Joint Intervenors
Exhibit 1

BEFORE THE SOUTH DAKOTA PUBLIC UTILITIES COMMISSION

In the Matter of the Application by Otter Tail Power Company on behalf of the Big Stone II Co-owners for an Energy Conversion Facility Siting Permit for the Construction of the Big Stone II Project	))))	**Case No EL05-022**

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

On Behalf of
Minnesotans for an Energy-Efficient Economy
Izaak Walton League of America – Midwest Office
Union of Concerned Scientists
Minnesota Center for Environmental Advocacy

May 19, 2006

Joint Intervenors
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Q. Mr. Schlissel, please state your name, position and business address.

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

Q. Ms. Sommer, please state your name position and business address.

A. My name is Anna Sommer. I am a Research Associate at Synapse Energy Economics, Inc., 22 Pearl Street, Cambridge, MA 02139.

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

A. We are testifying on behalf of Minnesotans for an Energy-Efficient Economy, Izaak Walton League of America – Midwest Office, Union of Concerned Scientists, and Minnesota Center for Environmental Advocacy ("Joint Intervenors").

Q. Please describe Synapse Energy Economics.

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

Synapse's clients include state consumer advocates, public utilities commission staff (and have included the Staff of the South Dakota Public Utilities Commission), attorneys general, environmental organizations, federal government and utilities.

Q. Mr. Schlissel, please summarize your educational background and recent work experience.

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

Since 1983 I have been retained by governmental bodies, publicly-owned utilities, and private organizations in 28 states to prepare expert testimony and analyses on engineering and economic issues related to electric utilities. My clients have included the Staff of the Arizona Corporation Commission, the General Staff of the Arkansas Public Service Commission, the Staff of the Kansas State Corporation Commission, municipal utility systems in Massachusetts, New York, Texas, and North Carolina, and the Attorney General of the Commonwealth of Massachusetts.

I have testified before state regulatory commissions in Arizona, New Jersey, Connecticut, Kansas, Texas, New Mexico, New York, Vermont, North Carolina, South Carolina, Maine, Illinois, Indiana, Ohio, Massachusetts, Missouri, and Wisconsin and before an Atomic Safety & Licensing Board of the U.S. Nuclear Regulatory Commission.

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

Q. Have you previously submitted testimony before this Commission?

A. No.

Q. Ms. Sommer, please summarize your educational background and work experience.

A. I am a Research Associate with Synapse Energy Economics. I provide research and assist in writing testimony and reports on a wide range of issues from renewable energy policy to integrated resource planning. My recent work includes aiding a Florida utility in its integrated resource planning, evaluating the feasibility of carbon sequestration and reviewing the analyses of the air emissions compliance plans of two Indiana utilities and one Nova Scotia utility.

I also have participated in studies of proposed renewable portfolio standards in the United States and Canada. In addition, I have evaluated the equity of utility renewable energy solicitations in Nova Scotia and the feasibility and prudence of the sale and purchase of existing gas and nuclear capacity in Arkansas and Iowa.

Prior to joining Synapse, I worked at EFI and XENERGY (now KEMA Consulting) and Zilkha Renewable Energy (now Horizon Wind Energy). At XENERGY and Zilkha I focused on policy and economic aspects of renewable energy. While at Zilkha, I authored a strategy and information plan for the development of wind farms in the western United States.

I hold a BS in Economics and Environmental Studies from Tufts University. A copy of my current resume is attached as Exhibit JI-1-B.

Q. Ms. Sommer, have you previously submitted testimony before this Commission?

A. No.

Q. What is the purpose of your testimony?

A. Synapse was asked by Joint Intervenors to investigate the following four issues regarding the proposed Big Stone II coal-fired generating facility:

A. The need and timing for new supply options in the utilities' service territories.

B. Whether there are alternatives to the proposed facility that are technically feasible and economically cost-effective.

C. Whether the applicants have included appropriate emissions control technologies in the design of the proposed facility.

D. Whether the applicants have appropriately reflected the potential for the regulation of greenhouse gases in the design of the proposed facility and in their analyses of the alternatives.

This testimony and the testimony of our colleague Dr. Ezra Hausman presents the results of our investigations of Issue D. Our testimony regarding Issues A, B and C will be submitted on May 26, 2006.

Q. Please summarize your conclusions on the issue of whether the Big Stone II Co-owners have appropriately reflected the potential for the regulation of greenhouse gases in the design of the proposed facility and in their analyses of the alternatives.

A. Our conclusions on this issue are as follows:

1. Climate change is causing and can be expected in the future to cause "significant" environmental harm, as explained in detail in the Testimony of Dr. Ezra Hausman.

2. There is scientific consensus that emissions of carbon dioxide cause climate change.

3. Big Stone Unit II would emit significant amounts of additional carbon dioxide.

4. As a result, the Big Stone Unit II will pose a serious threat to the environment.

5. The potential for the regulation of carbon dioxide must be considered as part of any prudent cost estimates of Big Stone Unit II and alternatives.

6. However, the Big Stone II Co-owners have not adequately analyzed the potential for future carbon regulation.

7. The externality values for carbon dioxide established by the Minnesota Public Utilities Commission and used in resource planning by some of the Co-owners are meant to recognize "external" costs, or, in other words, costs that are not directly paid by utilities or their customers. The Minnesota Commission's externality values are not reflective of any concerns about the real costs of complying with future carbon dioxide regulation.

8. Synapse Energy Economics has developed a greenhouse gas allowance price forecast that reflects a range of prices that could reasonably be expected through 2030.

9. Adopting Synapse's range of prices would increase Big Stone Unit II's annual projected costs by $35,152,128 to $137,463,322 on a levelized basis.

Q. In the process of your investigation did you keep in mind the interests of the Big Stone Co-owners' customers?

A. Absolutely. Synapse regularly works for consumer advocates and has worked for over half of the members of the National Association of State Utility Consumer Advocates. Fundamentally, we believe that greenhouse gas regulation not only is an environmental issue. It also is a consumer issue in that it will have direct and tangible impacts on future rates.

Q. You have mentioned the terms "carbon dioxide regulation" and "greenhouse gas regulation." What is the difference between these two?

A. As we use these terms 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 ("CO_2"), 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.

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

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

Despite being the single largest contributor to global emissions of greenhouse gases, the United States remains one of a very few industrialized nations that have not signed the Kyoto Protocol. Nevertheless, individual states, regional groups of states, shareholders and corporations are making serious efforts and taking significant steps towards reducing greenhouse gas emissions in the United States. Efforts to pass federal legislation addressing carbon, though not yet successful, have gained ground in recent years. These developments, combined with the growing scientific understanding of, and evidence of, climate change as outlined in Dr. Hausman's testimony, mean that establishing federal policy requiring greenhouse gas emission reductions is just a matter of time. The question is not whether the United States will develop a national policy addressing climate change, but when and how. The electric sector will be a key component of any regulatory or legislative approach to reducing greenhouse gas emissions both because of this sector's contribution to national emissions and the comparative ease of regulating large point sources.

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

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

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

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

To illustrate that there is significant uncertainty in other types of forecasts, we think it is informative to examine historical gas price forecasts by the Energy Information Administration (EIA). Exhibit JI-1-C compares EIA forecasts from the period 1990 - 2006 with actual price data through 2005. The data, over more than a decade, shows considerable volatility, even on an annual time scale.[1] But the truly striking thing that jumps out of the figure is how wrong the forecasts have sometimes been. For example, the 1996 forecast predicted gas prices would start at $2.61/MMBtu and remain under $3/MMBTU through 2010, but by the year 2000 actual prices had already jumped to $4.82/MMBTu and by 2005 they were up to $8.09/MMBtu.

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

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

Q. Do the Co-owners have any opinions or thoughts as to when carbon regulation will happen?

A. No. Interrogatory 18 of Joint Intervenors' First Set and First Amended Set of Interrogatories[2] asked each of the Co-owners to state whether it:

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

[2] The Co-owners' response to Interrogatory 18 is attached as Exhibit JI-1-D.

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

None of the co-owners had any thoughts as to when or even if greenhouse gas regulation would occur. Two of the Co-owners (GRE and HCPD) claim to closely follow discussion of GHG regulation at the federal and State levels, but apparently had no opinions about what might result from such discussions.

Q. If the siting permit for Big Stone Unit II were to be approved and the unit were built, is carbon regulation an issue that could be reasonably dealt with in the future, once the timing and stringency of the regulation is known?

A. Unfortunately, no. Unlike for other power plant air emissions like sulfur dioxide and oxides of nitrogen, there currently is no commercial or economical method for post-combustion removal of carbon dioxide from supercritical pulverized coal plants. The Big Stone II Co-owners agree on that point. During the public hearing in Milbank held on September 13, 20005, the Co-owners presented several slides on the expected combined emissions from Big Stone Units I & II. The descriptive slide for the CO_2 emissions chart submitted to the South Dakota PUC states there is "no commercially available capture and sequestration technology." This slide is attached as Exhibit JI-1-E. Regardless of the uncertainty, this is an issue that needs to be dealt with before new resource decisions are made.

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

A. Yes. For example, James Rogers, CEO of Duke Energy, has publicly said "[I]n private, 80-85% of my peers think carbon regulation is coming within ten years, but most sure don't want it now."[3] Not wanting carbon regulation from a utility perspective is understandable because carbon price forecasting is not simple and easy, it makes resource planning more difficult and is likely to change "business

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[3] "The Greening of General Electric: A Lean, Clean Electric Machine," *The Economist,* December 10, 2005, at page 79.

as usual." For many utilities, including the Big Stone II Co-owners, that means that it is much more difficult to justify building a pulverized coal plant. Regardless, it is imprudent to ignore the risk.

Duke is not alone in believing that carbon regulation is inevitable and, indeed, some utilities are advocating for mandatory greenhouse gas reductions. In a May 6, 2005, statement to the Climate Leaders Partners (a voluntary EPA-industry partnership), John Rowe, Chair and CEO of Exelon stated, "At Exelon, we accept that the science of global warming is overwhelming. We accept that limitations on greenhouse gases emissions [sic] will prove necessary. Until those limitations are adopted, we believe that business should take voluntary action to begin the transition to a lower carbon future."

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

Some of the companies believe that there is a high likelihood of federal regulation of greenhouse gas emissions within their planning period. For example, Pacificorp states a 50% probability of a CO_2 limit starting in 2010 and a 75% probability starting in 2011. The Northwest Power and Conservation Council models a 67% probability of federal regulation in the twenty-year planning period ending 2025 in its resource plan. Northwest Energy states that CO_2 taxes "are no longer a remote possibility."[4]

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

Even those in the electric industry who oppose mandatory limits on greenhouse gas regulation believe that regulation is inevitable. David Ratcliffe, CEO of Southern Company, a predominantly coal-fired utility that opposes mandatory limits, said at a March 29, 2006, press briefing that "There certainly is enough public pressure and enough Congressional discussion that it is likely we will see some form of regulation, some sort of legislation around carbon."[5]

Q. Do companies outside of electric utilities support greenhouse gas regulation?

Support for the passage of greenhouse gas regulation has been expressed by senior executives in companies such as Wal-Mart, General Electric, BP, Shell, and Goldman Sachs. For example, on April 4, 2006, during a Senate hearing on the design of a CO_2 cap-and-trade system, a representative of GE Energy said the following:

"GE supports development of market-based programs to slow, eventually stop, and ultimately reverse the growth of greenhouse gases (GHG)."

--David Slump, GE Energy, General Manager, Global Marketing, executive summary of comments to Senate Energy and Natural Resources Committee

Q. Why would so many electric utilities, in particular, be concerned about future carbon regulation?

A. Electricity generation is very carbon-intensive. Electric utilities are likely to be one of the first, if not the first, industries subject to carbon regulation because of the relative ease in regulating stationary sources as opposed to mobile sources (automobiles) and because electricity generation represents a significant portion of total U.S. greenhouse gas emissions. A new generating facility may have a book life of twenty to forty years, but in practice, the utility may expect that that asset will have an operating life of 50 years or more. By adding new plants, especially new coal plants, a utility is essentially locking-in a large quantity of

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5 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

carbon dioxide emissions for decades to come. In general, electric utilities are increasingly aware that the fact that we do not currently have federal greenhouse gas regulation is irrelevant to the issue of whether we will in the future, and that new plant investment decisions are extremely sensitive to the expected cost of greenhouse gas regulation throughout the life of the facility.

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

A. To date, the U.S. government has not required greenhouse gas emission reductions. However, legislative initiatives for a mandatory market-based greenhouse gas cap and trade program are under consideration.[6]

Several mandatory emissions reduction proposals have been introduced in Congress. These proposals establish carbon dioxide emission trajectories below the projected business-as-usual emission trajectories, and they generally rely on market-based mechanisms (such as cap and trade programs) for achieving the targets. The proposals also include various provisions to spur technology innovation, as well as details pertaining to offsets, allowance allocation, restrictions on allowance prices and other issues. Through their consideration of these proposals, legislators are increasingly educated on the complex details of different policy approaches, and they are laying the groundwork for a national mandatory program. Federal proposals that would require greenhouse gas emission reductions are summarized in Table 5.1 in Exhibit JI-1-F.

It is significant that the U.S. Congress is examining and debating these emissions reduction proposals. However, as shown in Figure 5.2 in Exhibit JI-1-F, the emissions trajectories contained in the proposed federal legislation are in fact quite modest compared with the emissions reductions that are anticipated to be necessary to achieve stabilization of atmospheric concentrations of greenhouse gases. Figure 5.2 in Exhibit JI-1-F compares various emission reduction trajectories and goals in relation to a 1990 baseline. U.S. federal proposals, and

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6 Exhibit JI-1-F, at pages 11- 16.

even Kyoto Protocol reduction targets, are small compared with the current E.U. emissions reduction target for 2020, and the emissions reductions that most scientists claim will ultimately be necessary to avoid the most dangerous impacts of global warming.

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

A. Yes. A growing number of states are developing and implementing the following types of policies that will affect greenhouse gas emissions in the electric sector: (1) direct policies that require specific emissions reductions from electric generation sources; (2) indirect policies that affect electric sector resource mix such as through promoting low-emission electric sources; (3) legal proceedings; or (4) voluntary programs including educational efforts and energy planning.[7]

Direct policies include the New Hampshire and Massachusetts laws imposing caps on carbon dioxide emissions from power plants in those states.

Indirect policies include the requirements by various states to either consider future carbon dioxide regulation or use specific "adders" for carbon dioxide in resource planning. It also includes policies and incentives to increase energy efficiency and renewable energy use, such as renewable portfolio standards. Some of these requirements are at the direction of state public utilities commissions, others are statutory requirements.

Lawsuits make up the majority of the third category. For example, several states are suing the U.S. Environmental Protection Agency (EPA) to have carbon dioxide regulated as a pollutant under the Clean Air Act.

Among the voluntary programs undertaken at the state level are the climate change action plans developed by 28 states.

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7 Exhibit JL-1-F, at pages 16 through 20.

But states are not just acting individually; there are a number of examples of innovative regional policy initiatives that range from agreeing to coordinate information (e.g., Southwest governors and Midwestern legislators) to development of a regional cap and trade program through the Regional Greenhouse Gas Initiative in the Northeast ("RGGI"). The objective of the RGGI is the stabilization of CO_2 emissions from power plants at current levels for the period 2009-2015, followed by a 10 percent reduction below current levels by 2019. These regional activities are summarized in Table 5.5 in Exhibit JI-1-F.

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

A. Yes. The states of Massachusetts, New Hampshire, Oregon and California have adopted policies requiring greenhouse gas emission reductions from power plants.[8]

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

A. Yes. As shown in Table 1 below, several states require companies under their jurisdiction to account for the emission of greenhouse gases in resource planning.

[8] Exhibit JI-1-F, Table 5.3 on page 18.

Table 1. Requirements for Consideration of Greenhouse Gas Emissions in Electric Resource Decisions

Program type	State	Description	Date	Source
GHG value in resource planning	CA	PUC requires that regulated utility IRPs include carbon adder of $8/ton CO_2, escalating at 5% per year.	April 1, 2005	CPUC Decision 05-04-024
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 CO2 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
GHG in CON	MN	Law requires that proposed non-renewable generating facilities consider the risk of environmental regulation over expected useful life of the facility	2005	Minn. Stat. §216B.243 subd. 3(12) (2005)

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

A. Table 2 below presents the carbon dioxide costs, in \$/ton CO_2, that are presently being used in the industry for both resource planning and modeling of carbon regulation policies.

Table 2. 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-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

**Values for these utilities from Wiser, Ryan, and Bolinger, Mark. "Balancing Cost and Risk: The Treatment of Renewable Energy in Western Utility Resource Plans." Lawrence Berkeley National Laboratories. August 2005. LBNL-58450. Table 7.*
Other values: PacifiCorp, Integrated Resource Plan 2003, pages 45-46; and Idaho Power Company, 2004 Integrated Resource Plan Draft, July 2004, page 59; Avista Integrated Resource Plan 2005, Section 6.3; Northwestern Energy Integrated Resource Plan 2005, Volume 1 p. 62; Northwest Power and Conservation Council, Fifth Power Plan pp. 6-7. Xcel-PSCCo, Comprehensive Settlement submitted to the CO PUC in dockets 04A-214E, 215E and 216E, December 3, 2004. Converted to \$2005 using GDP implicit price deflator.

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

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

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

Q. Please explain how Synapse developed its carbon price forecast.

A. Our forecast is described in more detail in Exhibit JI-1-F starting on page 39.

During the decade from 2010 to 2020, we anticipate that a reasonable range of carbon emissions prices will reflect the effects of increasing public concern over climate change (this public concern is likely to support increasingly stringent emission reduction requirements) and the reluctance of policymakers to take steps that would increase the cost of compliance (this reluctance could lead to increased emphasis on energy efficiency, modest emission reduction targets, or increased use of offsets). We expect that the widest uncertainty in our forecasts will begin at the end of this decade, that is, from \$10 to \$40 per ton of CO_2 in 2020, depending on the relative strength of these factors.

After 2020, we expect the price of carbon emissions allowances to trend upward toward a marginal mitigation cost. This number will depend on currently uncertain factors such as technological innovation and the stringency of carbon caps, but it is likely that, by this time, the least expensive mitigation options (such as simple energy efficiency and fuel switching) will have been exhausted. Our projection for greenhouse gas emissions costs at the end of this decade ranges from \$20 to \$50 per ton of CO_2 emissions.

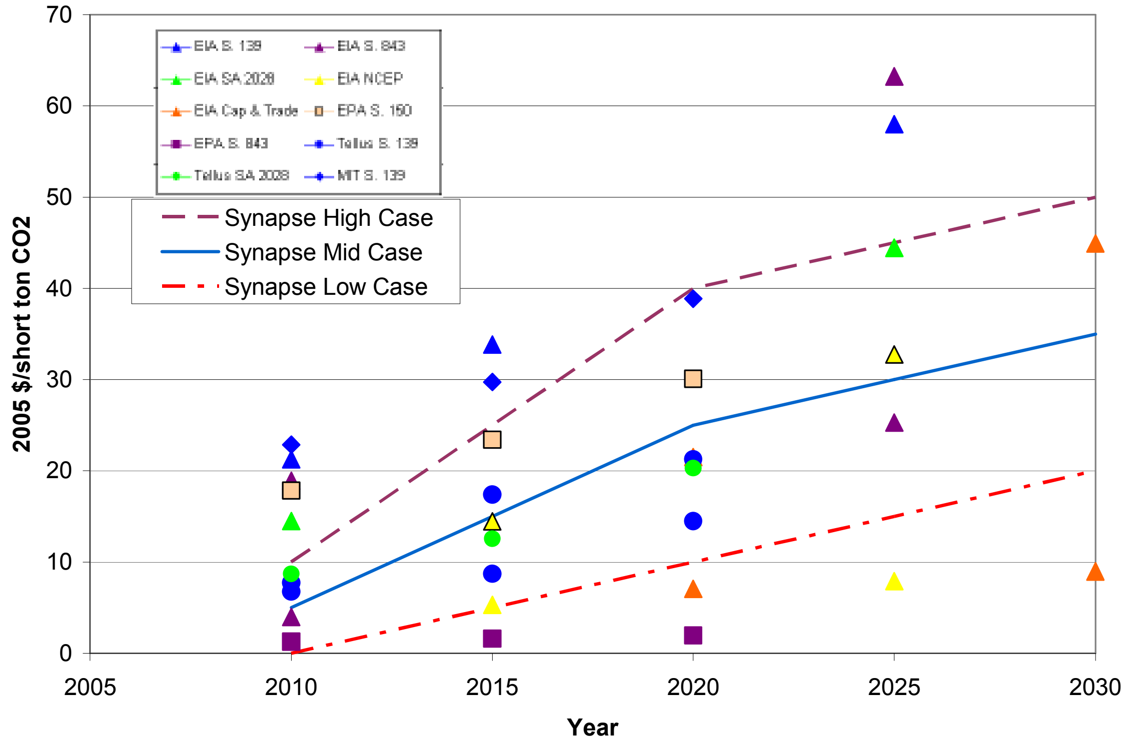
We currently believe that the most likely scenario is that as policymakers commit to taking serious action to reduce carbon emissions, they will choose to enact both cap and trade regimes and a range of complementary energy policies that lead to lower cost scenarios, and that technology innovation will reduce the price of low-carbon technologies, making the most likely scenario closer to (though not equal to) low case scenarios than the high case scenario. We expect that the probability of taking this path will increase over time, as society learns more about optimal carbon reduction policies.

After 2030, and possibly even earlier, the uncertainty surrounding a forecast of carbon emission prices will increase due to the interplay of factors such as the level of carbon constraints required and technological innovation. As discussed in Exhibit JI-1-F, scientists anticipate that very significant emission reductions will be necessary, in the range of 80 percent below 1990 emission levels, to achieve stabilization targets that will keep global temperature increases to a somewhat manageable level. As such, we believe there is a substantial likelihood that response to climate change impacts will require much more aggressive emission reductions than those contained in U.S. policy proposals, and in the Kyoto Protocol, to date. If the severity and certainty of climate change are such that emissions levels 70-80% below current rates are mandated, this could result in very high marginal emissions reduction costs, though we have not quantified the cost of such deeper cuts on a per ton basis.

Q. What is Synapse's forecast of carbon dioxide emissions prices?

A. Synapse's forecast of future carbon dioxide emissions prices are presented in Figure 1 below. This figure superimposes Synapse's forecast on the results of other cost analyses of proposed federal policies:

Figure 1. Synapse Carbon Dioxide Prices



Q. What is Synapse's levelized carbon price forecast?

A. Synapse's forecast, levelized[9] over 20 years, 2011 – 2030, is provided in Table 3 below.

Table 3. Synapse's Levelized Carbon Price Forecast (2005$/ton)

Low Case	Mid Case	High Case
$7.8	$19.1	$30.5

[9] 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).

Q. The Minnesota Public Utilities Commission has established environmental externality values for a number of pollutants including CO_2. Wouldn't it be sufficient and more efficient to simply use the CO_2 externality values? The effect is the same, to bias resource selection towards non-CO_2 emitting resources.

A. That would appear to be an easy solution, but the MN PUC values are meant to reflect external costs arising from damage to the environment caused by climate change (as a percentage of GDP). The Commission's order of January 3, 1997 explained: [10]

> The environmental values for CO_2 quantified in this Order follow MPCA witness Ciborowski's general methodology. First, Ciborowski estimated **long-term global costs** based on the existing economic literature and **discounted** them to current values. Then, he divided that amount by the amount of long-term CO_2 emissions to arrive at an average cost per ton. Ciborowski essentially converted published damage estimates made by economists from percentages of gross domestic product (GDP) into costs per ton of CO_2.

The full order is attached as Exhibit JI-1-G. Clearly this order shows that the Minnesota environmental externality values contain no consideration of future carbon regulation and the *actual* costs that regulation would impose on utilities. Indeed, the range of CO_2 values adopted by the Minnesota PUC is much smaller than the range of Synapse's price forecasts, \$0.35 – 3.64 per ton of CO_2 (2004\$).

Q. Have the Big Stone II co-owners adequately considered the risk of greenhouse gas regulation?

A. No. The Co-owners' approach is what might be called keeping their heads in the sand and hoping that the problem of global warming goes away. For example, the Co-owners could not answer basic questions about the United Nations Framework Convention on Climate Change. Request for Admission No. 22 in the Joint Intervenors' First Set of Requests for Admission asked the Co-owners to:

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[10] Page 27 of the Order Establishing Environmental Cost Values in Docket No. E-99/CI-93-583 issued January 3, 1997.

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

The Co-owners responded by saying that:

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

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

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

Again, the Co-owners responded, in part:

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

In *twenty* separate instances, the Co-owners could not answer requests for admission requiring them to do nothing more than admit facts that could easily be verified by an internet search (starting with the internet addresses that Joint Intervenors in many cases provided in the questions) or by referring to the document(s) attached to the request. Attached as Exhibit JI-1-H, is the Joint Intervenors' First Set of Requests for Admission with these twenty responses highlighted.

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

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

Q. Did the Co-owners reflect any potential greenhouse gas regulations in their resource planning for Big Stone II?

A. No. In certain instances they used the Minnesota PUC environmental externality value for carbon dioxide, which as we discussed above is not adequate consideration of regulatory risk and uncertainty.

Q. Are the Big Stone II Co-owners already heavily dependent upon coal-fired generation?

A. Yes. The testimony in this proceeding reveals that each of the Co-owners already is heavily dependent upon coal-fired generation. Although some Co-owners are making some efforts to add wind, participation in Big Stone II will further increase the Co-owners' dependence upon coal-fired generation and, consequently, their exposure to future greenhouse gas regulations.

For example, Otter Tail Power's testimony in this proceeding reveals that as of 2004, 60.3 percent (winter) to 65.3 percent (summer) of the Company's generating capacity was coal-fired.[11] When oil and natural gas fired capacity is included, more than 75 percent of Otter Tail's current generating capacity is fossil-fired.

GRE's 2006 generation mix is 76 percent from coal, not including additional coal-fired generation that might be the sources for the other purchased power listed in the Company's testimony.[12]

CMMPA's listing of its existing and planned capacity resources includes 43 MW of coal-fired capacity (75 percent of the total) and 13.5 MW of wind.[13]

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[11] Applicants' Exhibits 10-D and 10-E.

[12] Applicants' Exhibit 2, page 14, lines 19-23.

[13] Applicants' Exhibit 6, page 10, lines 1-2.

Seventy-six percent of Montana-Dakota Utilities existing owned-generation is coal-fired.[14] However, despite this reliance on coal, Montana-Dakota Utilities 2005 Integrated Resource Plan reveals that, other than possible purchases from other utilities or the energy market, the only new baseload options that the company was considering were coal-fired units.[15]

Approximately 50 percent of MRES' existing capacity, and all of its baseload capacity, is coal-fired.[16]

Approximately 59 percent of SMMPA's existing generating capacity is coal-fired.[17]

Finally, Heartland's existing resources appear to be a mix of coal-fired generation and purchased power contracts.[18] Heartland has indicated that from 2013 to 2020, i.e., after the end of its purchased power agreement with Nebraska Public Power District, it plans to have the following resources available for its customers: Laramie River Station (50 MW); Customer-owned peaking generation (24 MW); Big Stone Unit II (25 MW); and Whelan Energy Center Unit 2 (80 MW).[19] This means that all of the resources that Heartland plans to have available for its customers during these years will be fossil-fired, and approximately 86 percent will be coal-fired.

Q. How much additional CO_2 will Big Stone II emit into the atmosphere?

A. At its projected 88 percent capacity factor (i.e., 4625 GWH), Big Stone II will emit approximately 4,506,000 tons of CO_2 annually.

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14 Applicants' Exhibit 11, page 8, lines 9-17.

15 *Montana-Dakota Utilities Co. 2005 Integrated Resource Plan submitted to the Montana Public Service Commission*, dated September 15, 2005, at pages (iii) and (iv).

16 Applicants' Exhibit 14, at page 9, line 6, to page 10, line 3.

17 Applicants' Exhibit 13, page 4, line 14, to page 5, line 8.

18 Applicants' Exhibit 15, page 16, lines 16-23.

19 Co-owners' Response to Interrogatory 62 of the Intervenors' Sixth Set of Interrogatories in this Docket.

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

A. Yes. For illustrative purposes, we have calculated the CO_2 cost of a new fossil-fuel fired generating unit built in 2011 using each case of our carbon price forecast levelized over the 20-year period from 2011 to 2030.

Table 4. CO_2 Cost of New Fossil-Fuel Resources

For a new plant online in 2011

	Supercritical PC	Combined Cycle	IGCC	Source Notes
Size (MW)	600	600	535	1
CO_2 (lb/MMBtu)	208	110	200	1
Heat Rate (Btu/KWh)	9,369	7,400	9,612	1
CO_2 Low Price (2005$/ton)	7.80	7.80	7.80	2
CO_2 Mid Price (2005$/ton)	19.10	19.10	19.10	2
CO_2 High Price (2005$/ton)	30.50	30.50	30.50	2
CO_2 Low Cost per MWh	$7.60	$3.17	$7.50	
CO_2 Mid Cost per MWh	$18.61	$7.77	$18.36	
CO_2 High Cost per MWh	$29.72	$12.41	$29.32	

1 - From Applicants' Exhibit 23-A
2 - Synapse's carbon allowance price forecast levelized over 20 years at 7.32% real discount rate

As demonstrated in Table 4, the cost per MWh attributable to a supercritical coal plant like Big Stone II from greenhouse gas regulation is quite significant. From a purely qualitative standpoint, it is very difficult to imagine that other resources would not be more cost-effective than Big Stone II with the addition of *$18.61/MWh* in operating costs from our mid-case CO_2 price forecast.

According to Applicants' Exhibit 23-A, Burns & McDonnell's *Analysis of Baseload Generation Alternatives*, the busbar cost of Big Stone II is $50.71/MWh (2005$) for investor-owned utilities (IOUs) and $40.85/MWh (2005$) for public power. An $18.61/MWh increase in operating costs would represent a 37% increase in cost per MWh of Big Stone II generation to the Big Stone II investor owned utilities and a 46% increase to the public power Co-owners.

Q. What would be the annual CO_2 cost to the Big Stone II Co-owners?

A. Assuming the *Analysis of Baseload Generation Alternatives* will accurately reflect the operating parameters of Big Stone Unit II including an 88% capacity factor, the range of annual, levelized cost to the Big Stone II Co-owners of CO_2 regulation would be:

Low Case - 4,625,280 MWh · $7.74/MWh = $35,152,128

Mid Case - 4,625,280 MWh · $19.60/MWh = $86,076,461

High Case - 4,625,280 MWh · $30.39/MWh = $137,463,322

Q. Does this conclude your testimony?

A. No. The remainder of our testimony will be filed on May 26, 2006.