OTP/MDU EXHIBIT 336

CASE NOS. PU-06-481 & PU-06-482

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BEFORE THE NORTH DAKOTA PUBLIC SERVICE COMMISSION

IN THE MATTER OF THE APPLICATION BY OTTER TAIL POWER CORPORATION D/B/A

OTTER TAIL POWER COMPANY

AND

MONTANA-DAKOTA UTILITIES CO., A DIVISION OF MDU RESOURCES GROUP, INC.

FOR AN ADVANCED DETERMINATION OF PRUDENCE

FOR THE BIG STONE II GENERATING PLANT

PREFILED REBUTTAL TESTIMONY

OF

JEFF GREIG

GENERAL MANAGER, BUSINESS & TECHNOLOGY SERVICES

BURNS & MCDONNELL ENGINEERING COMPANY

APRIL 23, 2008

OTP/MDU EXHIBIT 336

PREFILED REBUTTAL TESTIMONY OF JEFFREY J. GREIG

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I. INTRODUCTION

Q: Please state your name and business address.

A: My name is Jeffrey (Jeff) J. Greig. My business address is Burns & McDonnell Engineering Co., 9400 Ward Parkway, Kansas City, MO, 64114.

Q: By whom are you employed, and in what capacity?

A: I am employed by Burns & McDonnell Engineering Company. I am the General Manager of the Business & Technology Services Division of the company.

Q: Did you previously provide any prefiled written testimony in this matter?

A: Yes, I submitted direct testimony on March 10, 2008 (OTP/MDU Exhibit 326).

Q: Did you testify at the previous hearing held in June 2007?

A: Yes, I did. I testified before the Commission on June 26, 2007.

Q: Have you reviewed the testimony of Public Service Commission Advocacy staff witness Terry Deason?

A: Yes, I have.

Q: Have you reviewed the testimony of witness David Schlissel, who filed testimony on behalf of Intervenors Mark Trechock and Dakota Resource Council?

A: Yes, I have reviewed his testimony, too.

II. PURPOSE AND SUMMARY OF TESTIMONY

Q: What is the purpose of your testimony?

A: The purpose of my rebuttal testimony is to respond to the allegations of Mr. Schlissel that we have failed to properly account for potential costs of carbon control and to provide

information requested by Mr. Deason relating to the effect of carbon costs on Big Stone II and on a natural gas plus wind alternative.

Q: Please summarize your testimony.

A: In early 2008 I conducted an additional analysis to supplement the work I reported on in my November 2007 Report (OTP/MDU Exhibit 327) to evaluate the effect of a range of costs for carbon control of $4/ton to $30/ton. Unless the Production Tax Credit for wind is available, the busbar cost for the gas/wind combination is higher than for Big Stone II at all carbon costs in the range. Even when it is assumed that the PTC continues, and other favorable assumptions for the gas/wind alternative are made, the break-even cost is still $17/ton applied to 100% of the emissions of Big Stone Unit II.

III. SUPPLEMENTAL ANALYSIS

Q: Can you describe the supplemental analysis you completed after your November 2007 Report (OTP/MDU Exhibit 327) was finalized?

A: Because my November 2007 Report (OTP/MDU Exhibit 327) reflected a $9/ton cost for carbon dioxide emissions consistent with direction from the Minnesota Department of Commerce, in early 2008 I went back and conducted some additional analyses using a $4/ton to $30/ton range to compare the effect those costs have on the busbar cost of electricity from both a supercritical pulverized coal plant like Big Stone II and a combined cycle gas turbine (CCGT) plus wind alternative. The CO_2 cost range was applied to every ton of CO_2 emissions, similar to an emissions tax. As the CO_2 costs increase, the busbar costs increase for both the Big Stone II plant and the CCGT plant as neither is a renewable energy source and both emit carbon dioxide.

The slope of the Big Stone II busbar cost line is steeper based on its higher carbon dioxide intensity compared to the CCGT/wind alternative. As a result, a pulverized coal plant

has a lower busbar cost than does a natural gas/wind combination at low CO_2 costs, but the lines will cross as some point as the CO_2 costs go up. The point at which the lines for each alternative intersect establishes the breakeven point of CO_2 costs where the busbar costs for both coal and natural gas/wind would be the same. At higher CO_2 costs, pulverized coal has a higher busbar cost than does a CCGT/wind combination.

Low Wind Case

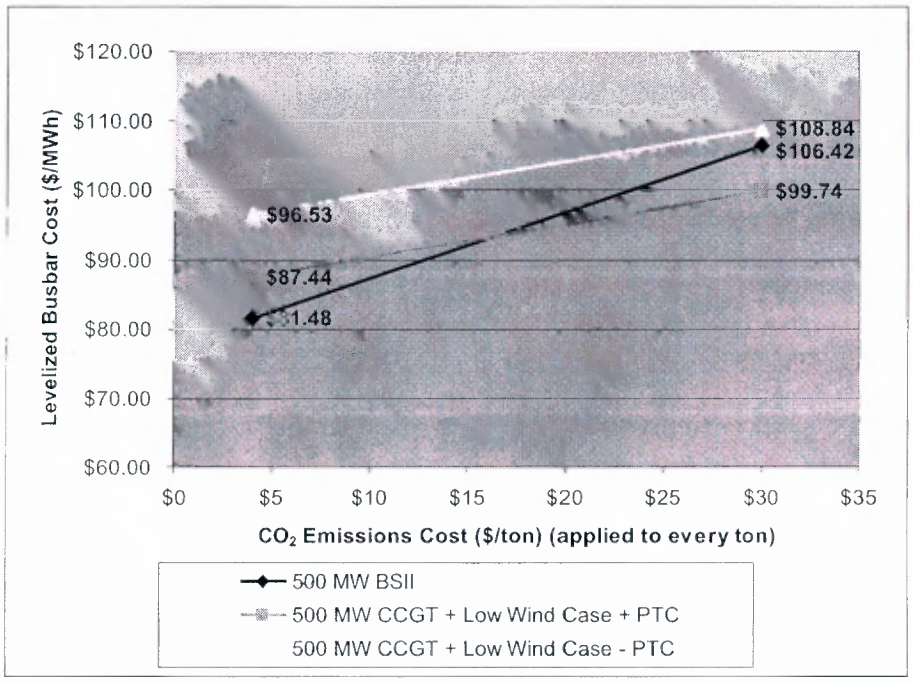
Q: What do you mean by the term "Low Wind Case?"

A: The "Low Wind Case" assumes that wind power will cost $40/MWh. Burns & McDonnell estimated in the earlier 2006 study that new wind farm development in the Midwest region costs $40/MWh with the PTC in place. This cost assumption was maintained ($40/MWh in 2006$) in the most recent 2007 updates. On Page 6 of the *Updated Economic Evaluation of Baseload Generation Alternatives* dated November 2007 (OTP/MDU Exhibit 327), I noted "...clients are currently pricing new wind farm developments at $50/MWh or higher." Thus, the reference to "Low Wind Case" denotes these results are based on an aggressive, and possibly unachievable, low cost for wind purchases in 2013.

Q: What are the results of the Low Wind Case?

A: The graph in Figure 1 below presents a comparison of busbar costs for investor-owned utilities comparing the 500 MW Big Stone Unit II alternative to a 500 MW CCGT plus Wind alternative with and without an assumed extension of the PTC under the Low Wind Cost case. The busbar costs are presented across the range of CO_2 costs $4/ton to $30/ton.

Figure 1: Investor-owned Utility – Low Wind Cost Case – Busbar Analysis



As indicated in Figure 1, the 500 MW Big Stone Unit II project represents a lower cost baseload generation alternative on a life-cycle basis considering capital and operating costs for an investor-owned utility across the entire range of CO_2 costs from $4/ton to $30/ton if Congress does not decide to extend the federal PTC in essentially the same form. There is not a point within the $4/ton to $30/ton CO_2 cost range that the CCGT plus Wind alternative results in lower cost busbar power without an extension of the PTC for wind. If the PTC is extended, however, the breakeven CO_2 cost between the 500 MW Big Stone Unit II alternative and the CCGT plus Wind alternative is approximately $17/ton, again assuming the CO_2 cost is applied on every ton of CO_2 emissions. This cross-over point is dependent upon an extension of the PTC, an aggressive, low cost assumption for wind purchases in 2013, and a set of other conservative assumptions that will be recapped at the conclusion of my testimony.

The 500 MW supercritical Big Stone Unit II project has an estimated levelized busbar cost of $81.48/MWh over the 2013 to 2032 planning period at a CO_2 cost of $4/ton. The CCGT

plus Wind alternative was $87.44/MWh (with PTC) at a CO_2 cost of $4/ton, which is 7% higher than the 500 MW Big Stone Unit II project. The gap narrows with higher and higher CO_2 costs, while the overall busbar cost is also increasing significantly. Both alternatives have an estimated busbar cost (with PTC) of approximately $94/MWh at a CO_2 cost of $17/ton.

Q: Mr. Schlissel suggests that any scenarios assuming that the Production Tax Credit is not available should be disregarded. Why did you analyze the costs without continuation of the PTC?

A: Regarding the PTC, it is a fact that the current PTC will expire this year. Congress could let the PTC expire, it could extend the credit, it could enact a different structure or incentive, it could choose to substitute a national renewable standard in lieu of the current PTC or a restructured PTC, or it could decide to do something else. The future of the PTC is uncertain, particularly for 2013. As such, Burns & McDonnell has consistently evaluated a set of analyses prepared under both scenarios – that the PTC is extended and available in current form in 2013, and that it is not. Because we cannot predict the future, particularly with respect to a subsidy that is dependent upon political action, we believe our approach is prudent.

Remarkably, Mr. Schlissel suggests that any results assuming no PTC are unrealistic and should be ignored. Given the significance of the federal PTC on the economics of wind energy, to advise the Commission to ignore the possibility that the PTC may not be extended in current form for 2013 is imprudent.

Market Wind Case

Q: What do you mean by the "Market Wind Case?"

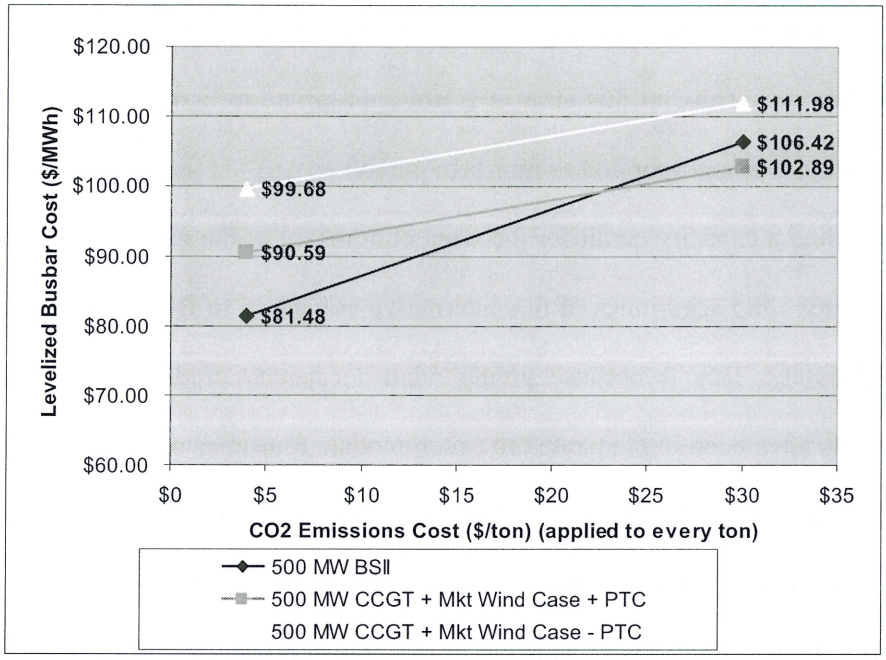
A: The "Market Wind Case" looks at the busbar costs when a more realistic price is assumed for the purchase of wind power. We assumed a market wind price of $52.00/MWh in 2008 with

the PTC in place. We escalated this 2008 price at 5.0% annually until the proposed commercial operation date.

Q: What are the results of your "Market Wind Case?"

A: Figure 2 presents a comparison of busbar costs for the baseload generation alternatives for investor-owned utilities under current market wind costs.

Figure 2: Investor-owned Utility – Market Wind Cost Case – Busbar Analysis



As indicated in Figure 2 above, the 500 MW Big Stone Unit II project represents a lower cost baseload generation alternative across the entire range of CO_2 costs from $4/ton to $30/ton if the PTC is not extended. If Congress decides to extend the PTC in the same form, the breakeven CO_2 cost between the 500 MW Big Stone Unit II alternative and the CCGT plus Wind alternative under the Market Wind Cost case is approximately $24/ton if applied to all tons of CO_2 emissions. Both alternatives have an estimated busbar cost (with PTC) of approximately $99/MWh at a CO_2 cost of $24/ton.

Q: Mr. Schlissel asserts at Page 80 of his direct testimony that your analysis is biased because you assumed no capacity credit for the wind component of the CCGT plus Wind alternative. What is your response?

A: Mr. Schlissel is incorrect. As I have previously explained, the analysis compares baseload generation alternatives. Wind cannot provide baseload capacity and energy on a

reliable basis. However, we added non-firm wind to supplement the CCGT, which can provide dependable capacity, to enhance its economic performance by displacing higher cost gas-fired energy production. Thus, in this case, it is not appropriate to assume a capacity credit for the wind since wind was incorporated as non-firm purchases.

Including a capacity credit for the wind component of the gas-wind alternative, however, does not improve the economics of this alternative compared to Big Stone Unit II as suggested by Mr. Schlissel. This is because giving wind a capacity credit assumes that transmission improvements have been implemented to accommodate transmission of the wind resource. This would come at a cost. The *Updated Economic Analysis of Baseload Generation Alternatives* (OTP/MDU Exhibit 327) was prepared on a busbar cost basis and did not include transmission system costs for the alternatives. This is a reasonable approach if transmission impacts between the alternatives under consideration are relatively similar. Each of the baseload generation alternatives considered by the updated study was developed to supply up to 500 MW of baseload capacity and energy. For the 500 MW CCGT plus Wind case, the wind component was assumed to be non-firm purchases. Thus, the Burns & McDonnell gas-wind scenario, like the other baseload scenarios we considered, requires 500 MW of transmission. In contrast, it is not appropriate for Mr. Schlissel to argue that 500 MW of wind should be combined with 425 MW of CCGT (giving wind a 15% capacity credit) while ignoring the transmission system investment required to accommodate up to 925 MW of resources compared to 500 MW of resources. This is not valid unless significant wind resources can be added to the system and receive a capacity credit with no additional transmission system impacts. This is simply not a realistic assertion.

Q: Do you run any scenarios assuming transmission costs?

A: Yes, we did.

Transmission Costs Included

Q: What transmission costs did you assume in this scenario?

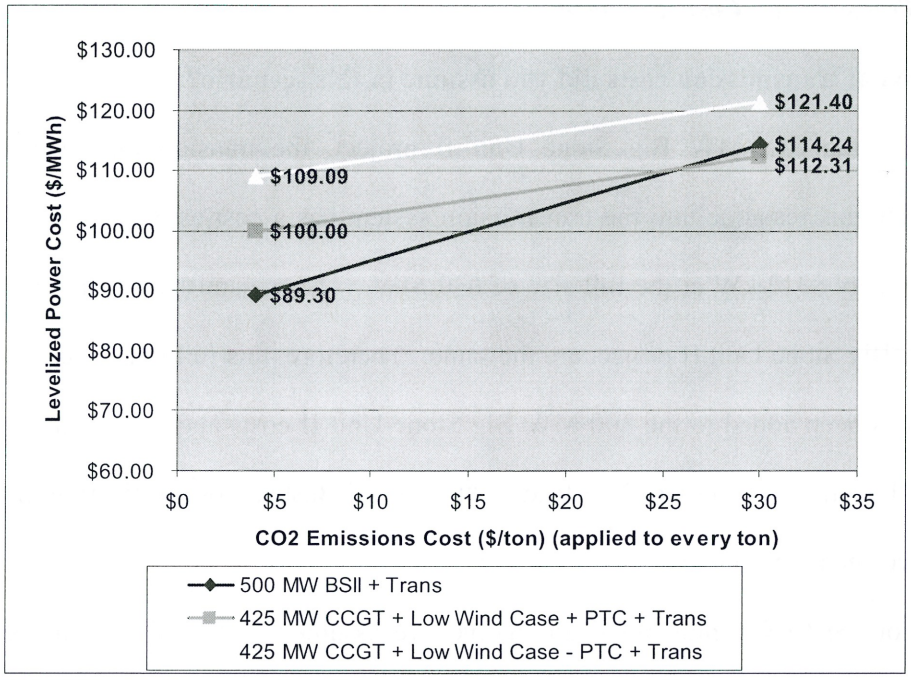
A: For the 630 MW Big Stone Unit II project, the transmission required to reliably incorporate this resource into the transmission system has a cost estimate of $197.3 million, or approximately $313/kW at the full size of 630 MW. The transmission facilities needed for the 500 MW Big Stone Unit II project are the same. Therefore, this full transmission cost of $197.3 million has been added to the 500 MW Big Stone Unit II costs and the levelized costs are now labeled "Levelized Power Cost" instead of "Levelized Busbar Cost" reflecting that transmission costs have been incorporated.

For the CCGT plus Wind alternative, we assumed 500 MW of wind receives a 15% capacity credit and the CCGT capacity needed is reduced from 500 MW to 425 MW. Although these are generic resources without site specific transmission analyses, it is reasonable for the purposes of this analysis to assume the same $313/kW transmission cost. This results in a transmission cost of $289.7 million that has been added to incorporate 925 MW of gas and wind resources. In addition, it is appropriate to add ancillary service costs for the wind component if it is relied on for capacity credit. In the *Final Report – 2006 Minnesota Wind Integration Study* submitted to the Minnesota PUC and dated November 2006, an ancillary service cost of $4.41/MWh for wind integration of 25% was estimated. Therefore, we included a cost of $4.00/MWh (2006$) for the wind generation. All other assumptions remained the same.

Q: What are the results when you included costs for transmission?

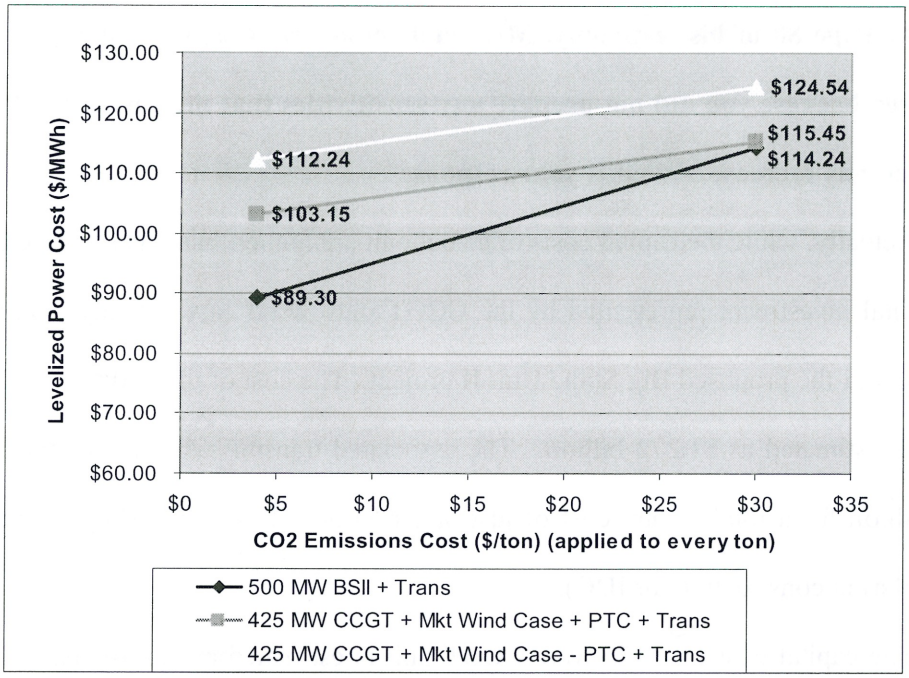
A: We assumed certain transmission costs under both a Low Wind analysis and a Market Wind analysis. Figures 3 and 4 present the results under both of those cases.

Figure 3: Investor-owned Utility – Low Wind Cost Case – Transmission Included


$130.00
$120.00
$110.00
$100.00
$90.00
$80.00
$70.00
$60.00
Levelized Power Cost ($/MWh)
$121.40
$114.24
$112.31
$109.09
$100.00
$89.30
$0
$5
$10
$15
$20
$25
$30
$35
CO2 Emissions Cost ($/ton) (applied to every ton)
500 MW BSII + Trans
425 MW CCGT + Low Wind Case + PTC + Trans
425 MW CCGT + Low Wind Case - PTC + Trans

1

Figure 4: Investor-owned Utility – Market Wind Cost Case – Transmission Included



Once again, as indicated in Figures 3 and 4, the 500 MW Big Stone Unit II project including transmission costs remains a lower cost baseload generation alternative for an investor-owned utility across the entire range of CO_2 costs from \$4/ton to \$30/ton if the PTC is not extended. If Congress extends the PTC in the same form and transmission costs are included, the breakeven CO_2 cost between the 500 MW Big Stone Unit II alternative and the CCGT plus Wind alternative under the Low Wind Cost case has increased to approximately \$26/ton if applied to all tons of CO_2 emissions.

When transmission costs are included, the breakeven CO_2 cost between the 500 MW Big Stone Unit II alternative and the CCGT plus Wind alternative under the Market Wind Cost case has increased to \$30/ton if applied to every ton of CO_2 emitted, and assuming the PTC is extended in the same form.

IV. OTHER RESPONSES

Q: At Page 80 of his testimony, Mr. Schlissel asserts that your analysis is also flawed and biased because you did not prepare any sensitivities that the cost of the Big Stone Unit II project may increase. What is your response?

A: Actually, while the capital costs of a coal unit are higher than a gas-fired CCGT plant, the total capital investment represented by the CCGT plus Wind case actually exceeds the capital investment of the proposed Big Stone Unit II project. The cost of the 500 MW Big Stone Unit II project is estimated as $1.272 billion. The associated transmission investment is estimated as $197 million for a total capital cost of just under $1.50 billion (excluding financing costs and interest during construction, or IDC).

The capital cost of a 425 MW CCGT unit is estimated as approximately $382 million. The capital cost of 500 MW of wind resources will total over $1.0 billion ($2,000/kW) for a 2013 project. Transmission costs at $313/kW for 925 MW of CCGT plus wind resources will be approximately $289.7 million. The total capital cost of this alternative is over $1.65 billion (excluding financing costs and IDC), or approximately $150 million more. In this comparison of the Big Stone Unit II project to a CCGT plus Wind alternative, a claim that the Big Stone Unit II project bears a disproportionate capital cost risk is not supported.

Q: At Page 79 of his testimony, Mr. Schlissel asserts that your analysis is also flawed and biased because you did not include energy efficiency with the CCGT plus wind alternative. What is your response?

A: Mr. Schlissel is well aware that the evaluations conducted by Burns & McDonnell were an economic comparison of baseload supply-side generation alternatives and were not directed at including demand-side energy efficiency reductions. However, the analyses remain valid as a

comparison of alternatives to meet baseload energy requirements net of any energy efficiency reductions.

Q: On Page 27 of his testimony, staff witness Mr. Deason wants clarification of the CCGT cost estimate used in your analysis. What is your response?

A: The CCGT cost estimate was based on a Black & Veatch report entitled, "Supply-Side Technology Study" dated August 2006. The capital cost estimate for a generic 2 x 1 GE 7FA 500 MW CCGT project was estimated in 2006$ at $337.2 million ($674/kW). This cost did not include escalation to the in service date or financing costs. The cost was escalated 5.0% annually until the proposed commercial operation date. The pro forma model used by Burns & McDonnell includes financing costs for all the baseload generation alternatives in the development of the levelized costs. When escalation and financing costs are included, the cost estimate for the 500 MW CCGT alternative used in the analysis was approximately $494 million ($988/kW). Note that this cost does not include transmission.

V. CONCLUSIONS

Q: Can you summarize the results of your analysis on the impacts of future carbon dioxide costs?

A: For investor-owned utilities like Otter Tail Power and Montana-Dakota, the 500 MW Big Stone Unit II project again represents a lower cost baseload generation alternative on a life-cycle basis across the entire range of CO_2 costs from $4/ton to $30/ton if the federal production tax credit is not extended. There is not a point within the $4/ton to $30/ton CO_2 cost range that the CCGT plus Wind alternative results in lower cost busbar power without an extension of the federal production tax credit for wind. If the PTC is extended, the breakeven CO_2 cost between the 500 MW Big Stone Unit II alternative and the CCGT plus Wind alternative is approximately

$17/ton applied to every single ton of CO_2 emissions. This $17/ton value depends on a number of favorable assumptions for the gas-wind alternative, including (a) wind purchase prices are lower than current market; (b) no transmission costs for wind are included; and (c) application of the $17/ton cost to every ton of CO_2 emitted by Big Stone Unit II. When the price for wind power is increased to current market conditions, the break-even CO_2 cost becomes approximately $24/ton, again applied to every single ton of CO_2 and without considering transmission costs. Including transmission costs and current market wind prices increases the breakeven point to approximately $30/ton applied to every single ton of CO_2 emissions. Even assuming all of the assumptions favorable to the gas-wind alternative, and further assuming that Big Stone Unit II will receive any significant allocation of no-cost allowances would increase the $17/ton CO_2 break-even cost point significantly – to more than $30/ton if Big Stone Unit II were allocated half of its emission allowances at no-cost and the remaining allowance cost is $17/ton.

Q: In addition to the assumptions described in the previous question, are there other assumptions you made that are conservative in favor of the CCGT plus Wind alternative relative to Big Stone Unit II?

A: Yes. I can list three other assumptions that were incorporated, all of which concurrently work to lower the overall economics of the CCGT plus Wind case:

(1) Wind Capacity Factor – The CCGT plus Wind case assumes a net capacity factor production of 40% for the wind resource.

(2) Natural Gas Transportation Costs – As noted in my Supplemental Direct Testimony filed March 10, 2008 (Applicants' Exhibit 326), the analyses continue to assume a low cost of $0.40/MMBtu for natural gas transportation in the CCGT cases, a very conservative assumption.

(3) Fuel Cost Escalation – In the recent analyses, Burns & McDonnell is reflecting a higher escalation rate for coal (3.5% annually) compared to natural gas (3.0% annually).

Q: Can you summarize how all these assumptions affect the results?

A: It is only if all the assumptions favoring a CCGT plus wind alternative hold true does the break-even cost, where the CCGT/wind alternative and Big Stone II have the same busbar cost, drop below $30/ton, and even then the lowest figure is $17/ton. The break-even CO_2 cost between the 500 MW Big Stone Unit II alternative and the CCGT plus Wind alternative increases, and goes beyond $30/ton, if one or more of these assumptions turns out to be untrue.

Q: Does this complete your rebuttal testimony?

A: Yes.