BEFORE THE STATE OF MINNESOTA

OFFICE OF ADMINISTRATIVE HEARINGS

FOR THE MINNESOTA PUBLIC UTILITIES COMMISSION

In the Matter of the Application by Otter Tail Power Company and Others for Certification of Transmission Facilities in Western Minnesota And In the Matter of the Application to the Minnesota Public Utilities Commission for a Route Permit for the Big Stone Transmission Project in Western Minnesota	)))))))	**MPUC Dkt. No. CN-05-619** **OAH Nos. 12-2500-17037-2 and 12-2500-17038-2**

Rebuttal Testimony to Boston Pacific Consultant Report

David A. Schlissel

Synapse Energy Economics, Inc.

On Behalf of

Fresh Energy

Izaak Walton League of America – Midwest Office

Wind on the Wires

Union of Concerned Scientists

Minnesota Center for Environmental Advocacy

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List of Exhibits

Exhibit JI-50-A: Synapse *2008 CO2 Price Forecasts*, July 2008

Exhibit JI-50-B: Synapse *Coal-Fired Power Plant Construction Costs,* July 2008

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

A. I am testifying on behalf of Fresh Energy, Izaak Walton League of America – Midwest Office, Wind on the Wires, Union of Concerned Scientists, and Minnesota Center for Environmental Advocacy ("Joint Intervenors").

Q. Have you testified previously in this Proceeding?

A. Yes. I filed testimony in this proceeding on November 17 and 29, 2006, December 21, 2007, and January 14, 2008.

Q. What is the purpose of your supplemental testimony?

A. The purpose of my testimony is to respond to the observations and conclusions in Boston Pacific Company's October 21, 2008 *Responding to Commission Inquiries on Emissions Costs, Construction Costs and Fuel* Costs. (hereinafter the "Boston Pacific Report")

Assessment of Risks

Q. Do you agree with Boston Pacific's conclusion that given the uncertainties surrounding the nature and cost of CO_2 and other greenhouse gas regulations, construction costs and future natural gas and coal prices, "all resource options must be assessed under a range of futures to assure ratepayers will get the best deal possible no matter how the future unfolds"?[1]

A. Yes.

[1] Boston Pacific Report, at page 3.

Q. Have the Big Stone II Applicants presented any evidence that they have assessed their resource options under a reasonable range of future CO_2 prices, construction costs and natural gas and coal prices?

A. No. As I have previously testified, the Big Stone II Applicants have not considered reasonable ranges of future CO_2 prices and power plant construction costs in their analyses. For example, except for MDU, the Applicants considered at most a $9/ton CO_2 emissions price in their modeling analyses. MDU did not assume any CO_2 emissions price in its modeling analyses.

Q. Do you have any comment on Boston Pacific's observation that to actually manage risks it would go beyond assessing risk to actually assigning it to a party able to do something about it?[2]

A. Yes. I agree with Boston Pacific's observation. If Otter Tail Power actually has confidence in its currently projected Big Stone II construction cost and its view of likely future CO_2 costs, the company would be willing to bear the risk that construction costs and CO_2 costs are higher than it now claims. But Otter Tail Power clearly does not have confidence in its own cost estimates because it is unwilling to bear those risks. Instead, it would have the Minnesota Commission grant it a blank check and allow the Company to pass all of the risks associated with the Big Stone II project onto its ratepayers.

Q. Have you seen any recent instances where state regulatory commissions have rejected proposed power plants because of the risks associated with federal regulation of greenhouse gases or rising construction costs or have assigned some of those risks to the plant's proponents?

A. Yes. In April of this year, the Virginia State Corporation Commission rejected a proposed integrated gasification combined cycle ("IGCC") coal plant citing

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[2] Id., at page 4.

uncertainties of costs, technology, and unknown federal mandates.[3] The Commission found that the Company's (APCo) cost estimate for project was "not credible" -- it had not been updated since November 2006.[4]

The Commission also concluded that "… APCo has no fixed price contract for any appreciable portion of the total construction costs; there are no meaningful price or performance guarantees or controls for this project at this time. This represents an extraordinary risk that we cannot allow the ratepayers of Virginia in APCo's service territory to assume."[5]

It also noted the uncertainties surrounding federal regulation of carbon emissions and carbon capture and sequestration technology and costs, and observed that the Company was asking for a "blank check."[6] On this basis, the Commission concluded that "We cannot ask Virginia ratepayers to bear the enormous costs – and potentially huge costs – of these uncertainties in the context of the specific Application before us."[7]

In July 2008, the Texas PUC placed a cap on the construction costs and the CO_2 emissions allowance costs that the Southwestern Electric Power Company ("SWEPCO") can recover from its Texas ratepayers for its share of the proposed Turk coal-fired power plant. For example, the Texas PUC noted the following concerning plant capital costs:

> The estimated cost of the Turk Plant, with September 2008 as the anticipated start of construction, is $1.522 billion. The Commission determines that it is unreasonable to expect Texas retail consumers to be responsible for the Texas jurisdictional allocation of any additional costs that exceed $1.522 billion. This cap on the capital costs of the Turk Plant limits the financial risk to

[3] Final Order in Case No. PUE-2007-00068, April 14, 2008. Available at http://scc.virginia.gov/newsrel/e_apfrate_08.aspx.
[4] Id., at pages 4 to 5.
[5] Id., at page 5.
[6] Id., at page 10.
[7] Id., at page 10.

> Texas ratepayers arising out of uncertainties identified in the testimony including, but not limited to, the following: increased material and labor costs because of delays; costs as a result of changes in certification or approval of the Turk Plant by other jurisdictions; changes in the currently proposed ownership participation; and additional costs of plant construction, including those associated with the use of ultra-supercritical technology.[8]

The Commission similarly capped the carbon mitigation costs that Texas ratepayers would have to bear:

> The Commission carefully studied the various price tags for carbon mitigation in the record that may be attributable to the energy generated from the Turk Plant. The amounts range from as low as $13 to $15 per ton of CO2 emissions to as high as $70 per ton. The average numbers for a coal plant range from $40 to $45 per ton. The lower numbers in this vast range are predictions of allowances to be mandated in the early phases of federal regulations on carbon dioxide emissions, growing to the larger numbers where the trade-off between a carbon "tax" and the implementation of carbon sequestration and capture technologies on coal and gas plants would occur sometime in the future. Based on these estimates and predictions, the Commission seeks to place a limit on the extent to which the Turk Plant's costs of carbon mitigation will be passed on to Texas retail ratepayers. It is unreasonable to expect the retail ratepayers to be responsible for these costs that exceed $28 per ton of CO2 emissions through the year 2030. To the extent that carbon legislation or implementation of mitigation technology results in costs that exceed that amount per ton, those costs shall not be borne by Texas ratepayers.[9]

Greenhouse Gas Regulation

Q. Do you agree with Boston Pacific's conclusion that resource choices must be assessed over a range of possible future CO_2 prices?

A. Yes.

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[8] August 12, 2008 Order in Texas Public Utility Commission Docket No. 33891, at page 6.
[9] Id., at page 7.

Q. Do you agree with the range of CO_2 emissions prices (or taxes) that Boston Pacific recommends be used to analyze resource choices?

A. Yes. In general, I agree with the range of CO_2 emissions prices recommended by Boston Pacific except that the low end of that range ($8/ton in 2012, escalating at the rate of inflation) is too low and would not reduce greenhouse gas emissions in the amounts and the time that the scientific community agrees is necessary to avoid the most harmful impacts of climate change.

Q. How does the range of CO_2 emissions prices that Boston Pacific recommends compare to Synapse's currently recommended range of CO_2 prices?

A. This past July, Synapse revised the range of CO_2 emissions prices that we recommend be used in resource planning. The new 2008 Synapse Low CO_2 Price Forecast starts at $10/ton in 2013, in 2007 dollars, and increases to approximately $23/ton in 2030. This represents a $15/ton levelized price over the period 2013-2030, in 2007 dollars.

The new 2008 Synapse High CO_2 Price Forecast starts at $30/ton in 2013, in 2007 dollars, and rises to approximately $68/ton in 2030. This High Forecast represents a $45/ton levelized price over the period 2013-2030, also in 2007 dollars.

Synapse also has prepared a new 2008 Mid CO_2 Price Forecast that starts close to the low case, at $15/ton in 2013 in 2007 dollars, but then climbs to $53/ton by 2030. The levelized cost of this mid CO_2 price forecast is $30/ton in 2007 dollars.

In levelized terms, the two ranges of CO_2 emissions prices, that is, Boston Pacific and Synapse, are reasonably consistent. In levelized terms, Boston Pacific's range of recommended CO_2 emissions prices is between a low end of $7.07/ton, in 2007 dollars, to a high end of $53.03/ton, also in 2007 dollars. In levelized terms, Synapse's recommended CO_2 emissions prices are between $15/ton and $45/ton, all in 2007 dollars.

Q. Please explain why Synapse decided to revise the range of CO_2 prices that it recommends be used in resource planning.

A. Significant developments in the past two years led Synapse to re-examine and revise the CO_2 price forecasts we had developed in 2006 to ensure that these forecasts reflect an appropriate level of financial risk associated with greenhouse gas emissions.[10] Most importantly, the political support for serious climate change legislation has expanded significantly in Federal and State governments, as well as in the public at large, as the scientific evidence of climate change has become more certain. Concurrently, the new greenhouse gas regulation bills under consideration in the 110th U.S. Congress contain emissions reductions that are significantly more stringent than would have been required by proposals introduced in earlier years. Moreover, an increasing number of states have adopted policies, either individually and/or as members of regional coalitions, to reduce greenhouse gas emissions. In addition, in the past two years, additional information has been developed regarding technology innovations in the areas of renewables, energy efficiency, and carbon capture and sequestration, leading to greater clarity about the cost of emissions mitigation; however, cost estimates for many of these technologies are still in the early stages. Taken together these developments lead to higher financial risks associated with future greenhouse gas emissions and justify the use of higher projected CO_2 emissions allowance prices in electricity resource planning and selection for the period 2013 to 2030.

Q. How do the CO_2 prices recommended by Synapse and Boston Pacific for use in resource planning compare to other analyses of future CO_2 costs?

A. As part of our work at Synapse we have reviewed the results of the modeling analyses that have been undertaken to evaluate the CO_2 emissions allowance

[10] See the July 2008 report *Synapse 2008 CO2 Price Forecasts*, a copy of which is attached as Joint Intervenors Exhibit JI-50-A, at pages 3 through 10.

prices that likely would result from the adoption and implementation of the major greenhouse gas regulatory legislation that has been introduced in the current U.S. Congress. These modeling analyses include:

- The Energy Information Administration of the U.S. Department of Energy's ("EIA") assessment of the *Energy Market and Economic Impacts of S. 280, the Climate Stewardship and Innovation Act of 2007* (July 2007).[11]
- The October 2007 Supplement to the EIA's assessment of the *Energy Market and Economic Impacts of S. 280, the Climate Stewardship and Innovation Act of 2007*.[12]
- The EIA's assessment of the *Energy Market and Economic Impacts of S. 1766, the Low Carbon Economy Act of 2007* (January 2008).[13]
- The EIA's assessment of the *Energy Market and Economic Impacts of S. 2191, the Lieberman-Warner Climate Security Act of 2007* (April 2008).[14]
- The U.S. Environmental Protection Agency's ("EPA") *Analysis of the Climate Stewardship and Innovation Act of 2007 – S. 280 in 110th Congress* (July 2007).[15]
- The EPA's *Analysis of the Low Carbon Economy Act of 2007 – S. 1766 in 110th Congress* (January 2008).[16]
- The EPA's *Analysis of the Lieberman-Warner Climate Security Act of 2008 – S. 2191 in 110th Congress* (March 2008).[17]
- *Assessment of U.S. Cap-and-Trade Proposals* by the Joint Program at the Massachusetts Institute of Technology ("MIT") on the Science and Policy of Global Change (April 2007).[18]
- *Analysis of the Cap and Trade Features of the Lieberman-Warner Climate Security Act – S. 2191* by the Joint Program at MIT on the Science and Policy of Global Change (April 2008).[19]

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[11] Available at http://www.eia.doe.gov/oiaf/servicerpt/csia/pdf/sroiaf(2007)04.pdf.
[12] Available at http://www.eia.doe.gov/oiaf/servicerpt/biv/pdf/s280_1007.pdf
[13] Available at http://www.eia.doe.gov/oiaf/servicerpt/lcea/pdf/sroiaf(2007)06.pdf
[14] Available at http://www.eia.doe.gov/oiaf/servicerpt/s2191/pdf/sroiaf(2008)01.pdf.
[15] Available at http://www.epa.gov/climatechange/economics/economicanalyses.html.
[16] Available at http://www.epa.gov/climatechange/economics/economicanalyses.html.
[17] Available at http://www.epa.gov/climatechange/economics/economicanalyses.html.
[18] Available at http://web.mit.edu/globalchange/www/MITJPSPGC_Rpt146.pdf.

- *The Lieberman-Warner America's Climate Security Act: A Preliminary Assessment of Potential Economic Impacts, prepared by the Nicholas Institute for Environmental Policy Solutions,* Duke University and RTI International (October 2007)[20]

- *U.S. Technology Choices, Costs and Opportunities under the Lieberman-Warner Climate Security Act: Assessing Compliance Pathways,* prepared by the International Resources Group for the Natural Resources Defense Council (May 2008*).*[21]

- *The Lieberman-Warner Climate Security Act – S. 2191, Modeling Results from the National Energy Modeling System – Preliminary Results,* Clean Air Task Force (January 2008).[22]

- *Economic Analysis of the Lieberman-Warner Climate Security Act of 2007 Using CRA's MRN-NEEM Model*, CRA International, April 2008.[23]

- *Analysis of the Lieberman-Warner Climate Security Act (S. 2191) using the National Energy Modeling System (NEMS/ACCF/NAM),* a report by the American Council for Capital Formation and the National Association of Manufacturers, NMA, March 2008.[24]

In total, these modeling analyses examined more than 75 different scenarios. These scenarios reflected a wide range of assumptions concerning important inputs such as: the "business-as-usual" emissions forecasts; the reduction targets in each proposal; whether complementary policies such as aggressive investments in energy efficiency and renewable energy are implemented, independent of the emissions allowance market; the policy implementation timeline; program flexibility regarding emissions offsets (perhaps international) and allowance banking; assumptions about technological progress and the cost of alternatives; and the presence or absence of a "safety valve" price.

The results of these modeling analyses are presented in Figures 1 and 2 below, along with the CO_2 prices recommended by Synapse and Boston Pacific. Figure 1

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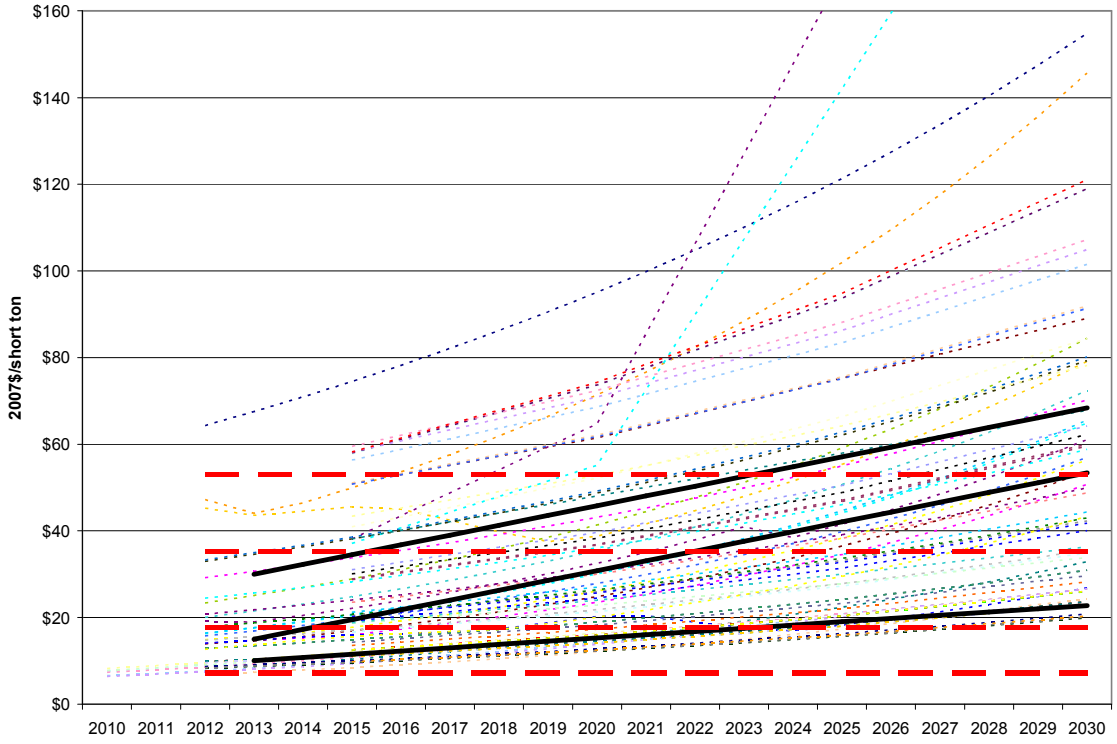
19 Available at http://mit.edu/globalchange/www/MITJPSPGC_Rpt146_AppendixD.pdf.
20 Available at http://www.nicholas.duke.edu/institute/econsummary.pdf.
21 Available at http://docs.nrdc.org/globalwarming/glo_08051401A.pdf.
22 Available at http://lieberman.senate.gov/documents/catflwcsa.pdf.
23 Available at http://www.nma.org/pdf/040808_crai_presentation.pdf.

presents the annual CO_2 prices, in 2007 dollars, from the scenarios in each modeling analysis. Figure 2 then presents the ranges of levelized CO_2 prices developed in each modeling analysis.

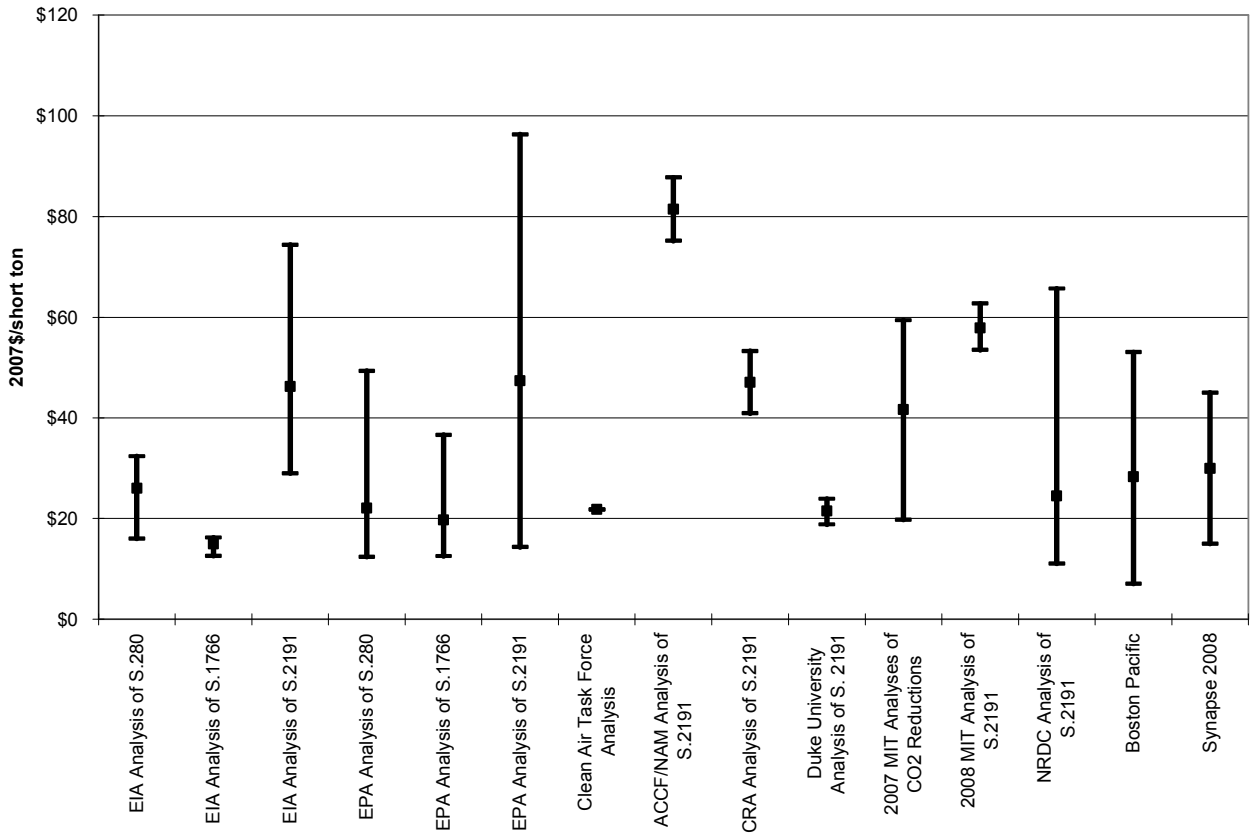
Figure 1: CO_2 Prices Recommended by Synapse and Boston Pacific vs. Results of Modeling Analyses of Major Bills in Current U.S. Congress – Annual CO_2 Prices (in 2007 dollars)



Boston Pacific's recommended CO_2 emissions prices are the horizontal dashed lines in Figure 1. Synapse's recommended CO_2 emissions prices are the solid lines.

[24] Available at http://www.accf.org/pdf/NAM/fullstudy031208.pdf.

Figure 2: CO_2 Prices Recommended by Synapse and Boston Pacific vs. Results of Modeling Analyses of Major Bills in Current U.S. Congress – Levelized CO_2 Prices (2013-2030, in 2007 dollars)



As can be seen, the ranges of CO_2 prices recommended by Synapse and Boston Pacific are very reasonable compared to the full range of CO_2 emissions allowance prices that could result from adoption of the major greenhouse gas regulatory legislation that has been introduced in the current U.S. Congress. In fact, there are a significant number of possible scenarios where CO_2 emissions allowance prices could be substantially higher than the high ends of the price ranges that Synapse and Boston Pacific have recommended be used in resource planning assessments.

Q. What is the likely effect of the recent presidential and congressional elections on the prospects for federal CO_2 emissions regulation?

A. Although it is obviously far too early to make any definitive predictions, it certainly does appear that the new President and the new Congress will seek to expeditiously take aggressive actions to address the threat of climate change.

For example, during a January 2008 with the San Francisco Chronicle newspaper, Senator Obama described his overall policy towards regulation of CO_2 emissions:

> EDITORIAL WRITER: Senator, you introduced a bill promoting coal-conducted fuels, and then you said you'd only support them if they emitted fewer greenhouse gases in gasoline. Now, all the scientific evidence points to coal being dirtier than pretty much anything else, so how are you going to score your support for coal with the need to fight global warming?
>
> OBAMA: Well, I've already – I've already done it. You know I voted against the Clear Skies bill – in fact, I was the deciding vote. Despite the fact that I'm a coal state, and that half of my state thought I'd thoroughly betrayed them, because I think clean air is critical, and global warming is critical. But, this notion of no coal, I think is an illusion. Because the fact of the matter is, is that, right now, we are getting a lot of our energy from coal, and China's building its coal-power plant once a week. So, what we have to do, then, is we have to figure out how we can use coal without emitting greenhouse gases and carbon, and how we can sequester that carbon and capture it. If we can't, then, you know, we're gonna still be working on alternatives.
>
> EDITORIAL WRITER: Alternatives including coal, or what?
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> OBAMA: Let me sort of describe my overall policy. I mean, what I've said is that we would put a cap-and-trade system in place that is more – that is as aggressive, if not more aggressive, than anybody else's out there. I was the first to call for a 100 percent auction on the cap-and-trade system, which means that every unit of carbon or greenhouse gases was emitted would be charged to the polluter. That will create a market in which whatever technologies are out there that are being presented, whatever power plants that are being built, that they would have to meet the rigors

> of that market and the ratcheted-down caps that are placed -- imposed every year.
>
> So, if somebody wants to build a coal power plant, they can. It's just that, it will bankrupt them because they're going to be charged a huge sum for all that greenhouse gas that's being emitted. That will also generate billions of dollars that we can invest in solar, wind, biodiesel, and other alternative energy approaches. The only thing that I've said, with respect to coal – I haven't been some coal booster – what I have said is, that, for us to take coal off the table as an ideological matter, as opposed to saying, if technology allows us to use coal in a clean way, we should pursue it. You know, that I think is the right approach.[25]

More recently, in October 2008, one of Senator Obama's senior energy advisors, Jason Grumet told Bloomberg that, if elected, he would "move quickly" to address climate change.[26] Grumet further said that Senator Obama would classify carbon dioxide as a dangerous pollutant that can be regulated should he win the election on November 4th, which he has now done, opening the way for new rules on greenhouse gas emissions. In particular, President Obama would direct the Environmental Protection Agency to initiate rulemakings under the 1990 Clean Air Act to set emissions limits on power plants and manufacturers.

Q. The Boston Pacific Report references the market clearing prices for CO_2 emissions obtained in the recent Regional Greenhouse Gas Initiative ("RGGI") auction.[27] Do the results of the recent RGGI CO_2 emissions allowance auction provide any significant insights into what the prices of CO_2 emissions allowances would be in a nationwide cap-and-trade system?

A. No. There are several reasons why the results of the recent RGGI auction of emissions allowances are not instructive as to what emissions prices would be under a federal cap-and-trade program. Allowance prices under a cap and trade

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[25] See http://mediamatters.org/items/200811030006 and http://www.youtube.com/watch?v=IEU1ElkjdLE&feature=related.

[26] http://www.bloomberg.com/apps/news?pid=20601087&sid=a2RHIj_6hvV0&refer=home

program will be affected by many factors, such as geographic scope, sector coverage, stringency, use of flexibility mechanisms, portfolio of policy tools, and technological innovation. The RGGI program differs from a likely federal program in many ways such as those described below.

First, the RGGI program is limited in geography and in coverage. The RGGI states are adjacent geographically to regions that currently do not have carbon constraints -- for example, Pennsylvania, Ohio and Virginia. Generators in those regions can sell electricity into RGGI, diluting the effectiveness of the emissions cap. Further, the RGGI cap applies only to the electric sector, not multiple sectors. These factors would lower the cost of emissions allowances below what they would be in a more comprehensive program. Most legislative proposals for a federal program have been more expansive, covering the entire nation as well as multiple sectors; and any federal program that is enacted can be expected to be broad in geography and coverage.

Second, the baseline cap under the RGGI agreement was initially set at "current" emissions, defined as the highest of 2000 to 2004, and budgets were set approximately 2-4% higher than actual current emissions. Legislative proposals for a federal program have all included more stringent long-term emission reduction targets than those contained in RGGI, and the trend in legislative proposals is toward greater stringency. Any meaningful federal cap-and-trade program is likely to include more aggressive emissions limits than those contained in RGGI. Allowance prices under a more aggressive emission reduction target will be higher than those under a less aggressive emission reduction target, all other things being equal.

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[27] Boston Pacific Report, at page 9.

Q. Do you agree with Boston Pacific's observation that the use of a $30/ton CO2 price in one of Applicant witness Grieg's levelized busbar analyses was a "good step forward but did not go far enough?"[28]

A. No. I certainly do support the use of a $30/ton CO_2 price as being within a reasonable range of possible future CO_2 emissions prices. However, Mr. Grieg's analysis was heavily biased in favor of Big Stone II by a number of assumptions such as the use of a $30/ton CO_2 price that was flat in nominal terms (that is, did not increase over time) and the assumption that a $30/ton CO_2 price would increase natural gas prices by 17 percent. Thus, I can't agree that Mr. Grieg's analyses represented a "good step forward."

Construction Costs

Q. Do you agree with Boston Pacific's conclusion that the Applicants' latest construction cost estimate is below even the low end of a reasonable range of installed costs for a new coal-fired facility?[29]

A. Yes.

Q. Do you have any comment on Boston Pacific's estimate that the possible range of installed costs for a new coal-fired facility would be from $2,600 per kW to $3,000 per kW?[30]

A. Yes. As shown in Table 1 below, the most recent evidence shows that the current construction cost estimates for some proposed coal-fired power plants have been significantly above $3,000 per kW. Based on this evidence, it is reasonable to expect that the cost of building the Big Stone II Project might reach or exceed $3,500 per kW instead of the $3,000 per kW high end recommended by Boston Pacific.

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28 Boston Pacific Report, at page 5.
29 Boston Pacific Report, at pages 5-6.
30 Boston Pacific Report, at pages 5 to 6.

Table 1: Recent Coal Power Plant Construction Cost Estimates (in nominal dollars, without financing costs)

Plant	Owner	Date of Estimate	Total Cost (Billions)	Size (MW)	Announced Cost/kW	Cost/kW Scaled to 500 MW Plant Size
Big Stone II	OTP, MDU, CMMPA, MRES, Heartland	June-06	$1.27	500	$2,545	$2,540
Karn-Weadock	Consumers Energy	September-07	$2.21	800	$2,765	$3,184
Turk	SWEPCO	Spring-08	$1.52	600	$2,537	$2,679
Meigs County	AMP-Ohio	October-08	$3.26	960	$3,394	$4,127
Marshalltown	Iowa Power & Light	September-08	$2.23	630	$3,538	$3,792
Nelson Dewey 3	Wisconsin Power & Light	September-08	$1.26	326	$3,865	$3,400
Columbia 3	Wisconsin Power & Light	September-08	$1.28	326	$3,936	$3,462

Consumers Energy's proposed Karn-Weadock unit and SWEPCO's Turk unit are the only power plants in Table 1, other than Big Stone II, with estimated construction cost of less than $3,394 per kW. However, I understand that SWEPCO already has purchased the equipment and many of the materials for the Turk Plant – therefore, its cost is not expected to increase as much as the costs of plants, like Big Stone II, that are not as far advanced in the contract and purchasing process. Also, the Consumers Energy Company has told the Michigan PSC that the estimated cost of its proposed Karn-Weadock plant has increased above $2,795 per kW and that a new cost estimate will be released early next year.

The estimated costs of the other plants are all in the range of $3,394 to $3,936 per kW, in as-spent nominal year dollars.

Q. Just to be clear, are all of the plant costs in Table 1 on the same basis as the range of possible coal plant construction costs discussed by Boston Pacific?

A. Yes. The plant costs in Table 1 are in nominal year dollars and include escalation but not financing costs.

Q. What types of coal-fired power plants are included in Table 1?

A. The proposed Marshalltown, Meigs County, Turk and Karn-Weadock plants would be supercritical units. The Nelson Dewey 3 plant would be a circulating fluid bed unit. The Columbia 3 plant would be a subcritical unit.

Q. Where in the U.S. would these plants be located?

A. The Marshalltown plant would be located about 60 miles northeast of Des Moines, IA. The Nelson Dewey and Columbia plants would be located in southwestern Wisconsin. The Meigs County plant would be located in southeastern Ohio. The Karn-Weadock plant would be located in western Michigan. And the Turk Plant would be located in southwestern Arkansas.

Q. Have any of the plants listed in Table 1 actually begun construction?

A. I believe not except that SWEPCO has said that it was planning to begin construction of the Turk Plant this fall.

Q. Please explain why you have included a column for "size adjusted cost" in Table 1.

A. It is generally accepted that there are economies of scale in the construction of power plants such that the per kW costs of larger power plants will be lower than the per kW costs of building smaller power plants. I have presented "size-adjusted" costs for each of the power plants in Table 1 to show that, except for the Turk and Karn-Weadock plants, the estimated construction costs would still be significantly higher than $3,000 per kW if they were being proposed as 500 MW units, that is, the same size as Big Stone II. This evidence supports my conclusion that it is reasonable to expect that the cost of building a new 500 MW pulverized coal plant like Big Stone II will reach or exceed $3,500 per kW.

In making these cost adjustments I have used the EPRI formula presented by Applicant witness Rolfes in his April 23, 2008 Prefiled Rebuttal Testimony before the North Dakota Public Service Commission.[31]

Q. Have you seen any other significant evidence concerning recent increases in estimated coal-fired power plant construction costs?

A. Yes. Many power plant construction projects have announced cost increases and schedule delays in the past couple of years.[32]

The cost increases announced for two of these projects, in particular, suggest that even plants that are much further along in the design, procurement and construction process than Big Stone II are not immune to rising costs. For example, in April 2008, Duke Energy Indiana announced an 18 percent increase in the estimated cost of its proposed Edwardsport IGCC coal plant just since the spring of 2007. Duke indicated that higher than expected costs had been experienced when the Company actually began final procurement of equipment for the plant. Duke also said that "the increase in the cost estimate is driven by factors outside the Company's control, including unprecedented global competition for commodities, engineered equipment and materials, and increased labor costs."[33] Duke also noted in its Petition to the Indiana Utility Regulatory Commission that this projected increase in cost "is consistent with other recent power plant project cost increases across the country."[34]

At the same time, Kansas City Power & Light recently announced a 15 percent price increase for the Iatan 2 power plant that has been under construction for

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31 Prefiled Rebuttal Testimony of Mark Rolfes, North Dakota Public Service Commission Case Nos. PU-06-481 and PU-06-482, at pages 2 and 3.

32 See Synapse's July 2008 *Coal-Fired Power Plant Construction Cost Report*, included as Joint Intervenors Exhibit JI-50-B.

33 Verified Petition in Indiana Utility Regulatory Commission Cause No. 43114 IGCC-1, filed on May 1, 2008, at pages 3-4

34 Id, at page 7.

several years and is scheduled to be completed by 2010. The company also has announced that it may have to increase the cost estimate again after further engineering review is completed. This example shows that even coal-fired power plants that are under construction are not immune to further cost increases.

Q. What is your conclusion concerning the coal plant construction costs that are prudent for the Big Stone II Applicants to use in their resource planning analyses?

A. Given the announced prices of comparable pulverized coal power plants scheduled to be built in the same relative geographical region of the country and in the same relative timeframe, I believe it is reasonable at this time to expect that the construction cost of the Big Stone II plant could increase to as high as $3,500 per kW or even higher (perhaps to $3,700 to $4,000 per kW).

Q. Do you agree with the ranges of natural gas and wind power plant construction costs that Boston Pacific has recommended by used in resource planning analyses?[35]

A. Yes.

Relationship Between Greenhouse Gas Regulation and Natural Gas Prices

Q. Boston Pacific has discussed the possible impact of climate change legislation on natural gas costs.[36] What impact does Synapse believe the enactment of CO_2 emissions regulations could have on natural gas prices?

A. It is possible that natural gas demand could be higher due to CO_2 emission regulations and, as a result, natural gas prices could be expected to be somewhat higher than otherwise would be the case. However, the effect is very complicated and will depend on a number of factors such as how much new natural gas

[35] Boston Pacific Report, at page 6.

capacity is built as a result of the higher coal-plant operating costs due to the CO_2 emission allowance prices, how much additional DSM and renewable alternatives are added to the U.S. system, the levels and prices of any incremental natural gas imports or developed in the U.S., and changes in the dispatching of the electric system. Indeed, depending on future circumstances there may be some periods in which the prices of natural gas may be lower as a result of CO_2 regulations. Thus it is very difficult to determine, at this time, the amount by which natural gas prices might be raised due to CO_2 emission regulations.

Q. Has Synapse examined the impact that the enactment of CO_2 emissions regulations might have on natural gas prices?

A. Yes. As I discussed in my January 14, 2008 Supplemental Testimony on MRES Issues[37] and in the Supplemental Statement I presented at the January 24, 2008 hearing[38], we have investigated the publicly available evidence to examine what relationship can be expected to exist between the adoption of climate change legislation and natural gas prices.

Q. Have you continued your investigations of the possible relationship between the adoption of climate change legislation and natural gas prices since you testified in this proceeding last January?

A. Yes. As I noted above, we have reviewed the results of the modeling analyses that have been undertaken to evaluate the CO_2 emissions allowance prices that likely would result from the enactment of the major greenhouse gas regulatory legislation that has been introduced in the current U.S. Congress.[39] As part of this

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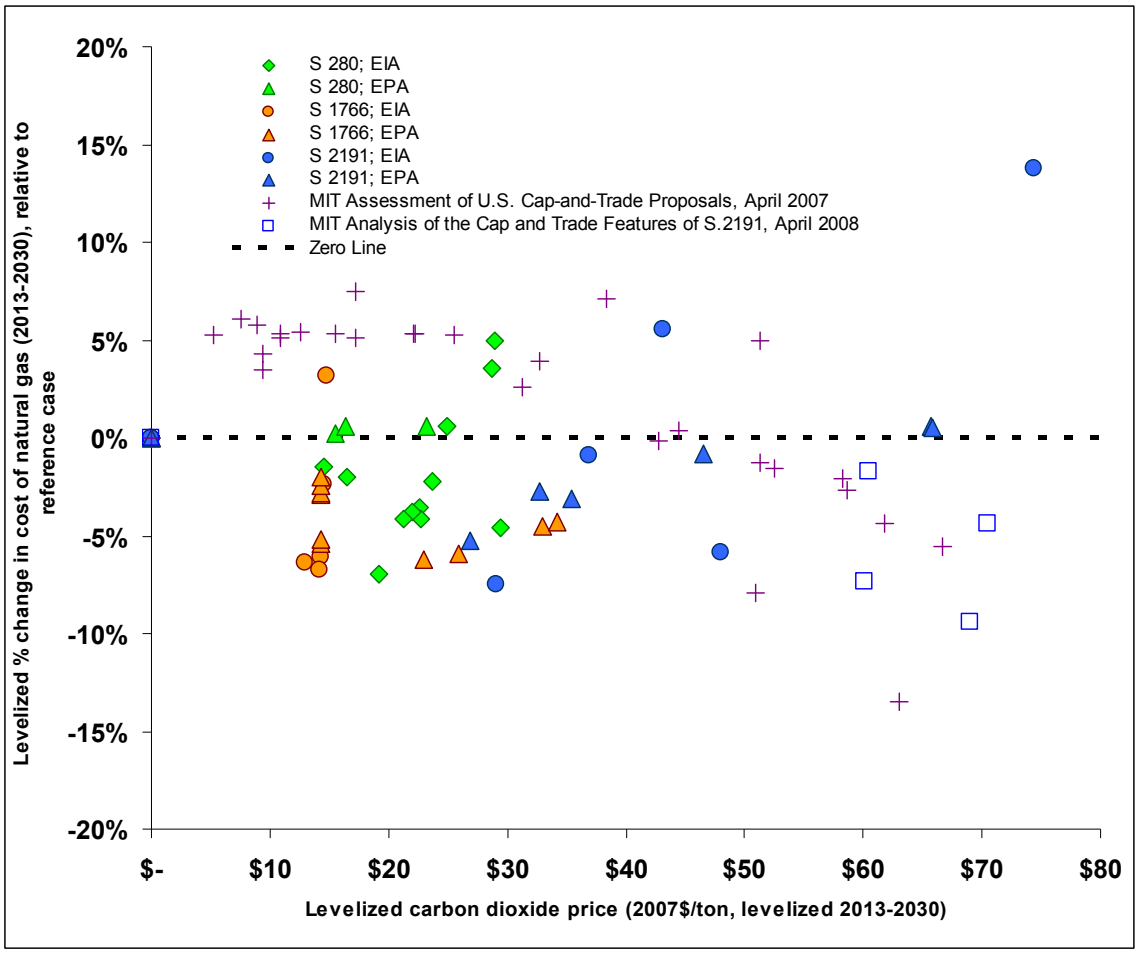
[36] Boston Pacific Report, at page 24.
[37] Joint Intervenors Exhibit JI-38, at pages 11-16.
[38] Joint Intervenors Exhibit JI-46.
[39] In fact, seven of the 14 analyses of proposed climate change legislation that we have reviewed had not been issued at the time I last testified in this proceeding in late January of this year.

work, we have looked at the available data on the impact that enactment of CO_2 regulatory legislation could have on natural gas prices.

Q. What were the results of this review?

A. Figure 3 below shows the levelized percentage changes in natural gas prices from the base case forecasts with no CO_2 prices versus the levelized CO_2 prices for various scenarios modeled by the Joint Program at the Massachusetts Institute of Technology ("MIT") on the Science and Policy of Global Change, the U.S. EPA, and the Energy Information Administration ("EIA") of the Department of Energy of climate change proposals in the current U.S. Congress: Senate Bill S.280 (the McCain-Lieberman bill), Senate Bill S.1766 (the Bingaman-Specter bill) and Senate Bill S.2191 (the Lieberman-Warner bill).

Figure 3: The Relationship Between CO_2 Emissions Allowance Prices and Natural Gas Prices



This analysis shows that for the ranges of CO_2 emissions prices recommended by Boston Pacific and Synapse (that is between $8/ton and $50/ton on a levelized basis) the evidence concerning the impact of the enactment of CO_2 regulatory legislation on natural gas prices is inconclusive: that is, there is no clear evidence that CO_2 prices in this range will have a positive impact on natural gas prices. The data certainly does not support the assumption made by Applicant witness Grieg in the levelized busbar analysis in his January 2008 testimony in this proceeding that $30/ton CO_2 emissions allowance prices would cause natural gas prices to rise by 17 percent in each year of the analysis.

Q. What is your conclusion concerning the impact that federal regulation of greenhouse gas regulation might have on natural gas prices?

A. The Big Stone II Applicants would have the Commission believe that the adoption of a greenhouse gas regulatory regime that would lead to relative minor CO_2 emissions prices will have a significant upward impact on natural gas prices. However, there is no consistent evidence that this will happen.

Q. Does this complete your rebuttal testimony?

A. Yes.