently, Otter Tail Power had

¹ Direct Testimony of Bryan Morlock, at pages 5 and 6.

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1 examined scenarios involving base, low and high load growth with no, low and
2 high externalities.

3 We believe that prudence also requires that OTP and Montana-Dakota look at
4 fossil plant-specific uncertainties and risks associated with their proposal to build
5 and operate the Big Stone II Project. This is especially true in light of the
6 substantial cost increase in the estimated capital cost of the Big Stone II Project
7 that was announced in July 2006.

8 **Q. What are the most significant fossil plant-specific uncertainties and risks**
9 **associated with the proposed Big Stone II Project?**

10 A. The most significant uncertainties and risks associated with the proposed Big
11 Stone II Project are the potential for further increases in the project's capital cost;
12 the potential for fuel supply disruptions that could affect plant operating
13 performance and fuel prices; and future restrictions on CO₂ emissions.

14 **Q. Is it important to evaluate the uncertainties and risks associated with**
15 **alternatives to the Big Stone II Project as well?**

16 A. Yes. The risks associated with building natural gas-fired alternatives include
17 potential CO₂ emissions costs, possible capital cost escalation and fuel price
18 uncertainty and volatility.

19 Renewable alternatives and DSM also have some uncertainties and risks. These
20 include potential capital cost escalation, contract uncertainty and customer
21 participation uncertainty.

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1 **IV. OTP AND MONTANA-DAKOTA HAVE NOT ADEQUATELY**
2 **CONSIDERED THE RISK OF FURTHER INCREASES IN THE**
3 **ESTIMATED COST OF THE BIG STONE II PROJECT**

4 **Q. When did the Big Stone II Co-owners last increase the estimated cost of the**
5 **Project?**

6 A. The Big Stone II Co-owners announced a cost increase in August 2006, raising
7 the estimated cost of the Project from about \$1 billion to approximately \$1.366
8 billion. This represented an increase of about \$300 million, in 2011 dollars.

9 **Q. Is it reasonable to expect that there will be no further increases in the**
10 **estimated cost of the Big Stone II Project?**

11 A. No. In their testimony before the Minnesota Public Utilities Commission, OTP
12 and Montana-Dakota witnesses Rolfes and Trout identified a number of factors
13 which have led to increases in the costs of building new power plants.

14 For example, Mr. Trout noted the following in his Supplemental Direct
15 Testimony in Minnesota PUC Dockets Nos. CN-05-619 and TR-05-1275:

16 Since the initial [Big Stone II cost] estimate was prepared in 2004,
17 the power generation industry has experienced significant pricing
18 increases for various commodities including steel, alloy piping,
19 cable and wire, and other critical commodities. These have
20 contributed to a constantly changing market for commodities and
21 power plant equipment....

22 * * * *

23 • Major construction commodities have increased 30% to
24 80% during the last two years.

25 • Labor rate escalation is currently double what it was two
26 years ago.

27 The global demands (the governments of China and India, for
28 example) for huge expansion in the electricity production sectors
29 will impact equipment prices and creates raw material and
30 fabrication facility (shop space) shortages worldwide for all types
31 of energy production projects. The U.S. electricity production
32 industry announced multiple large projects for development and

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1 construction, some of which have supply contracts which have
2 recently been awarded. The energy and process markets are
3 experiencing tremendous growth at the same time.

- 4 • Suppliers and Subcontractors that downsized after the
5 market collapsed in 2001 are challenged to grow their
6 capacity and workforce.
- 7 • Continuously increasing costs and longer delivery times for
8 raw materials are influencing engineered equipment costs
9 and commodity purchases.

10 Increased costs for fuel have caused unexpected increases in
11 fabrication and transportation costs for delivery of fabricated
12 materials, as well as higher construction costs to build this project.²

13 Mr. Rolfes identified the same factors as being responsible for the approximate
14 \$300 million increase in the estimated cost of building Big Stone II that was
15 announced in August 2006.³

16 **Q. Have other utilities similarly noted that the domestic U.S. and the worldwide**
17 **competition for power plant design and construction resources, commodities,**
18 **and manufacturing capacity have led to significant increases in power plant**
19 **construction costs?**

20 **A.** Yes. For example, in testimony filed at the North Carolina Utilities Commission
21 on November 29, 2006, Duke Energy Carolinas emphasized the significant impact
22 that the competition for the resources has been having on the costs of building
23 new power plants. This testimony was presented to explain the approximate 47
24 percent, that is, \$1 billion, increase in the estimated cost of Duke Energy
25 Carolinas' proposed coal-fired Cliffside Project that the Company announced in
26 October 2006.

² Applicants' Exhibit 33 in Minnesota Public Utilities Commission Dockets Nos. CN-05-619 and TR-05-1275, at page 27, line 20, to page 29, line 14.

³ Applicants' Exhibit 32 in Minnesota Public Utilities Commission Dockets Nos. CN-05-619 and TR-05-1275, at pages 5 and 6.

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1 In fact, Duke Energy Carolinas witness Judah Rose noted in his testimony to the
2 North Carolina Utilities Commission that:

3 The costs of new power plants have escalated very rapidly. This
4 effect appears to be broad based affecting many types of power
5 plants to some degree. One key steel price index has doubled over
6 the last twelve months alone. This reflects global trends as steel is
7 traded internationally and there is international competition among
8 power plant suppliers. Higher steel and other input prices broadly
9 affects power plant capital costs. A key driving force is a very
10 large boom in U.S. demand for coal power plants which in turn has
11 resulted from unexpectedly strong U.S. electricity demand growth
12 and high natural gas prices. Most integrated U.S. utilities have
13 decided to pursue coal power plants as a key component of their
14 capacity expansion plan. In addition, many foreign companies are
15 also expected to add large amounts of new coal power plant
16 capacity. This global boom is straining supply. Since coal power
17 plant equipment suppliers and bidders also supply other types of
18 plants, there is a spill over effect to other types of electric
19 generating plants such as combined cycle plants.⁴

20 Mr. Rose further noted that the actual coal power plant capital costs as reported
21 by plants already under construction exceed government estimates of capital costs
22 by "a wide margin (i.e., 35 to 40 percent). Additionally, current announced power
23 plants appear to face another increase in costs (i.e., approximately 40 percent
24 addition."⁵ Thus, according to Mr. Rose, new coal-fired power plant capital costs
25 have increased approximately 90 to 100 percent since 2002.

26 **Q. Do you agree that with these reviews of the current market conditions**
27 **affecting the costs of proposed coal-fired power plants like Big Stone II?**

28 **A.** Yes. These reviews of the factors affecting the estimated costs of new coal-fired
29 generating facilities appears reasonable and are consistent with other information
30 we have seen.

⁴ Direct Testimony of Judah Rose for Duke Energy Carolinas, North Carolina Utilities Commission
Docket No. E-7, SUB 790, at page 4, lines 2-14.

⁵ Ibid, at page 6, lines 5-9, and page 12, lines 11-16.

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1 **Q. In their economic and modeling analyses of the Big Stone II Project, have**
2 **OTP or Montana-Dakota assumed that there will be any further increases in**
3 **the estimated cost of Big Stone II as a result of the same market conditions**
4 **identified by Mr. Rolfes and Mr. Trout or other factors?**

5 A. No.

6 **Q. In your opinion, is that a prudent assumption, that is, that there will not be**
7 **any further increases in the capital cost of the Big Stone II Project before it is**
8 **completed?**

9 A. No. Although the current project cost estimate does increase some contingencies,
10 we believe that given past history of large construction projects, it is reasonable to
11 assume that the actual cost of building the Big Stone II Project may be higher than
12 the current cost estimate. This is especially true because all project bids have not
13 been let and construction has not even started.

14 Indeed, even Mr. Rolfes and Mr. Trout do not foreclose the potential for further
15 increases in the Project's estimated capital cost. For example, Mr. Rolfes has
16 testified in Minnesota that "the [current project] price estimate is a dynamic
17 number and there remains the possibility for design changes."⁶ Any significant
18 design changes could have an impact, resulting in capital cost increases or
19 decrease.⁷

20 Mr. Trout has further noted that future changes in the estimated cost for the Big
21 Stone II Project are "becoming more dependent on outside forces" some of which
22 he describes in his October 2, 2006 Testimony.⁸ Mr. Trout has further noted that
23 "the Big Stone II Co-owners have not been in a position realistically or

⁶ Applicants' Exhibit 32 in Minnesota Public Utilities Commission Dockets Nos. CN-05-619 and TR-05-1275, at page 4, lines 7-10.

⁷ Ibid.

⁸ Applicants' Exhibit 33 in Minnesota Public Utilities Commission Dockets Nos. CN-05-619 and TR-05-1275, at page 24, lines 19-20, and at page 27, line 18, to page 28, line 14.

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1 reasonably to “lock in” the prices for a substantial portion of the major cost
2 components of Big Stone Unit II” and that “Until they do so, the project budget
3 will be subject to further refinement.”⁹

4 **Q. Have you seen any specific evidence that shows that the estimated cost of the**
5 **Big Stone II Project, in fact, already has increased above the Co-owners’**
6 **current official public estimate?**

7 A. Yes. [PROTECTED MATERIALS BEGIN At a late August 2006 project
8 owners meeting, the CEOs of the Big Stone II Co-owners adopted a plan to
9 minimize their cost exposure until all of the various permits for the Project are
10 approved.¹⁰ By adopting this spending limitation plan, the Co-owners expected to
11 reduce their short-term spending on the Big Stone II Project and, consequently,
12 their financial exposure. To do they suspended all engineering work and
13 equipment procurements until mid-2007 and required that the equipment bids that
14 had been received be rebid.¹¹

15 An October 2006 Black & Veatch report described the work that would be
16 allowed under the new project plan:

17 This is the case which was selected by the CEOs after the August
18 2006 E&O meeting. This case reflects that, in general, only tasks
19 required to support permitting will be performed prior to the
20 [October 1, 2007] significant financial commitment (SFC) date,
21 except that the [project team] staff would remain intact to maintain
22 project continuity. The [Black & Veatch] team would be
23 disbanded. The ‘early five’ procurements would each be rebid,
24 with the bid issue documents being prepared before the SFC date
25 and issued to the bidders as soon as possible after the SFC date.¹²

⁹ Applicants’ Exhibit 33 in Minnesota Public Utilities Commission Dockets Nos. CN-05-619 and TR-05-1275, at page 28, lines 14-17.

¹⁰ *Financial Risk Commitments Prior to Receiving the MN CON*, prepared by Black & Veatch, October 19, 2006, provided in response to MCEA IRs Nos. 214-216, at Bates Page Numbers JCO0012380-JCO00012397.

¹¹ *Ibid.*, at page no. 1-1, Bates Page Number JCO0012381.

¹² *Ibid.*, at page 4-5, Bates Page Number JCO0012388.

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1 **PROTECTED MATERIALS END]**

2 **Q. Does it appear that this plan was implemented?**

3 A. Yes. **[PROTECTED MATERIALS BEGIN** Project documents indicate that
4 meetings were held in September to discuss the work that Black & Veatch would
5 undertake prior to and during the project suspension. **PROTECTED**
6 **MATERIALS END]**

7 **Q. What was the estimated impact of the adoption of this revised short-term**
8 **spending and financial exposure plan on the expected commercial operation**
9 **date of the Big Stone II Project?**

10 A. **[PROTECTED MATERIALS BEGIN** The project documents reveal that the
11 adoption of this plan was expected to push the actual commercial operation date
12 for the Big Stone II Project to July 1, 2013.¹³ However, according to Black &
13 Veatch, even this late date did not reflect any possible schedule impacts
14 associated with changes in equipment lead times, labor availability, rescheduling
15 or construction inefficiencies due to winter weather, or other market conditions.¹⁴
16 **PROTECTED MATERIALS END]**

17 **Q. What was the estimated impact of the adoption of this revised short-term**
18 **spending and financial exposure plan on the estimated capital cost of the Big**
19 **Stone II Project?**

20 A. **[PROTECTED MATERIALS BEGIN** The purpose of the spending limitation
21 plan adopted by the Co-owners in late August 2006 was to limit project
22 expenditures in the short-term and, hence, the Co-owners' financial exposure,
23 until the PSD air permit and Minnesota Certificate of Necessity are received.
24 However, Black & Veatch estimated that the adoption of this short-term plan
25 would increase the ultimate cost of the Big Stone II Project by approximately

¹³ Ibid., at page 4-6, Bates Page Number JCO0012389.

¹⁴ Ibid.

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1 \$199 million. This \$199 million figure reflected escalation at 6% plus additional
2 project team and Black & Veatch staff costs.¹⁵ **PROTECTED MATERIALS**
3 **END]**

4 But, even this figure does not reflect other factors that could lead to an increase in
5 the ultimate cost of the Big Stone II Project. These factors could include the
6 possibility that [**PROTECTED MATERIALS BEGIN** equipment bidders will
7 raise their prices during the rebidding process. This was something that the Big
8 Stone II project team was told during bidder interviews. **PROTECTED**
9 **MATERIALS END]** Other factors that could lead to higher project costs include
10 further project delays, changes in equipment lead times, labor availability,
11 rescheduling or construction inefficiencies due to winter weather, or other market
12 conditions.

13 **Q. [PROTECTED MATERIALS BEGIN Just to be clear, is the \$199 million**
14 **estimated increase in the ultimate Project cost due to the short-term**
15 **spending limitation plan adopted by the Big Stone II Co-owners in late**
16 **August would be in addition to or on top of the capital cost increase that was**
17 **announced earlier that month?**

18 **A.** Yes. The estimated \$199 million cost increase resulting from the late August
19 decision by the Big Stone II Co-owners is above or in addition to the \$1.366
20 billion cost estimate announced by the Co-owners in July 2006. **PROTECTED**
21 **MATERIALS END]**

¹⁵ *Owners' Alternatives for Financial Risk Commitments Prior to CON and PSD*, prepared by Black & Veatch, August 24, 2006, provided in response to MCEA IRs Nos. 214-216, at page 3-6, Bates Page Number JCO0012332.

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1 **Q. Have you seen any evidence that OTP or Montana-Dakota have reflected this**
2 **[PROTECTED MATERIALS BEGIN additional \$199 million cost increase**
3 **[PROTECTED MATERIALS END] in any Big Stone II Project economic or**
4 **modeling analyses?**

5 A. No.

6 **Q. Have OTP or Montana-Dakota assumed in their economic and modeling**
7 **analyses that the actual commercial operation date for the Big Stone II**
8 **Project will be delayed beyond 2011?**

9 A. No. Otter Tail Power has continued to assume a commercial date of January 1,
10 2011 for the Big Stone II Project.

11 **Q. Did Black & Veatch ask the Big Stone II Co-owners [PROTECTED**
12 **MATERIALS BEGIN to reconsider their short-term spending plan?**

13 A. Yes. Black & Veatch asked the Big Stone II Co-owners to reconsider their earlier
14 decision and to lift the short-term project suspension plan they adopted in August
15 2006. This would raise project spending, and, consequently, the Co-owners'
16 financial exposure, prior to September 2007 by approximately \$170 million.¹⁶

17 According to Black & Veatch, revising the short-term plan in this way could
18 enable the project to achieve a commercial operation date of May 2012, instead of
19 July 2013.¹⁷ Also revising the short-term plan in this way, could limit the effect of
20 the short-term spending limits on the ultimate Project cost to \$60 million instead
21 of \$199 million impact.¹⁸ This would still mean that the current capital cost
22 estimate for the Big Stone II Project is higher than the publicly announced \$1.366
23 million cost estimate. **PROTECTED MATERIALS END]**

¹⁶ Ibid., at page 4-2, Bates Page Number JCO0012385.

¹⁷ Ibid., at page 4-4, Bates Page Number JCO0012387.

¹⁸ Ibid., at page 4-4, Bates Page Number JCO0012387.

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1 **Q. Have the Big Stone II Co-owners approved this request?**

2 A. It is unclear what action the Big Stone II Co-owners took on this request. It
3 appeared that the Co-owners were going to vote on the [PROTECTED
4 MATERIALS BEGIN Black & Veatch request for reconsideration at a meeting
5 on November 30, 2006. PROTECTED MATERIALS END] But it is uncertain
6 whether they did so.

7 **Q. Is it reasonable to expect that there could be further increases in the cost of**
8 **the Big Stone II Project?**

9 A. Yes. During the remaining six or seven years before the Project is completed, if
10 indeed it is allowed to continue, any number of factors could lead to even higher
11 costs. These factors could include additional delays, additional regulation-related
12 costs, market conditions and weather conditions. Thus, there is no guarantee that
13 the current capital cost estimate for the Big Stone II Project will be the last, even
14 if it is increased by [PROTECTED MATERIALS BEGIN another \$199 million
15 to reflect the impact of the short-term spending limitations adopted by the Big
16 Stone II Co-owners in late August 2006. PROTECTED MATERIALS END]

17 **Q. Is it your testimony that OTP and Montana-Dakota should change their**
18 **current cost estimate for the Big Stone II Project?**

19 A. Clearly, OTP and Montana-Dakota should revise their economic and modeling to
20 reflect the impact of the [PROTECTED MATERIALS BEGIN short-term
21 spending limitation plan adopted by the Co-owner CEOs back in August 2006.
22 PROTECTED MATERIALS END] In addition, given that there is significant
23 uncertainty in the current cost estimate for the Project, OTP and Montana-Dakota
24 should perform sensitivity analyses to reflect further increases in the Project's
25 capital cost.

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1 **Q. Have you seen any utilities that have prepared such sensitivity analyses to**
2 **reflect increases in the estimated Project capital costs?**

3 A. Yes. In its modeling of the proposed coal-fired Cliffside Project, Duke Energy
4 Carolinas has considered some scenarios reflecting a 20 percent higher coal
5 capital cost. Unfortunately, Duke combined this 20 percent higher coal capital
6 cost with higher coal and natural gas prices which distorted the analysis and
7 masked the impact of the higher coal capital cost by including the mostly
8 unrelated higher natural gas prices.¹⁹ However, Duke still did consider a 20
9 percent higher coal capital cost.

10 **Q. Have you seen any such capital cost sensitivity analyses that have been**
11 **prepared by OTP or Montana-Dakota?**

12 A. Yes. The September 2005 *Analysis of Baseload Generation Alternatives* prepared
13 for the Big Stone II Co-owners by Burns & McDonnell examined a number of
14 sensitivity analyses including a plus or minus 10 percent of the estimated project
15 capital cost.²⁰ However, we are not aware or have we seen any similar capital
16 cost sensitivities being performed in subsequent analyses by OTP or Montana-
17 Dakota, particularly those prepared since the current Big Stone II capital cost
18 estimate was announced in August 2006.

¹⁹ Duke's 2005 Annual Plan filing, at page 49.

²⁰ Included as Exhibit No. MR-1 to the testimony of Mark Rolfes.

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1 **Q. Do you agree with the testimony of OTP and Montana-Dakota witnesses**
2 **Rolfes and Trout that these same market conditions also have led to increases**
3 **in the estimated costs of other supply-side alternatives such as wind and**
4 **natural gas-fired facilities?**²¹

5 A. Yes. In general we agree with Mr. Rolfes and Mr. Trout's testimony that these
6 same market conditions also have led to increases in the estimated costs of other
7 supply-side options.

8 However, there are several factors which suggest that the impact of these factors
9 might be greater on coal-fired facilities than on other alternatives. First, as Mr.
10 Trout has testified in Minnesota, coal-fired plants do require more labor hours
11 during construction than the other technologies – a comparably sized combined
12 cycle project would require substantially fewer labor hours to construct.²²

13 **[PROTECTED MATERIALS BEGIN** Second, Black & Veatch has noted that
14 the factors which have led to increased coal plant capital costs “generally apply to
15 all power generation technology capital costs.²³ However, Black & Veatch
16 further explained that simple cycle and combined cycle equipment costs have
17 remained steady because the demand for combustion turbines “is relatively
18 low.”²⁴ **PROTECTED MATERIALS END]**

²¹ Applicants' Exhibit 32 in Minnesota Public Utilities Commission Dockets Nos. CN-05-619 and TR-05-1275, , at page 8, line 21, to page 9, line 10, and Applicants' Exhibit 33, at page 28, line 17, to page 29, line 14.

²² Applicants' Exhibit 33 in Minnesota Public Utilities Commission Dockets Nos. CN-05-619 and TR-05-1275,, at page 29, lines 17-21.

²³ August 2006, *Otter Tail Power Company Supply-Side Technology Study Update*, prepared by Black & Veatch, at page 1-2, Bates Page Number OTP0006341, provided in response to MCEA IR No. 174 in Minnesota Public Utilities Commission Dockets Nos. CN-05-619 and TR-05-1275.

²⁴ Ibid.

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1 **V. OTP AND MONTANA-DAKOTA HAVE NOT ADEQUATELY**
2 **CONSIDERED THE RISKS ASSOCIATED WITH THE POTENTIAL FOR**
3 **FUEL SUPPLY DISRUPTIONS OR HIGHER FUEL COSTS**

4 **Q. What average annual capacity factors do OTP and Montana-Dakota assume**
5 **the Big Stone II Project will be able to achieve?**

6 A. Generally, the Big Stone II Co-owners project an 88 percent average annual
7 capacity factor for Big Stone II.

8 **Q. Is this a reasonable assumption?**

9 A. It is a very optimistic assumption to assume that a plant that has not yet started
10 commercial operations or, indeed, is not even under construction, will achieve
11 such a high capacity factor in every year, especially during the plant's early
12 immature "breaking-in" years of operation. However, it is not unreasonable to
13 assume that a new base load coal-fired facility, if prudently managed and
14 maintained, ultimately could be able to achieve relatively similar operating
15 performance during its mature operating years.

16 **Q. Are there any factors, besides imprudent management or maintenance, that**
17 **could result in the plant's failing to achieve the projected 88 percent capacity**
18 **factor?**

19 A. Yes. New coal-fired facilities, like Big Stone II, may be subject to some of the
20 same production and coal-deliverability problems that have recently plagued
21 existing coal-fired units throughout the Midwest that depend on coal supplies
22 from the Powder River Basin. Such problems could adversely affect the reliability
23 of Big Stone II and its ability to operate at a consistent 88 percent average annual
24 capacity factor.

25 **Q. Could such production and deliverability problems also affect the prices of**
26 **the coal that would be burned at Big Stone II?**

27 A. Yes.

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1 **Q. Have OTP or Montana-Dakota prepared any sensitivity analyses as part of**
2 **their recent modeling to determine whether higher than expected coal prices**
3 **and/or less than optimal plant performance due to coal deliverability**
4 **problems would affect the overall economics of the Big Stone II Project?**

5 A. OTP and Montana-Dakota have not prepared any such sensitivity analyses that we
6 have seen. Remarkably, the Big Stone II Co-owners, including OTP and
7 Montana-Dakota have refused to even acknowledge that future coal shortage
8 issues (caused by rail and/or production issues) *may* diminish Big Stone II's
9 reliability.²⁵ They similarly refused to acknowledge that recent coal shortage
10 issues *may* increase the risk associated with developing the Big Stone II power
11 plant.²⁶

12 Indeed, problems with the delivery of coal have already caused a significant
13 interruption in the operation of Big Stone I last year. For several weeks in 2006,
14 according to media reports,²⁷ the plant had to scale back operations to 45% of its
15 capacity. Big Stone Plant Manager Jeff Endrizzi said, about the period of reduced
16 production, "It was a very tough 54 days for us but we're here to produce as much
17 power as we can and to not be able to do that is very uncomfortable." He also
18 noted that "I think just raising the general level of awareness of the situation can't
19 hurt. It's hitting us here directly, locally, but it's a very broad based problem."

²⁵ Big Stone II Co-owner responses to Questions Nos. 5 and 39 of the South Dakota Commission Staff's Third Data Request in South Dakota Public Utilities Commission Case No. EL05-022.

²⁶ Big Stone II Co-owner responses to Questions No. 38 of the South Dakota Commission Staff's Third Data Request in South Dakota Public Utilities Commission Case No. EL05-022.

²⁷ "Coal Supply Still Uncertain at Big Stone," Keloland Television broadcast, 5/25/2006. Online at <http://keloland.com/NewsDetail6162.cfm?Id=0,48308>. See also, "Big Stone Plant Doesn't Have Enough Coal," Keloland Television broadcast, 03/20/2006, Online at <http://keloland.com/NewsDetail6162.cfm?Id=0,46855>.

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1 **Q. Is it prudent to not even consider the potential for coal shortages as a risk**
2 **associated with developing the Big Stone II Project?**

3 A. No. Given the serious deliverability problems that have been experienced with
4 coal from the Powder River Basin since May 2005 and the disputes that have
5 arisen between coal shippers, utilities and the railroads that deliver coal from the
6 Powder River Basin, it is not prudent to ignore this risk when evaluating the
7 economics of proposed coal-fired facilities like the Big Stone II Project. Some
8 utilities have been forced to import coal from Columbia in South America or as
9 far away as Indonesia.

10 **Q. Have any of the economic analyses prepared for the Big Stone II Co-owners**
11 **contained any sensitivities to reflect the potential for higher fuel prices**
12 **and/or lower than projected operating performance?**

13 A. Yes. The September 2005 *Analysis of Baseload Generation Alternatives*, prepared
14 by Burns & McDonnell, did prepare sensitivity analyses reflecting changes in the
15 assumed fuel prices and capacity factors.²⁸ However, OTP and Montana-Dakota
16 have not prepared similar sensitivity analyses as part of their more recent Big
17 Stone II Project modeling that reflects the increase in the estimated capital cost
18 that was announced in 2006.

²⁸ Exhibit No. MR-1 to the testimony of Mark Rolfes.

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1 **VI. OTP AND MONTANA-DAKOTA HAVE NOT CONSIDERED THE RISKS**
2 **ASSOCIATED WITH FUTURE FEDERALLY MANDATED**
3 **GREENHOUSE GAS REDUCTIONS**

4 **VI.A. FEDERALLY MANDATED GREENHOUSE GAS REDUCTIONS CAN BE**
5 **EXPECTED IN THE NEAR FUTURE**

6 **Q. Is it prudent to expect that a policy to address climate change will be**
7 **implemented in the U.S. in a way that should be of concern to coal-dependent**
8 **utilities in the Midwest?**

9 A. Yes. The prospect of global warming and the resultant widespread climate
10 changes has spurred international efforts to work towards a sustainable level of
11 greenhouse gas emissions. These international efforts are embodied in the United
12 Nations Framework Convention on Climate Change (“UNFCCC”), a treaty that
13 the U.S. ratified in 1992, along with almost every other country in the world. The
14 Kyoto Protocol, a supplement to the UNFCCC, establishes legally binding limits
15 on the greenhouse gas emissions of industrialized nations and economies in
16 transition.

17 Despite being the single largest contributor to global emissions of greenhouse
18 gases, the United States remains one of a very few industrialized nations that have
19 not signed the Kyoto Protocol.²⁹ Nevertheless, individual states, regional groups
20 of states, shareholders and corporations are making serious efforts and taking
21 significant steps towards reducing greenhouse gas emissions in the United States.
22 Efforts to pass federal legislation addressing carbon, though not yet successful,
23 have gained ground in recent years. These developments, combined with the
24 growing scientific understanding of, and evidence of, climate change as outlined

²⁹ As we use the terms “carbon dioxide regulation” and “greenhouse gas regulation” throughout our testimony, there is no difference. While we believe that the future regulation we discuss here will govern emissions of all types of greenhouse gases, not just carbon dioxide (“CO2”), for the purposes of our discussion we are chiefly concerned with emissions of carbon dioxide. Therefore, we use the terms “carbon dioxide regulation” and “greenhouse gas regulation” interchangeably. Similarly, the terms “carbon dioxide price,” “greenhouse gas price” and “carbon price” are interchangeable.

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1 in Dr. Hausman's testimony, mean that establishing federal policy requiring
2 greenhouse gas emission reductions is just a matter of time. The question is not
3 whether the United States will develop a national policy addressing climate
4 change, but when and how. The electric sector will be a key component of any
5 regulatory or legislative approach to reducing greenhouse gas emissions both
6 because of this sector's contribution to national emissions and the comparative
7 ease of regulating large point sources.

8 There are, of course, important uncertainties with regard to the timing, the
9 emission limits, and many other details of what a carbon policy in the United
10 States will look like.

11 **Q. If there are uncertainties with regard to such important details as timing,**
12 **emission limits and other details, why should a utility engage in the exercise**
13 **of forecasting greenhouse gas prices?**

14 **A.** First of all, utilities are implicitly assuming a value for carbon allowance prices
15 whether they go to the effort of collecting all the relevant information and create a
16 price forecast, or whether they simply ignore future carbon regulation. In other
17 words, a utility that ignores future carbon regulations is implicitly assuming that
18 the allowance value will be zero. The question is whether it's appropriate to
19 assume zero or some other number. There is uncertainty in any type of utility
20 forecasting and to write off the need to forecast carbon allowance prices because
21 of the uncertainties is not prudent.

22 For example, there are myriad uncertainties that utility planners have learned to
23 address in planning. These include randomly occurring generating unit outages,
24 load forecast error and demand fluctuations, and fuel price volatility and
25 uncertainty. These various uncertainties can be addressed through techniques
26 such as sensitivity and scenario analyses.

27 To illustrate that there is significant uncertainty in other types of forecasts, we
28 think it is informative to examine historical gas price forecasts by the Energy
29 Information Administration (EIA). Exhibit DAS-2 compares EIA forecasts from

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1 the period 1990 - 2006 with actual price data through 2005. The data, over more
2 than a decade, shows considerable volatility, even on an annual time scale.³⁰ But
3 the truly striking thing that jumps out of the figure is how wrong the forecasts
4 have sometimes been. For example, the 1996 forecast predicted gas prices would
5 start at \$2.61/MMBtu and remain under \$3/MMBTU through 2010, but by the
6 year 2000 actual prices had already jumped to \$4.82/MMBTU and by 2005 they
7 were up to \$8.09/MMBtu.

8 In view of the forecasting track record for gas prices one might be tempted to give
9 up, and either throw darts or abandon planning altogether. But thankfully
10 modelers, forecasters, and planners have taken on the challenge – and have
11 improved the models over time, thereby producing more reliable (although still
12 quite uncertain) price forecasts, and system planners have refined and applied
13 techniques for addressing fuel price uncertainty in a rational and proactive way.

14 It is, therefore, troubling and wrong to claim that forecasting carbon allowance
15 prices should not be undertaken as a part of utility resource decision-making
16 because it is “speculative.”

17 **Q. Do Montana-Dakota and OTP have any opinions or thoughts as to when**
18 **carbon regulation will happen?**

19 **A.** No. Interrogatory 18 of Joint Intervenors’ First Set and First Amended Set of
20 Interrogatories in South Dakota Public Utilities Commission Case No. EL05-022
21 asked each of the Co-owners to state whether it:

22 believes it is likely that greenhouse gas regulation (ghg) will be
23 implemented in the U.S. (a) in the next five years, (b) in the next ten
24 years, and (c) in the next twenty years.³¹

³⁰ Gas prices also show terrific volatility on shorter time scales (e.g., monthly or weekly prices).

³¹ Big Stone II Co-owners’ response to Interrogatory 18 in South Dakota Public Utilities Commission Case No. EL05-022.

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1 None of the Co-owners, including OTP and Montana-Dakota, had any thoughts as
2 to when or even if greenhouse gas regulation would occur.

3 **Q. If the Big Stone II Project were to be built, is carbon regulation an issue that**
4 **could be reasonably dealt with in the future, once the timing and stringency**
5 **of the regulation is known?**

6 A. Unfortunately, no. Unlike for other power plant air emissions like sulfur dioxide
7 and oxides of nitrogen, there currently is no commercial or economical method
8 for post-combustion removal of carbon dioxide from supercritical pulverized coal
9 plants. The Big Stone II Co-owners agree on that point. During the public hearing
10 in South Dakota Public Utilities Commission Case No. EL05-022 that was held in
11 Milbank, South Dakota on September 13, 2005, the Co-owners presented several
12 slides on the expected combined emissions from Big Stone Units I & II. The
13 descriptive slide for the CO₂ emissions chart submitted to the South Dakota PUC
14 states there is “no commercially available capture and sequestration technology.”
15 This slide is attached as Exhibit DAS-3. Regardless of the uncertainty, this is an
16 issue that needs to be dealt with before new resource decisions are made and
17 before transmission lines are constructed to enable generation at those new
18 resources.

19 Even if such technology were available, there is no indication that Montana-
20 Dakota or OTP have evaluated the possibility for carbon sequestration at or near
21 the Big Stone site nor the economics of carbon capture at Big Stone Unit II.

22 **Q. Do other utilities have opinions about whether and when greenhouse gas**
23 **regulation will come?**

24 A. Yes. A number of utility executives have argued that mandatory federal
25 regulation of the emissions of greenhouse gases is inevitable.

26 For example, in April 2006, the Chairman of Duke Energy, Paul Anderson, stated:

27 From a business perspective, the need for mandatory federal policy
28 in the United States to manage greenhouse gases is both urgent and

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1 real. In my view, voluntary actions will not get us where we need
2 to be. Until business leaders know what the rules will be – which
3 actions will be penalized and which will be rewarded – we will be
4 unable to take the significant actions the issue requires.³²

5 Similarly, James Rogers, who was the CEO of Cinergy and is currently CEO of
6 Duke Energy, has publicly said “[I]n private, 80-85% of my peers think carbon
7 regulation is coming within ten years, but most sure don’t want it now.”³³ Mr.
8 Rogers also was quoted in a December 2005 *Business Week* article, as saying to
9 his utility colleagues, “If we stonewall this thing [carbon dioxide regulation] to
10 five years out, all of a sudden the cost to us and ultimately to our consumers can
11 be gigantic.”³⁴

12 Not wanting carbon regulation from a utility perspective is understandable
13 because carbon price forecasting is not simple and easy, it makes resource
14 planning more difficult and is likely to change “business as usual.” For many
15 utilities, including the Big Stone II Co-owners, that means that it is much more
16 difficult to justify building a pulverized coal plant. Regardless, it is imprudent to
17 ignore the risk.

18 Duke Energy is not alone in believing that carbon regulation is inevitable and,
19 indeed, some utilities are advocating for mandatory greenhouse gas reductions. In
20 a May 6, 2005, statement to the Climate Leaders Partners (a voluntary EPA-
21 industry partnership), John Rowe, Chair and CEO of Exelon stated, “At Exelon,
22 we accept that the science of global warming is overwhelming. We accept that
23 limitations on greenhouse gases emissions [sic] will prove necessary. Until those

³² Paul Anderson, Chairman, Duke Energy, “Being (and Staying in Business): Sustainability from a Corporate Leadership Perspective,” April 6, 2006 speech to CERES Annual Conference, at: http://www.duke-energy.com/news/mediainfo/viewpoint/PAnderson_CERES.pdf

³³ “The Greening of General Electric: A Lean, Clean Electric Machine,” *The Economist*, December 10, 2005, at page 79.

³⁴ “The Race Against Climate Change,” *Business Week*, December 12, 2005, online at http://businessweek.com/magazine/content/05_50/b3963401.htm.

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1 limitations are adopted, we believe that business should take voluntary action to
2 begin the transition to a lower carbon future.”

3 In fact, several electric utilities and electric generation companies have
4 incorporated assumptions about carbon regulation and costs into their long term
5 planning, and have set specific agendas to mitigate shareholder risks associated
6 with future U.S. carbon regulation policy. These utilities cite a variety of reasons
7 for incorporating risk of future carbon regulation as a risk factor in their resource
8 planning and evaluation, including scientific evidence of human-induced climate
9 change, the U.S. electric sector’s contribution to emissions, and the magnitude of
10 the financial risk of future greenhouse gas regulation.

11 Duke Energy and FPL Group are participating in the high profile U.S. Climate
12 Action Partnership (“USCAP”) which advocates for federal, mandatory
13 legislation of greenhouse gases. The six principles of this group are:

- 14 • Account for the global dimensions of climate change;
- 15 • Create incentives for technology innovation;
- 16 • Be environmentally effective;
- 17 • Create economic opportunity and advantage;
- 18 • Be fair to sectors disproportionately impacted; and
- 19 • Reward early action.³⁵

20 Most significantly, USCAP has argued that CO₂ emissions should be reduced by
21 60% to 80% by 2050. As I will discuss later, this is relatively the same goal as
22 many of the climate change bills that have been introduced in the current U.S.
23 Congress.³⁶

³⁵ www.us-cap.org.

³⁶ *A Call for Action*, at page 7, available at www.us-cap.org.

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1 Some of the companies believe that there is a high likelihood of federal regulation
2 of greenhouse gas emissions within their planning period. For example,
3 Pacificorp states a 50% probability of a CO₂ limit starting in 2010 and a 75%
4 probability starting in 2011. The Northwest Power and Conservation Council
5 models a 67% probability of federal regulation in the twenty-year planning period
6 ending 2025 in its resource plan. Northwest Energy states that CO₂ taxes “are no
7 longer a remote possibility.”³⁷

8 Even those in the electric industry who oppose mandatory limits on greenhouse
9 gas regulation believe that regulation is inevitable. David Ratcliffe, CEO of
10 Southern Company, a predominantly coal-fired utility that opposes mandatory
11 limits, said at a March 29, 2006, press briefing that “There certainly is enough
12 public pressure and enough Congressional discussion that it is likely we will see
13 some form of regulation, some sort of legislation around carbon.”³⁸

14 **Q. Why would electric utilities, in particular, be concerned about future carbon**
15 **regulation?**

16 **A.** Electricity generation is very carbon-intensive. Electric utilities are likely to be
17 one of the first, if not the first, industries subject to carbon regulation because of
18 the relative ease in regulating stationary sources as opposed to mobile sources
19 (automobiles) and because electricity generation represents a significant portion
20 of total U.S. greenhouse gas emissions. A new generating facility may have a
21 book life of twenty to forty years, but in practice, the utility may expect that that
22 asset will have an operating life of 50 years or more. By adding new plants,
23 especially new coal plants, a utility is essentially locking-in a large quantity of
24 carbon dioxide emissions for decades to come. In general, electric utilities are
25 increasingly aware that the fact that we do not currently have federal greenhouse

³⁷ Northwest Energy 2005 Electric Default Supply Resource Procurement Plan, December 20, 2005; Volume 1, p. 4.

³⁸ Quoted in “U.S. Utilities Urge Congress to Establish CO₂ Limits,” Bloomberg.com, <http://www.bloomberg.com/apps/news?pid=10000103&sid=a75A1ADJv8cs&refer=us>

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1 gas regulation is irrelevant to the issue of whether we will in the future, and that
2 new plant investment decisions are extremely sensitive to the expected cost of
3 greenhouse gas regulation throughout the life of the facility.

4 **Q. Do others in the private sector, besides electric utilities, also believe that**
5 **regulation of greenhouse gases is inevitable?**

6 A. Yes. Corporate leaders, investors, financial analysts and major corporations are
7 increasingly anticipating and preparing for requirements to reduce greenhouse gas
8 emissions.³⁹ For example, a recent survey of 31 multinational corporations by the
9 Pew Center on Global Climate Change found that 90 percent expect the U.S.
10 government to set standards for greenhouse gas emissions imminently.⁴⁰ About
11 18 percent believe that federal standards will take effect before 2010; another 67
12 percent believe those standards will take effect between 2010 and 2015.⁴¹

13 Investors and investment analysts also are anticipating the imminent
14 establishment of federally mandated reductions in greenhouse gas emissions. For
15 example, in October 2004, Fitch Ratings reported that over the next ten years, it
16 expected that:

17 the power industry to face higher environmental standards for
18 sulfur dioxide (SO₂), nitrogen oxide (NO_x) and mercury, as well as
19 new rules for the emissions of greenhouse gases (GHGs). As the
20 scientific debate has moved from the topic of "whether global
21 warming exists) to a discussion of the magnitude of the problem,
22 concerns about GHGs have expanded to a wider audience.
23 Investors and insurance companies are becoming increasingly
24 concerned about the financial effects of future environmental
25 regulations on the power sector as a primary emitter of GHGs.
26 Requirements to control the sources of global warming and
27 enhanced regulation of other pollutants could increase the financial

³⁹ Exhibit DAS-4, at pages 23-26.

⁴⁰ <http://www.pewclimate.org/docUploads/PEW%5FCorpStrategies%2Epdf>, at page 1.

⁴¹ Ibid.

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1 liability of coal-dependent power producers, thereby leading to
2 lower returns and lower post-investment cash generation.⁴²

3 Fitch Ratings has more recently been quoted as telling industry representatives
4 that it believes that a federal law to cap CO₂ emissions is “imminent” and that
5 “compliance costs could have a significant effect on the credit profiles of
6 generators.”⁴³

7 **Q. Have mandatory greenhouse gas emissions reductions programs begun to be**
8 **examined and debated in the U.S. federal government?**

9 A. To date, the U.S. government has not required greenhouse gas emission
10 reductions. However, a number of legislative initiatives for mandatory emissions
11 reduction proposals have been introduced in Congress. These proposals establish
12 carbon dioxide emission trajectories below the projected business-as-usual
13 emission trajectories, and they generally rely on market-based mechanisms (such
14 as cap and trade programs) for achieving the targets. The proposals also include
15 various provisions to spur technology innovation, as well as details pertaining to
16 offsets, allowance allocation, restrictions on allowance prices and other issues.
17 Through their consideration of these proposals, legislators are increasingly
18 educated on the complex details of different policy approaches, and they are
19 laying the groundwork for a national mandatory program. Some of the federal
20 proposals that would require greenhouse gas emission reductions that had been
21 submitted in Congress through early February 2007 are summarized in Table 1
22 below.

⁴² *Status of Environmental Regulation*, Fitch Ratings Corporate Finance, October 12, 2004.

⁴³ *CO₂ Trading Plan could cost US utilities \$6bil/year: Fitch, Platts, 7Nov2006*,

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Table 1. Summary of Mandatory Emissions Targets in Proposals Discussed in Congress⁴⁴

Proposed National Policy	Title or Description	Year Proposed	Emission Targets	Sectors Covered
McCain Lieberman S.139	Climate Stewardship Act	2003	Cap at 2000 levels 2010-2015. Cap at 1990 levels beyond 2015.	Economy-wide, large emitting sources
McCain Lieberman SA 2028	Climate Stewardship Act	2003	Cap at 2000 levels	Economy-wide, large emitting sources
McCain Lieberman S 1151	Climate Stewardship and Innovation Act	2005	Cap at 2000 levels	Economy-wide, large emitting sources [CHECK]
National Commission on Energy Policy (basis for Bingaman-Domenici legislative work)	Greenhouse Gas Intensity Reduction Goals	2005	Reduce GHG intensity by 2.4%/yr 2010-2019 and by 2.8%/yr 2020-2025. Safety-valve on allowance price	Economy-wide, large emitting sources
Jeffords S. 150	Multi-pollutant legislation	2005	2.050 billion tons beginning 2010	Existing and new fossil-fuel fired electric generating plants > 15 MW
Carper S. 843	Clean Air Planning Act	2005	2006 levels (2.655 billion tons CO2) starting in 2009, 2001 levels (2.454 billion tons CO2) starting in 2013.	Existing and new fossil-fuel fired, nuclear, and renewable electric generating plants > 25 MW
Feinstein	Strong Economy and Climate Protection Act	2006	Stabilize emissions through 2010; 0.5% cut per year from 2011-15; 1% cut per year from 2016-2020. Total reduction is 7.25% below current levels.	Economy-wide, large emitting sources
Rep. Udall - Rep. Petri	Keep America Competitive Global Warming Policy Act	2006	Establishes prospective baseline for greenhouse gas emissions, with safety valve.	Energy and energy-intensive industries
Carper S.2724	Clean Air Planning Act	2006	2006 levels by 2010, 2001 levels by 2015	Existing and new fossil-fuel fired, nuclear, and renewable electric generating plants > 25 MW
Kerry and Snowe S.4039	Global Warming Reduction Act	2006	No later than 2010, begin to reduce U.S. emissions to 65% below 2000 levels by 2050	Not specified

⁴⁴ More detailed summaries of the bills that have been introduced in the U.S. Senate in the 110th Congress are presented in Exhibit DAS-5.

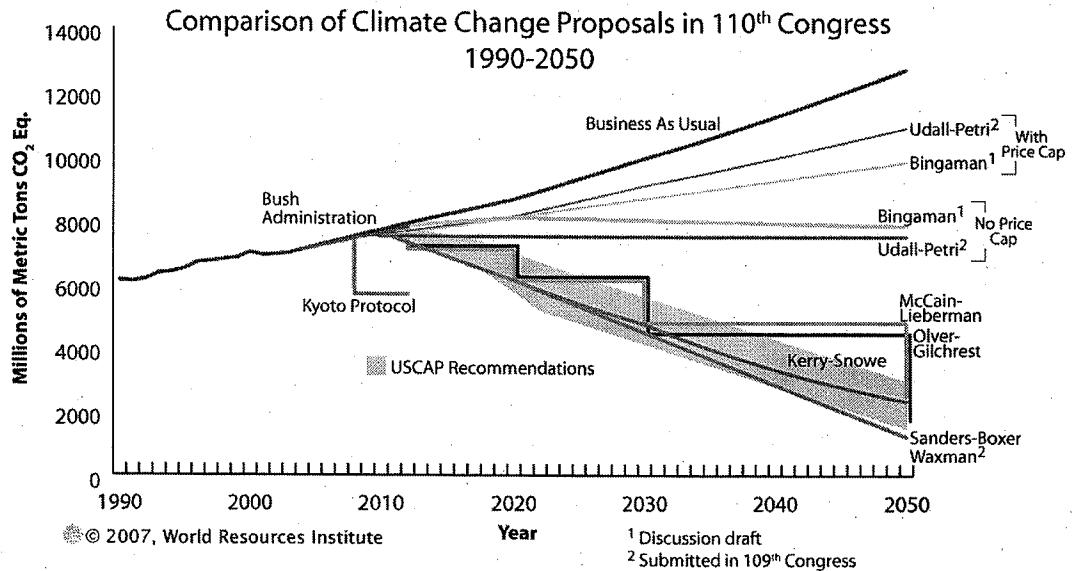
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Waxman H.R. 5642	Safe Climate Act	2006	2010 – not to exceed 2009 level, annual reduction of 2% per year until 2020, annual reduction of 5% thereafter	Not specified
Jeffords S. 3698	Global Warming Pollution Reduction Act	2006	1990 levels by 2020, 80% below 1990 levels by 2050	Economy-wide
Feinstein- Carper S.317	Electric Utility Cap & Trade Act	2007	2006 level by 2011, 2001 level by 2015, 1%/year reduction from 2016-2019, 1.5%/year reduction starting in 2020	Electricity sector
Kerry-Snowe	Global Warming Reduction Act	2007	2010 level from 2010-2019, 1990 level from 2020-2029, 2.5%/year reductions from 2020-2029, 3.5%/year reduction from 2030-2050, 65% below 2000 level in 2050	Economy-wide
McCain-Lieberman S.280	Climate Stewardship and Innovation Act	2007	2004 level in 2012, 1990 level in 2020, 20% below 1990 level in 2030, 60% below 1990 level in 2050	Economy-wide
Sanders-Boxer S.309	Global Warming Pollution Reduction Act	2007	2%/year reduction from 2010 to 2020, 1990 level in 2020, 27% below 1990 level in 2030, 53% below 1990 level in 2040, 80% below 1990 level in 2050	Economy-wide
Olver, et al HR 620	Climate Stewardship Act	2007	Cap at 2006 level by 2012, 1%/year reduction from 2013-2020, 3%/year reduction from 2021-2030, 5%/year reduction from 2031-2050, equivalent to 70% below 1990 level by 2050	US national
Sen. Bingaman – Discussion draft		As of 1/11/2007	2.6%/year reduction in emissions intensity from 2012-2021, 3%/year reduction starting in 2022	Economy-wide

- 1 The reductions that the bills that have been introduced in the current U.S.
- 2 Congress would mandate are illustrated in Figure 1 below.

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1
2
3
Figure 1: Emissions Reductions Required under Climate Change Bills in Current US Congress



4
5 **Q. Is it reasonable to believe that the potential for passage of greenhouse gas**
6 **regulations have improved as a result of last November's federal elections?**

7 **A.** Yes. Although there are increasing numbers of Republican legislators who
8 recognize the need for legislation to regulate the emissions of greenhouse gases,
9 the results of the recent elections, in which control of both Houses of Congress
10 shifted to Democrats, are likely to improve the chances for near-term passage of
11 significant legislation. For example, experts at an industry conference right after
12 the elections expressed the opinion that now that Democrats have won control of
13 Congress, electric utilities should expect a strong legislative push for mandatory
14 caps on carbon dioxide emissions.⁴⁵

15 Senator McCain also has indicated that he believed that the chances of Congress
16 approving meaningful global warming legislation before 2008 were "pretty good"

⁴⁵ *Mandatory US carbon caps coming following elections: observers, Platts 9Nov2006.*

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1 and that he believed that “we’ve reached a tipping point in this debate, and its
2 long overdue.”⁴⁶

3 At the same time, Senators Bingaman, Boxer and Lieberman sent a letter to
4 President Bush on November 14, 2006, seeking the President’s commitment to
5 work with the new Congress to pass meaningful climate change legislation in
6 2007.⁴⁷ Senators Bingaman, Boxer and Lieberman in January are the chairpersons
7 of, respectively, the Senate Energy and Natural Resources Committee, the Senate
8 Environment and Public Works Committee and the Senate Homeland Security
9 and Governmental Affairs Committee in the current Congress.

10 Nevertheless, our conclusion that significant greenhouse gas regulation in the
11 United States is inevitable is not based on the results of any single election or on
12 the fate of any single bill introduced in Congress.

13 **Q. Have recent polls indicated that the American people are increasingly in**
14 **favor of government action to address global warming concerns?**

15 **A.** Yes. A summer 2006 poll by Zogby International showed that an overwhelming
16 majority of Americans are more convinced that global warming is happening than
17 they were even two years ago, and they are also connecting intense weather
18 events like Hurricane Katrina and heat waves to global warming.⁴⁸ Indeed, the
19 poll found that 74% of all respondents, including 87% of Democrats, 56% of
20 Republicans and 82% of Independents, believe that we are experiencing the
21 effects of global warming.

22 The poll also indicated that there is strong support for measures to require major
23 industries to reduce their greenhouse gas emissions to improve the environment

⁴⁶ Ibid.

⁴⁷ Ibid.

⁴⁸ “Americans Link Hurricane Katrina and Heat Wave to Global Warming,” Zogby International, August 21, 2006, available at www.zogby.com/news.

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1 without harming the economy – 72% of likely voters agreed such measures
2 should be taken.⁴⁹

3 Other recent polls reported similar results. For example, a Time/ABC/Stanford
4 University poll issued in the spring found 68 percent of Americans are in favor of
5 more government action.⁵⁰ In addition, a September 2006 telephone poll,
6 conducted by NYU's Brademas Center for the Study of Congress, reported that
7 70% of those polled stated that they were worried about global warming.⁵¹

8 At the same time, according to a recent public opinion survey for the
9 Massachusetts Institute of Technology, Americans now rank climate change as
10 the country's most pressing environmental problem—a dramatic shift from three
11 years ago, when they ranked climate change sixth out of 10 environmental
12 concerns.⁵² Almost three-quarters of the respondents felt the government should
13 do more to deal with global warming, and individuals were willing to spend their
14 own money to help.

15 VI.B. STATE AND REGIONAL ACTION

16 **Q. Are any states developing and implementing climate change policies that will**
17 **have a bearing on resource choices in the electric sector?**

18 A. Yes. States continue to be the leaders and innovators in developing and
19 implementing policies that will affect greenhouse gas emissions.

20 On August 30, 2006, Governor Schwarzenegger and the California Legislature
21 reached an agreement on AB32, the Global Warming Solutions Act.⁵³ The Act

⁴⁹ Ibid.

⁵⁰ "Polls find groundswell of belief in, concern about global warming." Greenwire, April 21, 2006, Vol. 10 No. 9. See also Zogby's final report on the poll which is available at <http://www.zogby.com/wildlife/NWFfinalreport8-17-06.htm>.

⁵¹ Kaplun, Alex: "Campaign 2006: Most Americans 'worried' about energy, climate;" Greenwire, September 29, 2006.

⁵² *MIT Carbon Sequestration Initiative, 2006 Survey*, <http://sequestration.mit.edu/research/survey2006.html>

⁵³ Governor Schwarzenegger press release, August 30, 2006. <http://gov.ca.gov/index.php?/press-release/3722/>. Pew Center on Climate Change, "Latest News" from the states http://www.pewclimate.org/what_s_being_done/in_the_states/news.cfm

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1 creates an economy-wide cap on greenhouse gas emissions and includes penalties
2 for non-compliance. The cap limits California's greenhouse gas emissions at
3 1990 levels by 2020. This is the first state to adopt a mandatory economy-wide
4 greenhouse gas emissions limit. California has also adopted a law, SB 1368,
5 directing the California Energy Commission to set a greenhouse gas performance
6 standard for electricity procured by local publicly owned utilities, whether it is
7 generated within state borders or imported from plants in other states. The
8 standard is to be adopted by June 30, 2007 and will apply to all new long-term
9 electricity contracts. California is also exploring coordination of its statewide
10 greenhouse gas reduction program with the Northeast's Regional Greenhouse Gas
11 Initiative.

12 Similarly, in September 2006, the Governor of Arizona issued an Executive Order
13 (2006-13) establishing a statewide goal to reduce Arizona's greenhouse gas
14 emissions to 2000 levels by 2020, and 50% below this level by 2040.⁵⁴

15 Other states have indirect policies that will impact future emissions of greenhouse
16 gases. These indirect policies include the requirements by various states to either
17 consider future carbon dioxide regulation or use specific "adders" for carbon
18 dioxide in resource planning. They also include policies and incentives to
19 increase energy efficiency and renewable energy use, such as renewable portfolio
20 standards. Some of these requirements are at the direction of state public utilities
21 commissions, others are statutory requirements.

22 But states are not just acting individually; there are a number of examples of
23 innovative regional policy initiatives that range from agreeing to coordinate
24 information (e.g., Southwest governors and Midwestern legislators) to
25 development of a regional cap and trade program through the Regional

⁵⁴ Governor Napolitano Press release, September 8, 2006.
http://azgovernor.gov/dms/upload/NR_090806_CCAAG.pdf

Pew Center on Climate Change, "Latest News" from the states
http://www.pewclimate.org/whats_being_done/in_the_states/news.cfm

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1 Greenhouse Gas Initiative in the Northeast (“RGGI”). The objective of the RGGI
2 is the stabilization of CO₂ emissions from power plants at current levels for the
3 period 2009-2015, followed by a 10 percent reduction below current levels by
4 2019.⁵⁵

5 In an effort that could provide an important foundation for implementation of a
6 national cap on greenhouse gases, representatives of 30 states have begun
7 discussions of a multi-state climate action registry. This effort builds on existing
8 registries in the Northeast and California. The group is discussing development
9 of common accounting practices and development of an internet-based
10 monitoring system for voluntary and mandatory greenhouse gas reporting.⁵⁶

11 **Q. Have any states adopted direct policies that require specific emissions**
12 **reductions from electric sources?**

13 A. Yes. The states of Massachusetts, New Hampshire, Oregon and California have
14 adopted policies requiring greenhouse gas emission reductions from power
15 plants.⁵⁷

16 **Q. Do any states require that utilities or default service suppliers evaluate costs**
17 **or risks associated with greenhouse gas emissions in long-range planning or**
18 **resource procurement?**

19 A. Yes. As shown in Table 2 below, several states require companies to account for
20 the emission of greenhouse gases in resource planning.

21 **Table 2. Requirements for Consideration of Greenhouse Gas Emissions in**
22 **Electric Resource Decisions**

Program type	State	Description	Date	Source
GHG value in	CA	PUC requires that regulated utility	April 1, 2005	CPUC Decision 05-04-024

⁵⁵ Table 5.5, at page 21 of Exhibit DAS-4.

⁵⁶ O’Donnel, Arthur; “Thirty states discuss proposed emissions registry,” Greenwire, October 4, 2006.

⁵⁷ Exhibit DAS-4, Table 5.3 on page 18.

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resource planning		IRPs include carbon adder of \$8/ton CO ₂ , escalating at 5% per year.		
GHG value in resource planning	WA	Law requiring that cost of risks associated with carbon emissions be included in Integrated Resource Planning for electric and gas utilities	January, 2006	WAC 480-100-238 and 480-90-238
GHG value in resource planning	OR	PUC requires that regulated utility IRPs include analysis of a range of carbon costs	Year 1993	Order 93-695
GHG value in resource planning	NWPCC	Inclusion of carbon tax scenarios in Fifth Power Plan	May, 2006	NWPCC Fifth Energy Plan
GHG value in resource planning	MN	Law requires utilities to use PUC established environmental externalities values in resource planning	January 3, 1997	Order in Docket No. E-999/CI-93-583
GHG in resource planning	MT	IRP statute includes an "Environmental Externality Adjustment Factor" which includes risk due to greenhouse gases. PSC required Northwestern to account for financial risk of carbon dioxide emissions in 2005 IRP.	August 17, 2004	Written Comments Identifying Concerns with NWE's Compliance with A.R.M. 38.5.8209-8229; Sec. 38.5.8219, A.R.M.
GHG in resource planning	KY	KY staff reports on IRP require IRPs to demonstrate that planning adequately reflects impact of future CO ₂ restrictions	2003 and 2006	Staff Report On the 2005 Integrated Resource Plan Report of Louisville Gas and Electric Company and Kentucky Utilities Company - Case 2005-00162, February 2006
GHG in resource planning	UT	Commission directs PacifiCorp to consider financial risk associated with potential future regulations, including carbon regulation	June 18, 1992	Docket 90-2035-01, and subsequent IRP reviews
GHG in resource planning	MN	Commission directs Xcel to "provide an expansion of CO ₂ contingency planning to check the extent to which resource mix changes can lower the cost of meeting customer demand under different forms of regulation."	August 29, 2001	Order in Docket No. RP00-787

1 **VI.C. THE USE OF CARBON DIOXIDE COSTS IN UTILITY PLANNING**

2 **Q. What carbon dioxide values are being used by utilities in electric resource**
 3 **planning?**

4 **A.** Table 3 below presents the carbon dioxide costs, in \$/ton CO₂, that are presently
 5 being used in the industry for both resource planning and modeling of carbon
 6 regulation policies.

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1 **Table 3. Carbon Dioxide Costs Used by Utilities**

Company	CO2 emissions trading assumptions for various years (\$2005)
PG&E*	\$0-9/ton (start year 2006)
Avista 2003*	\$3/ton (start year 2004)
Avista 2005	\$7 and \$25/ton (2010) \$15 and \$62/ton (2026 and 2023)
Portland General Electric*	\$0-55/ton (start year 2003)
Xcel Energy-PSCCo	\$9/ton (start year 2010) escalating at 2.5%/year
Idaho Power*	\$0-61/ton (start year 2008)
Pacificorp 2004	\$0-55/ton
Northwest Energy 2005	\$15 and \$41/ton
Northwest Power and Conservation Council	\$0-15/ton between 2008 and 2016 \$0-31/ton after 2016

2 **Values for these utilities from Wisser, Ryan, and Bolinger, Mark. "Balancing Cost and Risk: The*
3 *Treatment of Renewable Energy in Western Utility Resource Plans." Lawrence Berkeley National*
4 *Laboratories. August 2005. LBNL-58450. Table 7.*

5 *Other values: PacifiCorp, Integrated Resource Plan 2003, pages 45-46; and Idaho Power*
6 *Company, 2004 Integrated Resource Plan Draft, July 2004, page 59; Avista Integrated Resource*
7 *Plan 2005, Section 6.3; Northwestern Energy Integrated Resource Plan 2005, Volume 1 p. 62;*
8 *Northwest Power and Conservation Council, Fifth Power Plan pp. 6-7. Xcel-PSCCo,*
9 *Comprehensive Settlement submitted to the CO PUC in dockets 04A-214E, 215E and 216E,*
10 *December 3, 2004. Converted to \$2005 using GDP implicit price deflator.*

11 **Q. How should utilities plan for and mitigate the risk of greenhouse gas**
12 **regulation?**

13 A. The key part of that question is "plan for the risk of greenhouse gas regulation."
14 Mitigating risk begins with the resource planning process and the decision as to
15 the demand-side and supply-side options that should be pursued. A utility that
16 chooses to go forward with a new, carbon intensive energy resource without
17 proper consideration of carbon regulation is imprudent. To give an analogy it
18 would be like choosing to build a gas-fired power plant without consideration of
19 the cost of gas because one believes that building the plant is "worth it" regardless
20 of what gas might cost.

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1 A utility that desires to be prudent about the risk of carbon regulation would, at a
2 minimum, consider carbon regulation by developing an expected carbon price
3 forecast as well as reasonable sensitivities around that case.

4 **Q. Has Synapse developed a carbon price forecast that would assist the**
5 **Commission in evaluating the Big Stone II Project?**

6 A. Yes. Our forecast is described in more detail in Exhibit DAS-4, starting on page
7 41 of 63.

8 During the decade from 2010 to 2020, we anticipate that a reasonable range of
9 carbon emissions prices will reflect the effects of increasing public concern over
10 climate change (this public concern is likely to support increasingly stringent
11 emission reduction requirements) and the reluctance of policymakers to take steps
12 that would increase the cost of compliance (this reluctance could lead to increased
13 emphasis on energy efficiency, modest emission reduction targets, or increased
14 use of offsets). We expect that the widest uncertainty in our forecasts will begin at
15 the end of this decade, that is, from \$10 to \$40 per ton of CO₂ in 2020, depending
16 on the relative strength of these factors.

17 After 2020, we expect the price of carbon emissions allowances to trend upward
18 toward a marginal mitigation cost. This number will depend on currently
19 uncertain factors such as technological innovation and the stringency of carbon
20 caps, but it is likely that, by this time, the least expensive mitigation options (such
21 as simple energy efficiency and fuel switching) will have been exhausted. Our
22 projection for greenhouse gas emissions costs at the end of this decade ranges
23 from \$20 to \$50 per ton of CO₂ emissions.

24 We currently believe that the most likely scenario is that as policymakers commit
25 to taking serious action to reduce carbon emissions, they will choose to enact both
26 cap and trade regimes and a range of complementary energy policies that lead to
27 lower cost scenarios, and that technology innovation will reduce the price of low-
28 carbon technologies, making the most likely scenario (the mid case) closer to

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1 (though not equal to) low our carbon cost scenario than our high carbon cost
2 scenario.

3 After 2030, and possibly even earlier, the uncertainty surrounding a forecast of
4 carbon emission prices will increase due to the interplay of factors such as the
5 level of carbon constraints required and technological innovation. Scientists
6 anticipate that very significant emission reductions will be necessary, in the range
7 of 80 percent below 1990 emission levels, to achieve stabilization targets that will
8 keep global temperature increases to a somewhat manageable level. As such, we
9 believe there is a substantial likelihood that response to climate change impacts
10 will require much more aggressive emission reductions than those contained in
11 U.S. policy proposals, and in the Kyoto Protocol, to date. If the severity and
12 certainty of climate change are such that emissions levels 70-80% below current
13 rates are mandated, this could result in very high marginal emissions reduction
14 costs, though we have not yet quantified the cost of such deeper cuts on a per ton
15 basis.

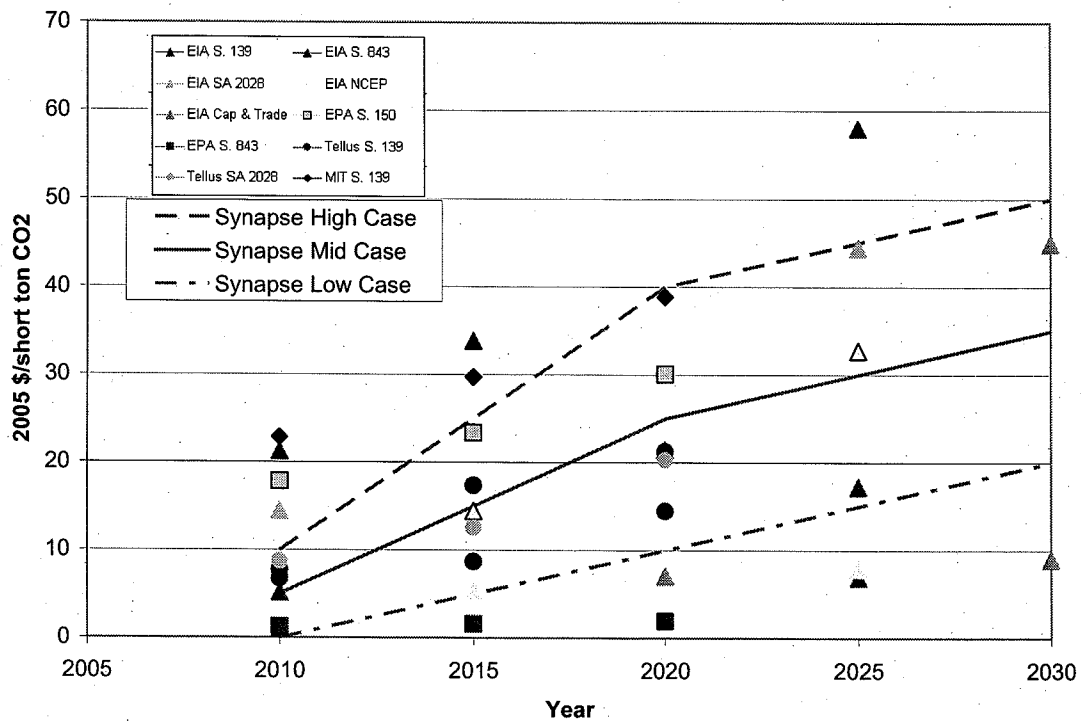
16 **Q. What is Synapse's forecast of CO₂ emissions prices?**

17 **A.** Synapse's forecast of future carbon dioxide emissions prices are presented in
18 Figure 2 below. This figure superimposes Synapse's forecast on the results of
19 other cost analyses of proposed federal policies.

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1

Figure 2. Synapse Carbon Dioxide Prices



2

3 **Q. What is Synapse’s levelized carbon price forecast?**

4 A. Synapse’s forecast, levelized⁵⁸ over 20 years, 2011 – 2030, is provided in Table 4
 5 below.

6

Table 4: Synapse’s Levelized Carbon Price Forecast (2005\$/ton)

Low Case	Mid Case	High Case
\$8.23	\$19.83	\$31.43

7

8 **Q. Are the Synapse CO₂ price forecasts based on any independent modeling?**

9 A. Yes. We did not perform any new modeling to develop our CO₂ price forecasts.
 10 However, as shown in Table 5 below, these forecasts were based on the results of

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1 independent modeling prepared at the Massachusetts Institute of Technology
2 (“MIT”), the Energy Information Administration of the Department of Energy,
3 (“EIA”) Tellus, and the U.S. Environmental Protection Agency. (“EPA”)

4 **Table 5: Analyses of Greenhouse Gas Regulation Proposals Considered**
5 **in Synapse CO₂ Price Forecast**

Policy proposal	Analysis
McCain Lieberman – S. 139	EIA 2003, MIT 2003, Tellus 2003
McCain Lieberman – SA 2028	EIA 2004, MIT 2003, Tellus 2004
Greenhouse Gas Intensity Targets	EIA 2005, EIA 2006
Jeffords – S. 150	EPA 2005
Carper 4-P – S. 843	EIA 2003, EPA 2005

6
7 **Q. Please comment on the fact that several of the analyses from which you**
8 **developed your CO₂ price forecast were prepared in 2003 and 2004.**

9 **A.** We believe it is important for the Commission to rely on the most current
10 information available about future CO₂ emission allowance prices, as long as that
11 information is objective and credible. The analyses presented in Table 5 above
12 were the most recent analyses available when we developed our CO₂ price
13 forecasts back in about the spring of 2006. However, the results of these analyses
14 remains relevant today even though some of the studies on which our forecast
15 were based are now several years old.

16 Most importantly, as can be seen from Figure 1 earlier in this testimony, almost
17 all of the new greenhouse gas regulation bills that have been introduced in
18 Congress are significantly more stringent than the bills that were being considered
19 prior to the spring of 2006. As I will discuss below, the increased stringency of
20 current bills can be expected to lead to higher CO₂ emission allowance prices.

⁵⁸ A value that is “levelized” is the present value of the total cost converted to equal annual payments. Costs are levelized in real dollars (i.e., adjusted to remove the impact of inflation).

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1 The higher forecast natural gas prices that are being forecast today, as compared
2 to the natural gas price forecasts from 2003 or 2004, also can be expected to lead
3 to higher CO₂ emissions allowance prices.

4 **Q. Do the triangles, squares, circles and diamond shapes in Figure 2 above**
5 **reflect the results of all of the scenarios examined in the MIT, EIA, EPA and**
6 **Tellus analyses listed in Table 5?**

7 **A.** As a general rule, we focused our attention on the modeler's primary scenario or
8 presented high and low scenarios to bracket the range of results.

9 For example, the blue triangles in Figure 2 represent the results from EIA's
10 modeling of the 2003 McCain Lieberman bill, S. 139. We used the results from
11 EIA's primary case which reflected the bill's provisions that allowed: (a)
12 allowance banking; (b) use of up to 15 percent offsets in Phase 1 (2010-2015) and
13 up to 10 percent offsets in Phase II (2016 and later years). The S.139 case also
14 assumed commercial availability of advanced nuclear plants and of geological
15 carbon sequestration technologies in the electric power industry.

16 Similarly, the blue diamonds in Figure 2 represent the results from MIT's
17 modeling of the same 2003 McCain Lieberman bill, S.139. MIT examined 14
18 scenarios which examined the impact of factors such as the tightening of the cap
19 in Phase II, allowance banking, availability of outside credits, and assumptions
20 about GDP and emissions growth. We have included the results from Scenario 7
21 which included allowance banking and zero-cost credits, which effectively
22 relaxed the cap by 15% and 10% in Phase I and Phase II, respectively. We
23 selected this scenario as the closest to the S.139 legislative proposal since it
24 assumed that the cap was tightened in a second phase, as in Senate Bill 139.

25 At the same time, some of the studies only included a single scenario representing
26 the specific features of the legislative proposal being analyzed. For example, SA
27 2028, the Amended McCain Lieberman bill set the emissions cap at constant 2000
28 levels and allowed for 15 percent of the carbon emission reductions to be met
29 through offsets from non-covered sectors, carbon sequestration and qualified

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1 international sources. EIA presented one scenario in its table for this policy. The
2 results from this scenario are presented in the green triangles in Figure 2.

3 **Q. Did Synapse selectively use certain scenarios from the analyses by MIT, EIA,**
4 **EPA and Tellus in order to present the highest possible CO₂ prices, thereby**
5 **ignoring other lower cost scenarios?**

6 A. No.

7 **Q. Do you believe that technological improvements and policy options will**
8 **reduce the cost of CO₂ emissions?**

9 A. Yes. Exhibit DAS-4 identifies a number of factors that will affect projected
10 allowance prices. These factors include: the base case emissions forecast;
11 whether there are complimentary policies such as aggressive investments in
12 energy efficiency and renewable energy independent of the emissions allowance
13 market; the policy implementation timeline; the reduction targets in a proposal;
14 program flexibility involving the inclusion of offsets (perhaps international) and
15 allowance banking; technological progress; and emissions co-benefits.⁵⁹ In
16 particular, we anticipate that technological innovation will temper allowance
17 prices in the out years of our forecast.

18 **Q. Have you seen any recent forecasts of future CO₂ emissions prices that are**
19 **similar to the Synapse forecast?**

20 A. Yes. A report of an interdisciplinary study at the Massachusetts Institute of
21 Technology on *The Future of Coal* was issued in early March 2007. Figure 3
22 below shows that the CO₂ price forecasts in this study are very close to the high
23 and low Synapse forecasts.

⁵⁹ Exhibit DAS-4, at pages 46 to 49 of 63.

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1 *Assessment* evaluated the impact of the greenhouse gas regulation bills that are
2 being considered in Congress.

3 Twenty nine scenarios were modeled in the *Assessment*. These scenarios reflected
4 differences in such factors as emission reduction targets (that is, reduce CO₂
5 emissions 80% from 1990 levels by 2050, reduce CO₂ emissions 50% from 1990
6 levels by 2050, or stabilize CO₂ emissions at 2008 levels), whether banking of
7 allowances was allowed, whether there would be international trading of
8 allowances, whether only developed countries or the United States pursue
9 mitigation, whether there would be safety valve prices adopted as part of
10 greenhouse gas regulations, etc.⁶⁰

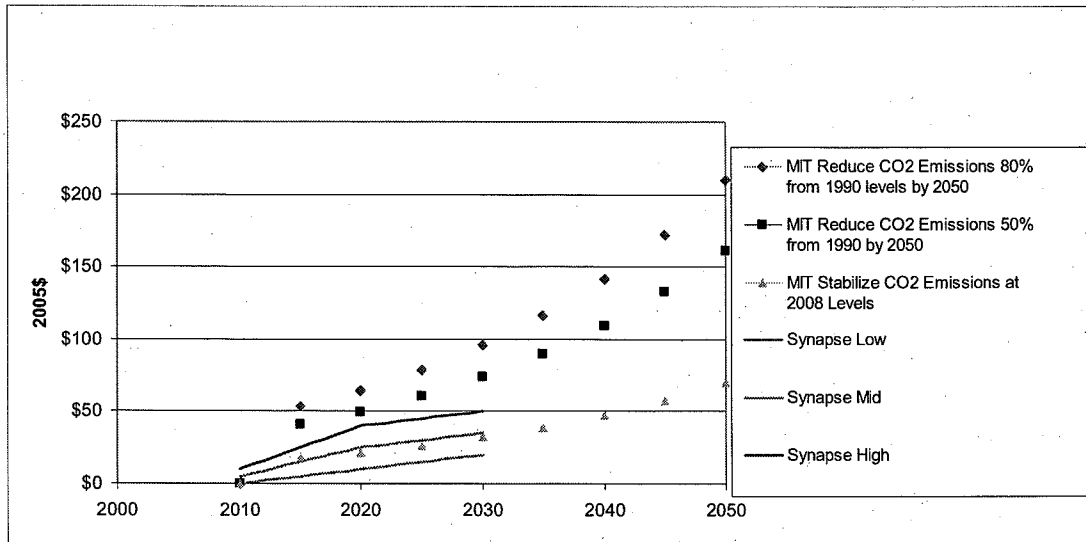
11 In general, the ranges of the projected CO₂ prices in these scenarios were
12 significantly higher than the range of CO₂ prices in the Synapse forecast. For
13 example, twelve of the 29 scenarios modeled by MIT projected higher CO₂ prices
14 in 2020 than the high Synapse forecast. Fourteen of the 29 scenarios projected
15 higher CO₂ prices in 2030 than the high Synapse forecast.

16 Figure 4 below compares the three Core Scenarios in the MIT *Assessment* with
17 the Synapse CO₂ price forecast.

⁶⁰ The scenarios examined in the MIT *Assessment of U.S. Cap-and-Trade Proposals* are listed in Exhibit DAS-4.

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1 **Figure 4: CO₂ Price Scenarios – Synapse and Core Scenarios in April**
2 **2007 MIT Assessment of U.S. Cap-and-Trade Proposals**



3
4 **Q. Did the recent MIT Assessment of U.S. Cap-and-Trade Proposals examine any**
5 **scenarios in which there would be “safety valve” prices similar to those in the**
6 **draft bill by Senator Bingaman?**

7 **A. Yes. Although these scenarios forecast significantly lower CO₂ emissions**
8 **allowance prices than the Synapse mid and high forecasts, the CO₂ emission**
9 **reductions achieved by 2050 in these scenarios were not close to the 60% to 80%**
10 **levels that are set forth as the goals in most of the legislation that has been**
11 **introduced in the current Congress.**

12 **Q. Are you recommending that the North Dakota Public Service Commission**
13 **adopt these significantly higher projected CO₂ allowance prices in its**
14 **evaluation of the prudence of Montana-Dakota and OTP’s proposed**
15 **participation in the Big Stone II Project?**

16 **A. Not at this time. However, the results of the recent MIT Assessment confirm the**
17 **reasonableness of the range of the current Synapse forecast of future CO₂ prices.**

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1 **Q. Have OTP and Montana-Dakota adequately considered the risk of**
2 **greenhouse gas regulation?**

3 A. No. The approach of the Big Stone II Co-owners is what might be called keeping
4 their heads in the sand and hoping that the problem of global warming goes away.
5 For example, the Co-owners could not answer basic questions about the United
6 Nations Framework Convention on Climate Change. Request for Admission No.
7 22 in the Joint Intervenors' First Set of Requests for Admission in South Dakota
8 Public Utilities Commission Case EL05-022 asked the Big Stone II Co-owners to:

9 Admit that in 1992 the United Nations Framework Convention on
10 Climate Change was adopted [IPCC 2005, p 5].

11 The Co-owners responded by saying that:

12 Applicant has made reasonable inquiry and the information known to
13 it is insufficient to enable Applicant to admit or deny this statement.

14 Similarly, Request for Admission No. 25 asked the Co-owners to:

15 Admit that the most recent Assessment Report released by the IPCC is
16 the Third Assessment Report (TAR), released in 2001, and that part of
17 the TAR is the report of the Working Group I of the IPCC, entitled
18 "Climate Change 2001: The Scientific Basis."

19 Again, the Co-owners responded, in part:

20 Applicant has made reasonable inquiry and the information known to
21 it is insufficient to enable Applicant to admit or deny this statement.

22 In twenty separate instances, the Co-owners could not answer requests for
23 admission requiring them to do nothing more than admit facts that could easily be
24 verified by an internet search (starting with the internet addresses that, in many
25 cases, were provided in the questions) or by referring to the document(s) attached
26 to the request.

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1 **Q. How are such responses relevant to the issue of considering carbon**
2 **regulation in resource planning?**

3 A. If a utility does not rely upon outside expertise to, at a basic level, advise the
4 utility on future carbon regulation and second to forecast carbon allowance prices,
5 it must rely upon its own knowledge and information gathering to do so. A major
6 step in that process is to understand the various parties involved and what their
7 recommendations mean to policymakers. Organizations such as the
8 Intergovernmental Panel on Climate Change are well recognized and regarded
9 and their thoughts on topics such as climate change do not go by the wayside.
10 The inability to answer these basic questions, let alone put in the small effort that
11 would be necessary to answer such questions, bodes poorly for the Co-owners'
12 decision-making.

13 **Q. Did OTP or Montana-Dakota reflect any potential greenhouse gas**
14 **regulations in their resource planning for Big Stone II?**

15 A. No. In some of its analyses OTP did use the Minnesota Commission's
16 environmental externality value for carbon dioxide. However, because the Big
17 Stone II plant would be located just across the border in South Dakota, the
18 Minnesota Commission CO₂ externality value was \$0/ton.

19 Our forecast of CO₂ prices assumes that the legislation controlling greenhouse gas
20 emissions that will be implemented by the early part of the next decade will not
21 be significantly different from the bills that have been introduced to date in
22 Congress. While these bills may make significant strides towards lowering future
23 CO₂ emissions, none is likely to put the country on the CO₂ emissions reductions
24 trajectories that will be required to truly stabilize the concentrations of
25 atmospheric CO₂. Therefore, the atmospheric concentrations of carbon dioxide
26 will continue to increase, global temperatures will continue to rise, and the
27 evidence of the resulting adverse climate changes from those rising temperatures
28 will become even more pronounced. As a result, the public and legislative debates

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1 on climate change and how to deal with the threat it poses will evolve, and the
2 American public will demand stronger governmental action to address this threat.

3 For these reasons, it is reasonable to expect that the stringency of carbon
4 regulations will increase in future years in order to achieve the emissions
5 reductions sufficient to stabilize atmospheric concentrations of CO₂. At the same
6 time, future CO₂ prices can be expected to rise because increasing energy use will
7 mean greater competition for a fixed or decreasing pool of emissions allowances.

8 **Q. Have Montana-Dakota and OTP criticized your carbon price forecasts in the**
9 **Big Stone II proceedings in South Dakota and/or Minnesota?**

10 A. Yes. The Big Stone II Co-owners, including Montana-Dakota and OTP,
11 presented rebuttal testimony before the South Dakota Commission and the
12 Minnesota Public Utilities Commission that challenged our forecast of carbon
13 prices.⁶¹ However, that rebuttal testimony was not credible for several reasons.

14 First, the rebuttal testimony on CO₂ prices that was presented by Montana-Dakota
15 and OTP in Minnesota and South Dakota was based on a review of a single piece
16 of proposed legislation, Senator Bingaman's Climate and Economy Insurance Act
17 of 2005, that was discussed but never introduced in Congress. The Big Stone II
18 Co-owners appeared to believe that this one piece of proposed legislation was the
19 best indicator of what Congress might pass in the future and that politics and the
20 will of the American people won't change even as the impacts of climate change
21 become more apparent. In contrast to the Co-owners, our carbon price forecasts
22 were based on our reviews of a number of legislative proposals that were
23 introduced in Congress and on the results of the modeling studies of the impact of
24 proposed legislation on future carbon prices. Our carbon price forecasts are not
25 tied to the fate of any single bill. Rather we believe that, overall, the bills that

⁶¹ Prefiled Rebuttal Testimony of Thomas A. Hewson, Jr., Applicants' Exhibit 30 in South Dakota Public Utilities Commission Case No. EL05-022.

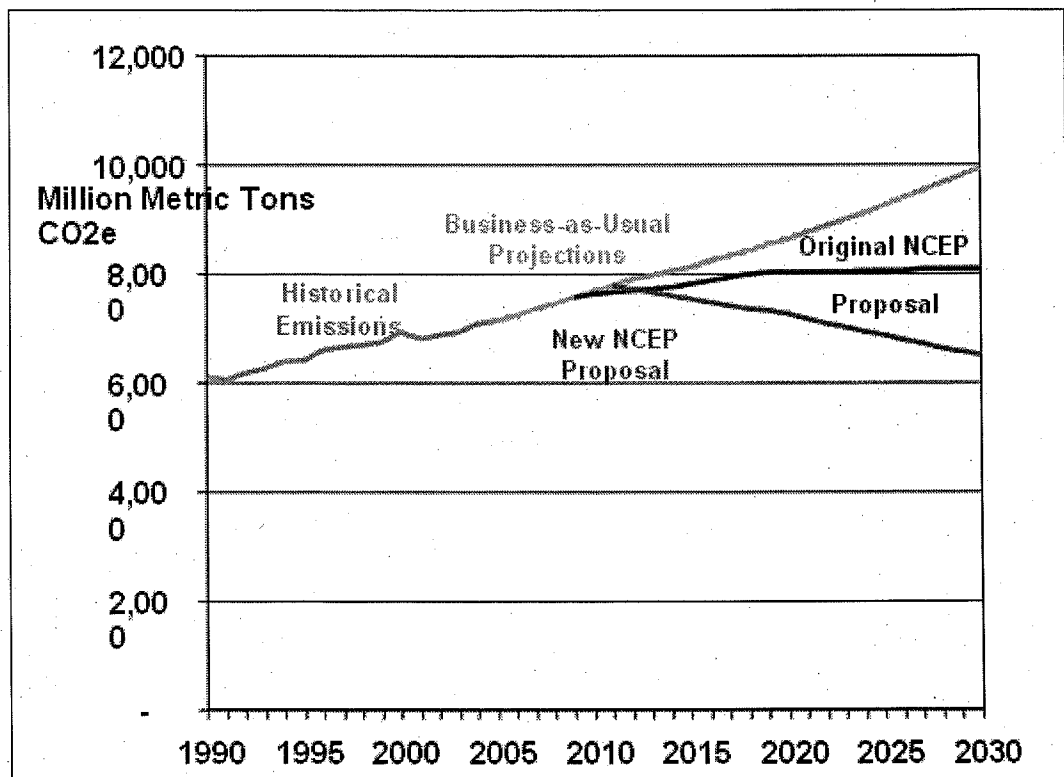
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1 have been and that are being proposed in Congress are representative of the
2 legislation that ultimately will be implemented.

3 Second, Senator Bingaman's draft bill was largely based on a proposal by the
4 National Commission on Energy Policy (NCEP) from December 2004, which
5 recommended a greenhouse gas intensity target starting in 2010 with an
6 allowance price cap starting at \$7/ton. However, the National Commission on
7 Energy Policy recently modified its greenhouse gas regulation proposal. Instead
8 of advocating for a reduction in greenhouse gas intensity, NCEP now proposes
9 that starting in 2012, national emissions be reduced so that by 2020 they are at
10 2006 levels and by 2030, they are 15% below current levels. A graphical version
11 of the difference between this new proposal and the proposal on which Senator
12 Bingaman's draft bill and, consequently, the Big Stone II Co-owners' rebuttal
13 testimony in South Dakota and Minnesota was based, is shown in Figure 5 below.

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1 **Figure 5: Original and Current NCEP Proposals⁶²**



2
3

4 **Q. How much additional CO2 will Big Stone II emit into the atmosphere?**

5 A. At its projected 88 percent capacity factor (i.e., 4856 GWH), Big Stone II will
6 emit more than 4.7 million tons of CO2 annually.

7 **Q. Would incorporating Synapse's carbon price forecast have a material effect
8 on the economics of building and operating the proposed Big Stone II
9 Project?**

10 A. Yes. For example, the Co-owners have said that the busbar cost of Big Stone II
11 will be \$69.62/MWh (2005\$) for investor-owned utilities (IOUs) and
12 \$56.38/MWh (2005\$) for public power. The use of the Synapse middle CO₂ price
13 forecast of an approximate \$19/MWh increase in operating costs would represent

⁶² From the National Commission on Energy Policy, www.energycommission.org.

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1 a 27% increase in cost per MWh of Big Stone II generation to the Big Stone II
2 investor owned utilities and a 33% increase to the public power Co-owners.

3 **Q. What would be the annual CO₂ cost to OTP and Montana-Dakota?**

4 A. Assuming an 88% average annual capacity factor, the range of annual, levelized
5 cost of CO₂ regulation for each Company would be:

6 Low Case - 4,700,000 tons * \$8.23/ton * 19.3% = \$7.5 million.

7 Mid Case - 4,700,000 tons * \$19.83/ton * 19.3% = \$18.0 million.

8 High Case - 4,700,000 tons * \$31.43/ton * 19.3% = \$28.5 million.

9 **Q. Are OTP and Montana-Dakota already heavily dependent upon coal-fired**
10 **generation?**

11 A. Yes. Exhibits BM-6 and BM-7 to OTP witness Morlock's Direct Testimony
12 shows that as of 2004, 60.3 percent (winter) to 65.3 percent (summer) of Otter
13 Tail Power Company's generating capacity was coal-fired.⁶³ When oil and
14 natural gas fired capacity is included, more than 75 percent of Otter Tail's
15 generating capacity was fossil-fired.

16 Seventy-six percent of Montana-Dakota Utilities current owned generation is
17 coal-fired.⁶⁴

18 **Q. Even if they add the Big Stone II Project, are OTP and Montana-Dakota**
19 **pursuing resource plans that, overall, will reduce their dependence on coal-**
20 **fired generation?**

21 A. No. OTP and Montana-Dakota may be saying that they are going to be adding a
22 diverse resource mix. However, they will remain heavily dependent on fossil-

⁶³ Applicants' Exhibits 10-D and 10-E in South Dakota Public Utilities Commission Case No. EL05-022.

⁶⁴ Applicants' Exhibit 11 in South Dakota Public Utilities Commission Case No. EL05-022, page 8, lines 9-17/

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1 fired generation even if they actually do pursue the resource plans that they are
2 now discussing. In other words, participating in the Big Stone II Project will limit,
3 not reduce, their future fuel diversity and maintain their dependence on coal.

4 For example, the results of Otter Tail Power's recent modeling shows that in
5 2007, [PROTECTED MATERIALS BEGIN 75 percent of the megawatt hours
6 produced by the Company will be generated at coal-fired facilities. With the Big
7 Stone II Project, in 2013 Otter Tail will still generate 75 percent of its megawatt
8 hours at coal-fired plants.⁶⁵ PROTECTED MATERIALS END]

9 **Q. Is this continued heavy dependence on coal-fired generation prudent?**

10 A. No. A continued heavy dependence on coal-fired generation is not prudent. In
11 particular, the failure by OTP and Montana-Dakota to accept that there will be
12 significant restrictions on future greenhouse gas emissions and to reflect the
13 potential for such restrictions in their resource planning is not prudent. We hope,
14 therefore, that the Commission will hold that the shareholders of OTP and
15 Montana-Dakota must bear any costs attributable to such imprudence.

16 **VII. OTP AND MONTANA-DAKOTA'S ECONOMIC AND MODELING**
17 **ANALYSES ARE BIASED IN FAVOR OF THE BIG STONE II PROJECT**
18 **AND DO NOT PRUDENTLY CONSIDER THE RISKS ASSOCIATED**
19 **WITH PARTICIPATING IN THE PROJECT**

20 **VII.A. OTTER TAIL POWER**

21 **Q. Have you reviewed the results of the modeling analyses that are discussed by**
22 **OTP in the Testimony of Bryan Morlock and that forms the basis for OTP's**
23 **participation in the Big Stone II Project?**

24 A. Yes. As part of our reviews in South Dakota and Minnesota, we have reviewed
25 the economic and modeling analyses which OTP has said form the basis for its

⁶⁵ Applicants' response to MCEA IR No. 139 in Minnesota Public Utilities Commission Dockets Nos. CN-05-619 and TR-05-1275.

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1 continued participation in the Big Stone II Project. This includes the IRP-Manager
2 resource planning modeling analyses that Mr. Morlock discusses.

3 **Q. Do the results of OTP's modeling analyses provide persuasive evidence that**
4 **the Company's participation in the Big Stone II Project is prudent?**

5 A. No. The Company's evidence in support of its claim that its participation in the
6 Big Stone II is prudent is unpersuasive for several reasons.

7 First, Otter Tail used the IRP-Manager model for its resource planning studies.
8 However, OTP has acknowledged that the IRP-Manager model has significant
9 limitations and that the company is in the process of changing to another capacity
10 expansion model.

11 Second, the IRP-Manager model optimizes for lowest cost based on a defined
12 predictable future without assessment of uncertainty or risks. Otter Tail Power
13 did not conduct any sensitivity analyses based on variations in such critical input
14 assumptions as the cost of Big Stone II, fuel costs, plant performance due to fuel
15 supply disruptions, etc.

16 Thus, Otter Tail has not prepared any sensitivities as part of its recent modeling to
17 evaluate the significant risks associated with building and operating a new coal-
18 fired generating facility. For example, the company does not present any
19 scenarios that reflect power plant power reductions or outages or increased fuel
20 costs as a result of disruptions of the supply of Powder River Basin coal. Such
21 disruptions have led to substantial amounts of lost plant generation and higher
22 fuel costs at coal plants around the U.S. as a result of the train derailments and
23 track problems experienced in 2005 on the rail lines emanating from Powder
24 River Basin.

25 Otter Tail also has not prepared any sensitivity analyses to consider the economics
26 of the Big Stone II Project assuming higher project capital costs. Consequently, it
27 has ignored the [PROTECTED MATERIALS BEGIN \$199 million increase in
28 the Project's estimated costs expected to be a consequence of the Co-owners'

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1 decision in late August 2006 adopt a short-term spending limitation plan that
2 would reduce their short-term engineering and procurement expenditures.

3 **PROTECTED MATERIALS END]**

4 Third, OTP's IRP-Manager analyses do not reflect any greenhouse gas regulation
5 costs.⁶⁶ This advantages coal-fired options, such as Big Stone II, that can be
6 expected to emit large amounts of CO₂.

7 Fourth, OTP assumed a January 1, 2011 commercial operation date for Big Stone
8 II in its IRP-Manager analyses. However, as indicated in the Direct Testimony of
9 Mark Rolfes, the plant is not scheduled to achieve an actual commercial
10 operations date before the late spring or summer of 2012, at the earliest.⁶⁷

11 **Q. What limitations has Otter Tail acknowledged in the IRP-Manager model?**

12 **A.** Otter Tail has identified a number of significant limitations in IRP-Manager that
13 affect its usefulness in capacity planning. For example, the company's response to
14 Joint Intervenors' IR No. 173 in Minnesota PUC Docket Nos. CN-05-619 and
15 TR-05-1275 notes the following limitations:

- 16 • IRP-Manager is not Windows compatible, and has to be run at the DOS
17 level for optimization runs. The manner in which IRP-Manager uses and
18 manages memory is incompatible with newer PC versions. This requires
19 that the model be operated on older PC's with slower CPU times, resulting
20 in single optimization runs taking 5-7 days.
- 21 • IRP-Manager is limited to monitoring and calculating six emissions.
- 22 • IRP-Manager has some hard-wired limits in the software that are now
23 becoming an issue as regulatory agencies want more options modeled and
24 with greater complexity. Examples of some of these limits are the number
25 of supply options, the number of interchange options, and the number of
26 interchange options with hourly pricing.

⁶⁶ Applicants' response to MCEA IR No. 176 in Minnesota PUC Docket Nos. CN-05-619 and TR-05-1275.

⁶⁷ Direct Testimony of Mark Rolfes, at page 13, lines 5-8.

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- 1 • Data input and output capabilities from IRP-Manager are extremely
2 limited and very labor intensive.
- 3 • Error checking is extremely cumbersome. There are times when a data
4 input error has occurred and it isn't realized until the end of a 5-7 day run,
5 causing further delay in analysis to complete another long-term run.

6 Indeed, Mr. Morlock told us that, unlike some of the other Co-owners, Otter Tail
7 had been unable to model any commercial operation date(s) for Big Stone II other
8 than January 1, 2011. We assume that the reason for this is the extremely long
9 time, i.e., 5-7 days, required to complete a new optimization run.

10 Otter Tail also has acknowledged that IRP-Manager is not well equipped to
11 properly handle all of the federal and state incentives for wind.⁶⁸ Therefore, the
12 company has modeled wind as being purchased from developers. However, Otter
13 Tail is considering ownership of wind generation, which might be a more
14 economic option than purchasing it from developers. This limitation in IRP-
15 Manager might bias the analysis against wind alternatives by inflating the cost
16 above what it would be if the wind resources were developed by the company
17 instead of developers.

18 In addition, due to the limitations in the number of hourly priced transactions
19 allowed within IRP-Manager, Otter Tail was unable to optimize the size of the
20 approximately 50 MW of Manitoba Hydro purchase included in its preferred
21 plan.⁶⁹ As result, the company intends to make that determination in its next
22 resource plan filing, using the capabilities of its new planning model, Strategist.⁷⁰

23 In summary, all of the limitations in the IRP-Manager model render it inadequate
24 for use in determining whether the Big Stone II Project is the most economic
25 option for the company's ratepayers and for assessing the economic benefits of

⁶⁸ Otter Tail Power Company's October 25, 2006, Supplemental Information Filing in Minnesota PUC Docket No. E017/RO-05-968, at page 4.

⁶⁹ Ibid., at page 9.

⁷⁰ Ibid., at page 18.

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1 participating in that project against the risks of doing so. In fact, Otter Tail Power
2 appears to be the only utility in the nation that uses this outdated planning model
3 and it is even in the process of changing to a new planning model.⁷¹ The North
4 Dakota Commission should not rely on the results from the IRP-Manager model
5 to find that OTP's participation in the Big Stone II Project is prudent.

6 **Q. Mr. Morlock has noted that under Minnesota law, OTP developed a number**
7 **of resource plans to satisfy regulatory requirements. Have you examined the**
8 **economics of any non-Big Stone II plans developed by Otter Tail?**

9 A. Yes. The Minnesota Commission required the Big Stone II Co-owners to present
10 an analysis that examined the relative economics of their best plans without Big
11 Stone II. The information that Otter Tail Power developed for use in this analysis
12 compared the company's preferred resource plan with Big Stone II against a plan
13 that includes a 115 MW hydro purchase in place of Big Stone II.

14 **Q. Was Otter Tail's plan without the Big Stone II Project a least cost plan?**

15 A. No. Otter Tail Power has said that its alternate plan was not a least cost plan
16 because the company did not have time to execute its IRP-Manager model in full
17 optimized fashion. Instead, Otter Tail simply substituted what appeared to be the
18 next lowest cost resource from the preferred plan for Big Stone II in the alternate
19 plan.⁷² This means that there might have been an optimized alternate plan that
20 has an even lower-cost than the alternate plan examined by Otter Tail.

⁷¹ Applicants' response to MCEA IR No. 173 in Minnesota Public Utilities Commission Dockets Nos. CN-05-619 and TR-05-1275.

⁷² Some, but not all, of the workpapers for Otter Tail's analysis of the alternative plan to Big Stone II Project were provided as the workpapers for the analysis presented in Applicants' Exhibit 48-A by Applicants' witness Harris in Minnesota Public Utilities Commission Dockets Nos. CN-05-619 and TR-05-1275; at Bates Page Number JCO0008272.

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1 **Q. Did the alternate plan examined by Otter Tail include more wind than the**
2 **plan with Big Stone II?**

3 A. No. Both plans were capped at 160 MW of wind.⁷³

4 **Q. Did the alternate plan examined by Otter Tail include more DSM than the**
5 **plan with Big Stone II?**

6 A. No. Both plans included the same amount of DSM.

7 Consequently, it is quite possible that there is a least cost plan with more wind
8 and more DSM that has a lower overall present worth revenue requirement than
9 the alternate plan examined by Otter Tail Power. Such a plan could reflect more
10 DSM and more wind.

11 **Q. Did this comparative analysis show that Big Stone II is a lower cost option**
12 **than the hydro purchase reflected in the alternate plan?**

13 A. No. As shown in Table 6 below, the difference in the present worth revenue
14 requirements between the company's preferred resource plan with Big Stone II
15 and the non-optimized no-Big Stone II alternate plan through the year 2020 is
16 only [PROTECTED MATERIALS BEGIN \$12.02 million (in 2011\$) or about
17 0.2 of one percent of the present worth revenue requirement of the preferred
18 resource plan with Big Stone II. Therefore, the plans have essentially the same
19 cost during the period 2006-2020. PROTECTED MATERIALS END]

⁷³ Updated Resource Breakdown, included in the materials provided as part of the workpapers of Kiah Harris for Applicants' Exhibit 48 in Minnesota Public Utilities Commission Dockets Nos. CN-05-619 and TR-05-1275.

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1 **Table 6: Otter Tail Power Revenue Requirements**
 2 **[PROTECTED MATERIALS BEGIN]**

Otter Tail Power IRP Revenue Requirements Prepared for BSPII CON Filing October 5, 2006								
OTP Discount Rate		9.80%						
Units are Millions of 2011 Dollars								
		Preferred Resource Plan		No BSPII Alternate Plan		Differences Between Two Plans		
	Year	Annual Revenue Requirement	PW of Annual Revenue Requirement	Annual Revenue Requirement	PW of Annual Revenue Requirement	Annual Revenue Requirement	PW of Annual Revenue Requirement	CUM PW of Annual Rev Req
1	2003	\$236.71	\$500.08	\$236.71	\$500.08	\$0.00	\$0.00	\$0.00
2	2004	\$240.66	\$463.04	\$240.66	\$463.04	\$0.00	\$0.00	\$0.00
3	2005	\$255.65	\$447.98	\$255.65	\$447.98	\$0.00	\$0.00	\$0.00
4	2006	\$269.41	\$429.96	\$269.36	\$429.88	-\$0.05	-\$0.08	-\$0.08
5	2007	\$280.30	\$407.41	\$280.35	\$407.48	\$0.05	\$0.07	-\$0.01
6	2008	\$286.14	\$392.02	\$297.61	\$394.23	\$1.67	\$2.21	\$2.20
7	2009	\$289.12	\$360.62	\$304.44	\$367.03	\$5.32	\$6.41	\$8.62
8	2010	\$300.77	\$330.25	\$310.28	\$340.69	\$9.51	\$10.44	\$19.06
9	2011	\$355.05	\$355.05	\$348.69	\$348.69	-\$6.36	-\$6.36	\$12.70
10	2012	\$362.53	\$330.17	\$355.65	\$323.91	-\$6.88	-\$6.27	\$6.43
11	2013	\$368.11	\$305.33	\$362.12	\$300.36	-\$5.99	-\$4.97	\$1.46
12	2014	\$374.22	\$282.70	\$368.60	\$278.21	-\$4.62	-\$3.49	-\$2.03
13	2015	\$378.22	\$260.22	\$376.66	\$259.14	-\$1.56	-\$1.07	-\$3.10
14	2016	\$377.02	\$236.24	\$378.29	\$237.04	\$1.27	\$0.80	-\$2.30
15	2017	\$370.78	\$211.59	\$375.18	\$214.10	\$4.40	\$2.51	\$0.21
16	2018	\$462.35	\$240.30	\$468.68	\$243.59	\$6.33	\$3.29	\$3.50
17	2019	\$469.78	\$222.37	\$477.75	\$226.14	\$7.97	\$3.77	\$7.27
18	2020	\$482.33	\$207.93	\$493.34	\$212.68	\$11.01	\$4.75	\$12.02
		\$6,179.15	\$5,983.25	\$6,201.22	\$5,895.27	\$22.07	\$12.02	

3
 4 **PROTECTED MATERIALS END]**

5 **Q. Have you changed any of the assumptions underlying the Otter Tail**
 6 **Company figures presented in Table 6 above?**

7 **A.** No. The annual revenue requirement figures for each plan shown in Table 6
 8 above were taken directly from Otter Tail Power's workpapers. All we have done
 9 is to change the PW of Annual Revenue Requirements figures to 2011\$ and to
 10 add the last three columns on the right hand side of Table 6 to show the
 11 differences between the two plans.

12 **Q. What are the relative present worth revenue requirements of the two plans**
 13 **when the Commission's emissions externality values are included?**

14 **A.** Using the Minnesota Commission's externality values has only a very minor
 15 effect, changing the relative difference in the present worth revenue requirements
 16 between the two plans to make the non-BSII Alternate Plan approximately 0.3 of
 17 a percent more expensive. This is essentially due to the fact that the CO₂

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1 emissions from Big Stone II have an externality value of \$0/ton because the plant
 2 would be located just across the border into South Dakota.

3 However, if you apply the Commission's high externality values to all of the CO₂
 4 emissions, not just those in Minnesota, the no-Big Stone II Alternate Plan is less
 5 expensive than the plan with Big Stone II by about [PROTECTED
 6 MATERIALS BEGIN \$12 million (in 2011\$) or about 0.2 percent.
 7 PROTECTED MATERIALS END]

8 **Q. What are the relative present worth revenue requirements of the two plans
 9 when greenhouse gas regulation costs are included?**

10 A. As shown in Table 7 below, the non-Big Stone II Alternate Plan becomes the
 11 lower cost option if you apply any of the Synapse CO₂ price forecasts that I have
 12 presented in Figure 2 and Table 4 above.

13 **Table 7: Benefits and (Costs) of Otter Tail's Preferred Resource Plan
 14 with Minnesota Commission Externalities and Synapse CO₂
 15 Prices**

Scenario	Benefit/(Cost) of Otter Tail's Preferred Resource Plan with BSII compared to Alternate Plan with No BSII
Synapse Low CO ₂ Prices – Low MN Externality Values	(\$17 million)
Synapse Low CO ₂ Prices – High MN Externality Values	(\$19 million)
Synapse Mid CO ₂ Prices – Low MN Externality Values	(\$80 million)
Synapse Mid CO ₂ Prices – High MN Externality Values	(\$80 million)
Synapse High CO ₂ Prices – Low MN Externality Values	(\$141 million)
Synapse High CO ₂ Prices – High MN Externality Values	(\$142 million)

16 Consequently, Big Stone II is more expensive than the non-optimized Alternate
 17 Plan examined by Otter Tail Power if you accept all of the company's
 18 assumptions except that you either apply the Minnesota Commission's high

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1 externality values to all of the project's estimated CO₂ emissions or use any of the
2 Synapse CO₂ price forecasts. Moreover, these results suggest that it also is
3 reasonable to expect that an optimized least cost no-BSII Alternate Plan that
4 included more wind and more DSM would be even more economic than the non-
5 optimized plan presented by Otter Tail Power as its "next best" alternative to the
6 Big Stone II Project.

7 **VII.B. MONTANA-DAKOTA**

8 **Q. Have you reviewed the Montana-Dakota resource planning analyses**
9 **discussed by Company witness Stomberg and that form the basis for the**
10 **Company's decision to participate in the Big Stone II Project?**

11 A. Yes.

12 **Q. Prior to the preparation of the modeling analyses discussed by Montana-**
13 **Dakota witness Heidell, had Montana-Dakota prepared any economic**
14 **analyses that showed the Big Stone II was the lowest cost option for its**
15 **ratepayers?**

16 A. No. Montana-Dakota's 2003 Integrated Resource Plan selected 120 MW of new
17 combustion turbines and some improvements to existing CTs to meet the
18 company's demand through 2021.⁷⁴ However, in its 2005 Integrated Resource
19 Plan, where it does not appear to use any model or to perform any quantitative
20 analysis, the company concludes that "subsequent to the filing of the 2004 IRP,
21 Montana-Dakota determined that the plan's heavy reliance on gas-fired
22 generation exposed our customers to considerable price and reliability risk
23 associated with fuel cost and availability. The company believes that coal-fired
24 generation, which has lower and less volatile fuel prices and a more stable fuel
25 supply than natural gas, provides a better value for our customers."⁷⁵

⁷⁴ Montana-Dakota Utilities 2003 Integrated Resource Plan, at page iv.

⁷⁵ Montana-Dakota Utilities 2003 Integrated Resource Plan, at page 4-2.

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1 Indeed, Montana-Dakota apparently did not prepare any economic analyses when
2 considering whether to participate in Big Stone II. Instead, it qualitatively
3 evaluated four options, three of which were coal-fired with the fourth being
4 reliance on purchased power.⁷⁶ As Montana-Dakota explained in the South
5 Dakota Public Utilities Commission Case:

- 6 ▪ The reference [in the testimony of MDU witness Stomberg] to a “model”
7 was generic, and was intended to convey the concept of a hypothetical,
8 purely quantitative model.⁷⁷
- 9 ▪ Montana-Dakota did not perform a purely quantitative model. The
10 statement refers to the fact the expert judgment is required in resource
11 planning; not just quantitative modeling.⁷⁸
- 12 ▪ For its 2005 IRP, Montana-Dakota did not use a computer model to
13 compare supply-side and demand-side resources.⁷⁹

14 We agree with Montana-Dakota that expert judgment is required in resource
15 planning but that is **in addition to** quantitative modeling. Thus, we find that the
16 Company’s decision to commit to a more than One Billion Dollar coal-plant
17 without having examined the economics of the various supply-side (let alone both
18 supply- and demand-side) options to have been imprudent.

19 **Q. What is the expected impact of Big Stone II on Montana-Dakota’s residential**
20 **customer rates?**

21 **A.** Montana-Dakota has estimated that the addition of Big Stone II will increase its
22 residential customer rates by approximately 20 percent, or about 1.9 cents/kWh⁸⁰
23 excluding the potential impact of greenhouse gas regulation.

⁷⁶ Response to Interrogatory 27 of Joint Intervenors’ Sixth Set of Interrogatories and Combined Request for Production of Documents in South Dakota Public Utilities Commission Case No.EL05-022.

⁷⁷ Interrogatory 28 of Joint Intervenors’ Sixth Set of Interrogatories and Combined Request for Production of Documents in South Dakota Public Utilities Commission Case No.EL05-022.

⁷⁸ Ibid.

⁷⁹ Response to Interrogatory 58 of Joint Intervenors’ Sixth Set of Interrogatories and Combined Request for Production of Documents in South Dakota Public Utilities Commission Case No.EL05-022.

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1 **Q. Have you reviewed the modeling by PA Consulting that is presented in the**
2 **testimony of Montana-Dakota witness Heidell?**

3 A. Yes.

4 **Q. Does this modeling show that MDU's participation in the Big Stone II Project**
5 **is prudent?**

6 A. No. The modeling analyses presented by Mr. Heidell are flawed.

7 **Q. Please describe the flaws you have identified in the modeling presented by**
8 **MDU.**

9 A. Among the first things we noticed was how marginal Big Stone Unit II was, even
10 under MDU's base case assumptions. In fact, as shown in Table 8 below, MDU's
11 own modeling projects that the Big Stone II Project would operate at capacity
12 factors of only 38 percent to 56 percent. These are significantly below what the
13 other Co-owners are forecasting for the plant.

14 **Table 8: Big Stone Unit II Capacity Factor in MDU Modeling⁸¹**

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
53	54	55	55	55	44	44	44	45	46	56	42	39	38

16 However, Montana-Dakota's modeling did not assume that the company would
17 make off-system sales. Consequently, the additional energy that MDU would
18 receive from Big Stone II, that is, the difference between Big Stone Unit II's
19 projected 88 percent annual capacity factor and the figures shown in Table 4
20 would presumably be used to make off-system sales.

21 **Q. Does Montana-Dakota have a financial incentive to make off-system sales?**

22 A. Yes. Hoa Nguyen of MDU testified in the Big Stone II siting permit proceeding
23 before the South Dakota Public Utilities Commission that in North Dakota, where

⁸⁰ Response to MCEA Information Request 44 in MPUC Docket No. CN-05-619.

⁸¹ Applicants' Exhibit 41-B, page A-12.

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1 60 percent of MDU's energy is sold, the Company "is allowed to keep 15 percent
2 of the margin" of off-system, off-peak sales.⁸²

3 **Q. Have you identified any other errors in Montana-Dakota's modeling of the**
4 **Big Stone II Project?**

5 A. Lack of risk analysis was a common error among all the Big Stone II Co-owners,
6 but PA Consulting's report explicitly acknowledges that limitation, saying:

7 PA's analysis was limited to base case scenarios using a combination
8 of existing unit costs provided by Montana-Dakota, and PA generic
9 unit cost assumptions. Risks related to fuel prices, load deviations
10 from the forecast, environmental regulations, MISO market design,
11 and a range of other factors were not included in the study.⁸³

12 In particular, MDU did not include in its modeling any costs associated with
13 mandated restrictions on greenhouse gas emissions.

14 In addition, the amount of DSM available for the model to select was very
15 limited.

16 **Q. Did you undertake any modeling of your own to address the limitations and**
17 **errors in MDU's modeling?**

18 A. Yes. As part of our work in the Minnesota Big Stone II dockets, we reran MDU's
19 modeling analyses using the Strategist model.

20 **Q. Please describe the Strategist modeling you undertook in the Minnesota**
21 **dockets.**

22 A. Our goal from the beginning was to keep the MDU Strategist database intact; only
23 making corrections to the database as a result of major errors in the modeling
24 inputs. MDU provided its Strategist database in response to MCEA IR 138 in that

⁸² South Dakota Public Utilities Commission Case No. EL05-022, hearing transcript at page 482, lines 10-17.

⁸³ Exhibit JAH-2, at page 2-1.

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1 proceeding. The response provided us with one run. In the run, the following
2 resources were available to the model during the planning period (2006-2025):

- 3 • 1160 MW of Big Stone II (in ten 116-MW blocks),
- 4 • 157.5 MW of wind (in five 31.5-MW blocks),
- 5 • 217.5 MW of combustion turbines (in five 43.5-MW blocks),
- 6 • 1300 MW of combined cycle (in ten 130-MW blocks),
- 7 • 580 MW of lignite coal (in five 116-MW blocks),
- 8 • 580 MW of IGCC (in five 116-MW blocks),
- 9 • 17.36 MW of DSM (in one 7.36-MW block and 2 10-MW blocks, these
10 10-MW blocks are mutually exclusive),
- 11 • 225 MW of a baseload contract (in three 75-MW blocks), and
- 12 • 105 MW of an Xcel peaking contract for one year (in one 105-MW block).

13 **Q. What changes did you make to MDU's modeling?**

14 **A.** We wanted to test very specific scenarios to determine whether Big Stone Unit II
15 would remain MDU's least-cost option. As such, we ran the following scenarios:

- 16 • Include the low Synapse CO₂ price and input CO₂ emission rates for
17 MDU's alternatives.
- 18 • Include the mid Synapse CO₂ price and input CO₂ emission rates for
19 MDU's alternatives.
- 20 • Increased wind resource availability to 315 MW.
- 21 • Increased DSM.
- 22 • Increased Big Stone II's capital cost by 10%.

23 In each of these scenarios, we made *no* other changes to the model.

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1 **Q. What were the results of this modeling?**

2 A. Table 9, below, shows the amount of Big Stone II capacity included in the least
3 cost plan as determined by Strategist, including MDU's preferred plan.

4 **Table 9: Amount of Big Stone II Added in Least Cost Plan**

Scenario	
MDU Preferred Plan	116 MW
Low CO ₂ Price	0 MW
Mid CO ₂ Price	0 MW
Increased Wind Availability	116 MW
Increased DSM	0 MW
Increased BSII Capital Cost 10%	0 MW

5 The addition of Big Stone II is highly sensitive to model assumptions and
6 consequently, the model only chose Big Stone II Project in the increased wind
7 availability case that we ran.

8 **Q. What resources did the model pick as an alternative to Big Stone II?**

9 A. It depends upon the scenario. In general additional wind and CT capacity was
10 added instead of Big Stone II. Table 10, below, shows the MW capacity additions
11 of new resources in each of the four plans shown above in which the model
12 selected none of the Big Stone II Project.

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1 **Table 10: Capacity Additions of New Resources under Five Scenarios**

Scenario	Xcel Contract	CT	Wind	MDU DSM 1	MDU DSM 2	MDU DSM 3
Low CO ₂ Price		174 MW	158 MW	7 MW		10 MW
Mid CO ₂ Price		174 MW	158 MW			
Increased DSM	105 MW	131 MW	63 MW	n/a	n/a	n/a
Increased BSII Capital Cost 10%		174 MW	95 MW	7 MW		

2

3 **Q. Can you explain why the model selected 116 MW of Big Stone II in the**
4 **Increased Wind Availability scenario that you ran?**

5 **A.** Yes. The model selected 116 MW of Big Stone II in that scenario because MDU
6 had constrained the Strategist model to select either 0 MW of its share of Big
7 Stone II or all 116 MW. That is, the model was unable to select some, but not all,
8 of MDU's share of the project.

9 We subsequently reran the Increased Wind Availability scenario and allowed the
10 Strategist model to select between 0 and ten blocks of Big Stone II (with each
11 block 11.6 MW in size) in 2012, instead of constraining it to choose either 0 MW
12 or 116 MW. In this case, the model selected only 23.2 MW of Big Stone II
13 instead of the 116 MW that the model had originally selected.

14 More importantly, the Strategist model selected only 23.2 MW of Big Stone II
15 under MDU's Base Case assumptions, rather than 116 MW, when the model was
16 allowed to select up to ten 11.6 MW blocks of the Project in 2012, instead of
17 constraining it to choose either 0 MW or 116 MW. In addition, we found that
18 using all of MDU's Base Case assumptions, the Strategist model did create a non-
19 Big Stone II plan that had a slightly lower net present value than did MDU's
20 Preferred Plan with 116 MW of the Project.

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1 **Q. Would any of these least-cost plans substitute as MDU's preferred plan?**

2 A. No. Additional analysis would be necessary to make that determination. For
3 example, we have not performed a combination run in which both increased wind
4 and DSM resources were made available to the model. Our intent was not to
5 create a preferred plan but rather to test MDU's assertion that its least-cost plan
6 includes 116 MW of Big Stone II and the sensitivity of that conclusion to the
7 input assumptions made by MDU.

8 **Q. Please summarize your conclusions concerning MDU's resource planning
9 and modeling analyses?**

10 A. MDU's resource planning and modeling analyses do not show that Big Stone II is
11 the lowest cost or best option for its ratepayers and, consequently, do not
12 demonstrate that the Company's participation in the Big Stone II Project is
13 prudent.

14 **VIII. THE TWO ECONOMIC ANALYSIS PRESENTED BY OTP AND
15 MONTANA-DAKOTA WITNESS ROLFES DO NOT SHOW THAT
16 PARTICIPATION IN THE BIG STONE II PROJECT IS PRUDENT**

17 **Q. Have you reviewed the two economic studies that are discussed by OTP and
18 Montana-Dakota witness Rolfes?**

19 A. Yes. We have reviewed in detail the two economic studies that are included as
20 Exhibits Nos. MR-1 and MR-2.

21 **Q. Do these studies demonstrate that the addition of Big Stone II is prudent?**

22 A. No. The two studies presented by Mr. Rolfes do not show that OTP and Montana-
23 Dakota's participation in the Big Stone II Project is prudent. In particular, neither
24 study compared Big Stone II to DSM and/or renewable alternatives in a complete
25 and unbiased manner. Consequently, their results are not credible.

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1 **Q. Did the September 2005 *Generation Alternatives Study* (Exhibit No. MR-1)**
2 **evaluate the economics of DSM or a renewable alternative to Big Stone II?**

3 A. The *Generation Alternatives Study* did not examine DSM as part of an alternative
4 to the Big Stone II Project. However, among the six alternatives considered, the
5 *Generation Alternatives Study* did examine a wind-gas alternative. Unfortunately,
6 the evaluation of the wind alternative in the *Generation Alternatives Study* had
7 two flaws which substantially biased its results in favor of the 600 MW
8 supercritical PC alternative that was essentially Big Stone II.

9 **Q. What were the two flaws which critically biased the economic analyses**
10 **presented in the *Generation Alternatives Study* against the wind-gas**
11 **alternative?**

12 A. First, the *Generation Alternatives Study* assumed that the wind resources had no
13 capacity value and, therefore, required a 600 MW backup natural gas-fired
14 combined cycle facility. Second, the *Study* limited the amount of wind in the
15 alternative to 600 MW which meant that substantially more than half of the
16 energy provided by the alternative would be produced by the more expensive
17 combined cycle facility. Together, these assumptions significantly increased the
18 cost of the wind-gas alternative in the *Generation Alternatives Study*.

19 **Q. Is the assumption that wind facilities have no capacity value, and therefore**
20 **require a 100 percent backup, consistent with the assumptions made in the**
21 **most recent Integrated Resource Plans filed by OTP or Montana-Dakota?**

22 A. No. The capacity tables in Otter Tail Power's 2006-2020 Resource Plan credit
23 wind with a capacity value of approximately 15 percent in the summer and
24 approximately 20 percent in the winter.⁸⁴

⁸⁴ Otter Tail Power Company's 2006-2020 Resource Plan, dated June 28, 2005, Table 4-B, at page 4-9.

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1 **Q. Was the assumption that wind facilities have no capacity value, and therefore**
2 **require 100 percent backup, consistent with the testimony sponsored by the**
3 **Big Stone II Co-owners in either the South Dakota or the Minnesota Big**
4 **Stone II proceedings?**

5 A. No. The testimony of Heartland witness McDowell in South Dakota noted that
6 wind generation is accredited to be available 20 percent of the time for MAPP
7 load and capability planning purposes.⁸⁵ Similarly, SMMPA witness Geschwind
8 noted a 20 percent capacity value for wind when he testifies that “SMMPA would
9 have to install approximately 5 MW of nameplate wind capacity for every 1 MW
10 of nameplate capacity from Big Stone Unit II to arrive at the same level of
11 MAPP-accredited capacity.”⁸⁶

12 **Q. Please explain how limiting the amount of wind resources to 600 MW biased**
13 **the *Generation Alternatives Study*.**

14 A. Each of the alternatives considered in the *Generation Alternatives Study* were
15 designed to provide the same amounts of capacity for reliability (600 MW) and
16 energy (approximately 4,625 GWh). Because it assumes that the wind resources
17 have zero capacity value, in the wind alternative examined, the *Study* added 600
18 MW of natural-gas fired combined cycle capacity to “back up” the 600 MW of
19 wind it assumed would be built. By limiting the amount of wind resources to 600
20 MW, the *Study* limits the energy that would be produced by that wind capacity to
21 2,102 GWh (assuming a 40 percent capacity factor for wind). This means that
22 2,523 GWh, or more than half of the required energy, would be generated by the
23 far more expensive natural gas-fired combined cycle facility. This increases the
24 overall cost of the wind-gas alternative.

⁸⁵ Applicants’ Exhibit 4 in South Dakota Public Utilities Commission Case No. EL05-022, at page 8, lines 7-8.

⁸⁶ Applicants’ Exhibit 5 in South Dakota Public Utilities Commission Case No. EL05-022, at page 10, line 22, to page 11, line 2.

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1 Instead of assuming that only 600 MW of wind would be built, the *Generation*
2 *Alternatives Study* could have assumed that the wind-gas alternative included 800
3 MW of wind resources. In this scenario, wind would be expected to provide 2,803
4 GWh of energy, or approximately 61 percent of the total required 4,625 GWh.
5 The remaining 1,822 GWh, or 39 percent, of the required energy would be
6 generated by the significantly more expensive natural gas-fired facility.

7 Or, the *Generation Alternatives Study* could have assumed that the wind-gas
8 alternative included 1200 MW of wind resources. In this scenario, wind would be
9 expected to provide 4,205 GWh, or approximately 91 percent, of the total
10 required 4,625 GWh. Only 420 MWh, or less than ten percent of the total, would
11 have to be generated at the more expensive natural gas-fired facility.

12 **Q. Are there any circumstances under which a utility would undertake a wind**
13 **project with a dedicated gas backup constrained to run when wind is not**
14 **generating energy, as the Co-owners have assumed in the *Generation***
15 ***Alternatives Study*?**

16 A. It is difficult to imagine that such a situation would ever occur for the Big Stone II
17 Co-owners. First, it is illogical and contrary to customary practice to build one
18 generating unit to “back up” a second unit. Usual practice is to back up the entire
19 pool of generation, not just an individual unit.

20 Second, to have, but not to bid or operate a gas unit, could be a violation of the
21 current MISO rules since the Co-owners could be accused of withholding
22 capacity from the market. This example also violates the principles of economic
23 dispatch since a unit will run when it is economic to do so, not simply in cases
24 where it would be supplying energy not generated by a wind turbine. So, in
25 practice, the gas “backup” would not be constrained.

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1 **Q. Did the *Generation Alternatives Study* properly calculate the Production Tax**
2 **Credit for wind facilities?**

3 A. No. The study assumed a levelized value of \$12/MWh for the Production Tax
4 Credit ("PTC") for wind facilities, which understated the value of the PTC by not
5 counting the additional tax benefit of the PTC because it is a credit on tax liability
6 rather than a dollar of taxable income.

7 For example, a 2005 study by the Energy Information Administration ("EIA")
8 shows that the PTC is worth approximately \$28/MWh levelized over a 10-year
9 period or \$21/MWh levelized over a 20-year period, assuming a 38% marginal
10 tax rate. Another study by the National Renewable Energy Laboratory found that
11 the PTC could be worth as much as \$23/MWh levelized over a 15-year period,
12 assuming a 40% tax rate.

13 **Q. Did the September 2005 *Generation Alternatives Studies* reflect the currently**
14 **estimated cost of the Big Stone II Project and/or any greenhouse gas**
15 **regulations?**

16 A. No.

17 **Q. Is it possible that there are wind with hydro and/or demand-side**
18 **management measures that would have lower costs than the wind-gas**
19 **combinations you have looked at in your revisions to the Co-owners'**
20 ***Generation Alternatives Study*?**

21 A. Yes. There is evidence of additional, very low cost demand-side management
22 measures available to the Co-owners.

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1 **Q. Did the *Generation Alternatives Study* examine a combination of renewable**
2 **resources, other than the 600 MW wind–600 MW gas mix, to meet the**
3 **projected needs of the Co-owners?**

4 A. No. The *Generation Alternatives Study* did not examine, with the exception of gas
5 and wind, any combinations of resources, such as a portfolio of wind, demand-
6 side measures, and hydro, to meet the projected needs of the Co-owners.

7 **Q. Does the second analysis discussed by Mr. Rolfes, that is, the October 2006**
8 ***Revised Analysis of Baseload Generation Alternatives*, demonstrates that OTP**
9 **and Montana-Dakota’s participation in the Big Stone II Project is prudent?**

10 A. No. The *Revised Analysis of Baseload Generation Alternatives* is significantly
11 flawed and biased in favor of the Big Stone II option.

12 **Q. What is the basis for this conclusion?**

13 A. The study analysis suffers from the following flaws:

- 14 • It does not examine DSM and hydro at all.
- 15 • It rejects wind as a baseload resource and considers it as only a non-firm
16 resource.⁸⁷
- 17 • It assumes no continuation of the wind Production Tax Credit.⁸⁸
- 18 • It appears to use an estimated Big Stone II Project capital cost that does
19 not reflect the additional [PROTECTED MATERIALS BEGIN \$199
20 million that Black & Veatch has projected will be the result of the short-
21 term spending reduction plan adopted by the Co-owners in August of this
22 year.⁸⁹ PROTECTED MATERIALS END]

⁸⁷ Exhibit No. MR-2, at page 3.

⁸⁸ *Ibid.*, at page 4.

⁸⁹ Exhibit No. MR-2, Table 1, at page 3.

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1 **Q. Is it possible that there are wind with hydro and/or demand-side**
2 **management measures that would have lower costs than the wind-gas**
3 **combination that has presented in Exhibit No. MR-2?**

4 A. Yes. We believe that there is evidence of additional, very low cost demand side
5 management measures available to OTP and Montana-Dakota.

6 **Q. Do you believe that wind can be a baseload resource?**

7 A. Yes. Wind can be part of a portfolio of resources that can provide needed capacity
8 and baseload energy.

9 Indeed, as the 2004 *Wind Integration Study – Final Report* prepared for Xcel
10 Energy and the Minnesota Department of Commerce has noted:

11 Many of the earlier concerns and issues related to the possible
12 impacts of large wind generation facilities on the transmission grid
13 have been shown to be exaggerated or unfounded by a growing
14 body of research studies and empirical understanding gained from
15 the installation and operation of over 6000 MW of wind generation
16 in the United States.⁹⁰

17 Wind power can reduce the need for other capacity and provide low cost energy.
18 One of the Big Stone II Co-owners, GRE agrees, stating in discovery in the
19 Minnesota Certificate of Need proceeding for the transmission line that “GRE
20 believes that renewables and conservation could serve at least a portion of future
21 baseload power needs.”⁹¹ In fact, when combined with other energy resources,
22 wind can produce energy in patterns comparable to a baseload generation facility.
23 At the same time, the effects of short term wind variability can be mitigated by
24 building a larger number of wind turbines and by siting the wind turbines in
25 different geographic locations.

⁹⁰ *Wind Integration Study-Final Report*, prepared for Xcel Energy and the Minnesota Department of Commerce by EnerNex Corporation and Wind Logics, Inc., dated September 28, 2004.

⁹¹ Response to MCEA IR No. 73 in MNPUC Docket No. CN-05-619.

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1 Moreover, studies and actual operating experience has shown that fairly high
2 penetrations of wind generation can be integrated into the electricity system (up to
3 20% of system peak demand⁹² or more) without having adverse impacts on the
4 reliability or stability of the electric grid. Some additional regulation or load-
5 following support may be needed if large amounts of wind are added to the grid,
6 but that can be provided by existing facilities.⁹³ OTP and Montana-Dakota
7 witness Mark Rolfes has admitted the same, saying “The [Balancing Area
8 Authority] simply must have enough generation available to handle variations
9 between expected and actual generating level of wind on a second-by-second
10 basis. Presuming some type of pre-scheduling was performed based upon wind
11 forecasts, this amount can be a relatively small fraction of the nameplate capacity
12 of the wind.”⁹⁴

13 I also would make two comments regarding the claim in the that the Big Stone II
14 Co-owners need a fully dispatchable facility. First, the electric grid and, indeed,
15 many of the Co-owners, already have fully dispatchable facilities. OTP and
16 Montana-Dakota have not shown any evidence why new generation also must be
17 fully dispatchable. Second, none of the economic and/or modeling studies that we
18 have seen from any of the Big Stone II Co-owners, including OTP and Montana-
19 Dakota, reflected any dispatching of the proposed Big Stone II facility in response
20 to changes in demand or any other factor(s). Instead, these studies have assumed
21 that Big Stone II will operate “flat-out” at an 88 percent average annual capacity.

⁹² “Utility Wind Integration State of the Art” report prepared by Utility Wind Integration Group in cooperation with American Public Power Association, Edison Electric Institute and National Rural Electric Cooperative Association, dated May 2006.

⁹³ “Grid Impacts of Wind Power Variability: Recent Assessments from a Variety of Utilities in the United States,” Parson, Mulligan, et al., presented at the 2006 European Wind Energy Conference.

⁹⁴ Response to Interrogatory 33 of the Joint Intervenors’ Sixth Set of Interrogatories and Combined Set of Request for Production of Documents.

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1 **Q. Is it reasonable to assume that the Production Tax Credit will not be**
2 **renewed before it expires at the end of 2008?**

3 A. No. We believe that it is reasonable to assume that the Production Tax Credit will
4 be renewed given (1) its history, (2) increasing concern over U.S. dependence on
5 foreign sources of energy, and (3) mounting concern over global warming and
6 climate change the resulting interest in providing subsidies to non-carbon emitting
7 technologies. This is particularly true given the results of the recent
8 Congressional elections.

9 Interestingly, the Big Stone II Co-owners filed rebuttal testimony on December 8,
10 2006 that argued that it was not reasonable to expect that the Production Tax
11 Credit would be extended before it expired at its then-scheduled expiration date of
12 December 31, 2007. However, without hours of the filing of that testimony, the
13 outgoing U.S. Congress extended the Production Tax Credit by an additional year
14 to the end of 2008.

15 **Q. Do the same flaws invalidate the carbon price break-even analysis in the**
16 ***Revised Analysis of Baseload Generation Alternatives?***

17 A. Yes.

18 **Q. Do you nevertheless have any comments on the results of the carbon-**
19 **breakeven analysis in the *Revised Analysis of Baseload Generation***
20 ***Alternatives?***

21 A. The break-even carbon dioxide cost shown in the *Revised Analysis of Baseload*
22 *Generation Alternatives* for the investor-owned utility ownership structure, such
23 as OTP and MDU, without the wind Production Tax Credit is approximately
24 \$11.10/ton. This is between our levelized Synapse low- and mid-CO₂ prices.

25 The break-even carbon dioxide cost shown in the study for the investor-owned
26 utility structure, with the wind Production Tax Credit, is only approximately
27 \$5/ton, in 2006\$. This is substantially below even our Synapse low-CO₂ price

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1 **Q. Are you surprised that the Co-owners have filed the September 2005 *Analysis***
2 ***of Baseload Generation Alternatives* (Exhibit No. MR-1) and the October 2006**
3 ***Revised Analysis of Baseload Generation Alternatives* (Exhibit No. MR-2) in**
4 **support of their request for an advanced determination of the prudence of**
5 **their participation in the Big Stone II Project?**

6 A. Yes. The Big Stone II Co-owners, including OTP and Montana-Dakota were very
7 adamant in their position in the hearings before the South Dakota Public Utilities
8 Commission that such a comparison based on levelized costs was not
9 appropriate. For example, the Co-owners noted the following in their
10 interrogatory responses:

11 It must be noted that simply comparing \$/MWh busbar costs of
12 dissimilar projects is misleading and violates the most basic
13 principles of integrated resource planning. Such a comparison
14 completely ignores the impact of the costs and benefits a single
15 resource can have on other resources, and provides only limited
16 information on how any particular resource matches up with a
17 utility's existing resource mix, the existing load requirements, or
18 the electrical system in total.⁹⁵

19 Consequently, I am surprised that OTP and Montana-Dakota have filed Exhibits
20 Nos. MR-1 and MR-2 if they truly do believe this way about the limits of
21 levelized cost analyses.

22 For the same reason, I am similarly surprised that OTP witness Uggerud has
23 testified that Otter Tail decided to pursue construction of a supercritical
24 pulverized coal plant at the Big Stone site as a joint project because of "the
25 proposed plant's low busbar cost and high reliability."⁹⁶

⁹⁵ Applicants' response to Interrogatory No. 17 of Joint Intervenors' Sixth Set of Interrogatories and Combined Request for Production of Documents in South Dakota Public Utilities Commission Case No. EL05-022.

⁹⁶ Direct Testimony of Ward Uggerud, at page 4, lines 12-13.

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1 **Q. Do you believe that such levelized analyses can serve a useful function?**

2 A. Yes. Although we believe that the levelized analysis presented in Exhibits Nos.
3 MR-1 and MR-2 are fatally flawed, as discussed above, we believe that the use of
4 levelized costs is a useful tool in the screening of possible alternatives to be
5 studied in greater detail to capture the various factors noted by the Co-owners.

6 **Q. Does this complete your testimony?**

7 A. Yes.

8

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