STATE OF MINNESOTA
OFFICE OF ADMINISTRATIVE HEARINGS
FOR THE MINNESOTA PUBLIC UTILITIES COMMISSION

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In the Matter of a Petition by Excelsior Energy, Inc. for Approval Of a Power Purchase Agreement, Under Minn. Stat. § 216B.1694, Determination of Least Cost Technology, and Establishment of a Clean Energy Technology Minimum Under Minn. Stat § 216B.1693

PUC Docket No. E-6472/M-05-1993
OAH Docket No. 12-2500-17260-2

SURREBUTTAL TESTIMONY OF MICHAEL G. CASHIN

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The above matter is before Administrative Law Judges Steve M. Mihalchick and Bruce Johnson. Pursuant to Minnesota Rules Chapter 1400, the following is submitted as direct testimony offered by Minnesota Power.

Q. Please state your name and business address.

A. My name is Michael G. Cashin, PE. My business address is Minnesota Power, 30 West Superior Street, Duluth, MN 55802.

Q. For whom are you testifying?

A. I am testifying on behalf of Minnesota Power, a party to this contested case.

Q. Have you previously provided testimony in this proceeding?

A. Yes, on September 5, 2006, I filed Direct Testimony on behalf of Minnesota Power that addressed environmental benefit issues and air permit issues related to the Mesaba Project.

Q. Are you sponsoring any documents and exhibits in the filing?

A. Yes. Exhibit MGC-2, "Gasification: Moving From an Environmental Push to an Economic Pull". Dale Simbeck, SFA Pacific, Inc. presented at the October 2006 Gasification Technologies Conference in Washington, D.C.

Q. What is the purpose of your Surrebuttal Testimony in this proceeding?

A. The purpose of my Surrebuttal Testimony is to respond to the Rebuttal Testimony of Excelsior Energy, Inc. witness Robert S. Evans II. I will respond to the issues raised by Robert S. Evans II about the following matters:

- IGCC's relative performance in reducing emissions of mercury, sulfur dioxide (SO_2), nitrogen oxides (NO_x) and particulate matter compared to modern pulverized coal technology.
- Whether carbon capture and storage is a realistic option for the Mesaba Project.
- At Page 20 of his Rebuttal Testimony, Mr. Evans states, "… Mr. Cashin states 'Because the differential between IGCC and PC technologies' ability to reduce emissions for mercury, SO_2 and NO_x is relatively small, in terms of actual emissions compared to uncontrolled emissions, the most important benefit that could come out of IGCC technology could be an answer for major carbon emission reduction through sequestration.' The statement as it applies to the removal of mercury, SO_2 and NO_x is carefully crafted to discount the significant reductions apparent in Figure RSE-3. By qualifying the reductions in terms of 'actual emissions compared to uncontrolled emissions,' Mr. Cashin is avoiding the fact that what comes out the stack is important. If this was not the case, there

would be no basis for Mr. Cashin's opening remarks that Minnesota Power's 'announced plans for major mercury, sulfur dioxide (SO_2), particulate [sic] and nitrogen oxide [sic] (NO_x) emission reductions….help to underscore our appreciation for today's and tomorrow's environmental policy realities' and the statement would be considered hypocritical."

- At Page 23 of his Rebuttal Testimony, Mr. Evans states regarding capability of conventional coal-fired PC power plants to deliver performance comparable to IGCC for mercury removal that "This may prove to be true (if 90% removal is the target), but the measures that must be taken at such facilities which fire subbituminous coals (to which most such plants in the state are limited) are less proven and are expected to be more expensive to achieve than the same level of control associated with the use of the activated carbon beds to be employed on the Project. Cleaning mercury from large volumes of stack gases in conventional coal settings is much more difficult than cleaning mercury from the fuel as is the case in IGCC facilities."
- At Page 4 of his Rebuttal Testimony, Mr. Evans states, "Information contained in testimony presented by Mr. Clarke and Mr. Cashin underscores Excelsior's position that the overall emissions profile associated with the project is unrivaled by any conventional coal-fueled steam electric generating technology and clearly provides for significant emission reductions."

Q. How does the relative environmental performance of conventional pulverized coal technology operated with conventional emission control equipment compare with IGCC technology?

A. Relative to uncontrolled emissions from pulverized coal technology, the environmental performance for criteria pollutant emissions from PC technology operated with conventional emission control equipment and IGCC technology are both significantly better. IGCC environmental emission performance can be better or not as good as that for PC technology operated with emission control equipment, depending on factors such as the specific coal being burned and design of emission controls. The significance of these emission performance differences depends on local or regional environmental quality and, in the case of emissions that are subject to management under a cap and trade program like SO_2, NO_x and mercury, the relative cost for alternatively achieving emission reductions in other locations by purchasing emission allowances from the marketplace.

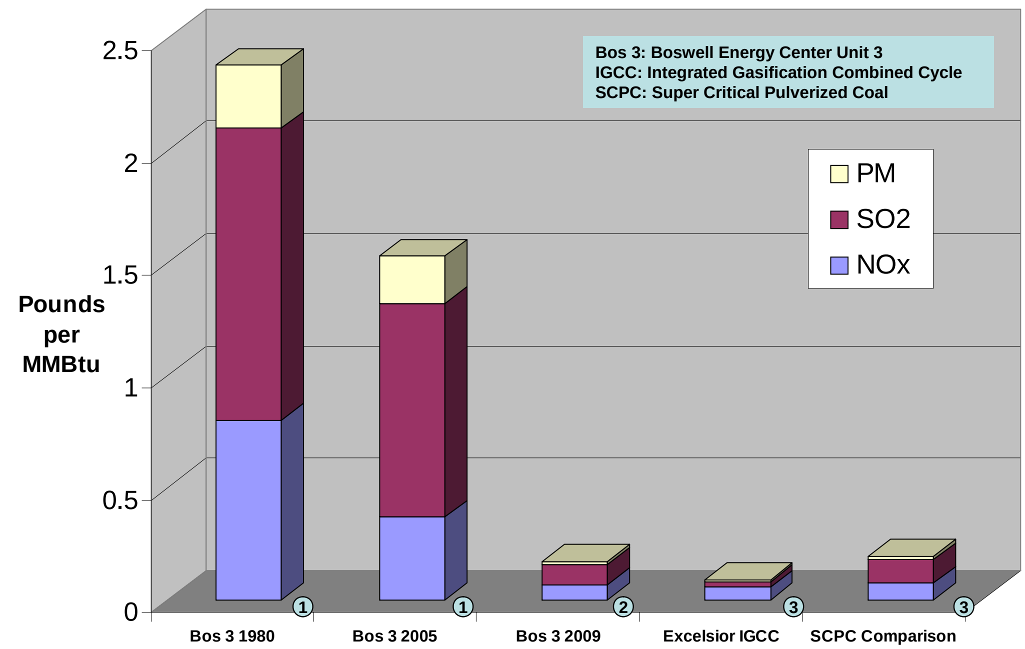
Q. What is the relative emission performance of criteria pollutants of concern for pulverized coal and IGCC technology?

A. Relative emission performance can be assessed through side-by-side comparison of the historic emission rates of Minnesota Power's Boswell Energy Center Unit 3, emission control retrofits announced for the Boswell Energy Center Unit 3 for operation in 2009, Excelsior Energy's Mesaba Energy Project Part 70 Operating Permit submittal information for Mesaba Energy Unit 1, subbituminous coal IGCC performance and the Excelsior Energy characterization of Super Critical Pulverized Coal (SCPC) emissions performance referenced in Excelsior's Part 70

Operating Permit Application. Assessment can also give consideration to emission allowance pricing projections made by the United States Environmental Protection Agency.

This direct comparison of PM, SO_2 and NO_x emission rates demonstrates how conventional pulverized coal units like Boswell Unit 3, which was outfitted with a wet particulate scrubber to help control emissions, have improved environmental performance through means such as optimizing coal supply and operation of pollution control equipment. Minnesota Power's announced retrofit of Best Available Control Technology for PM, SO_2 and NO_x on Boswell Unit 3 results in operational emissions performance comparable to that cited by Excelsior Energy for IGCC and SCPC, as shown in the Criteria Emissions Performance Comparison.

Criteria Emissions Performance Comparison



References:
1- Boswell Unit 3 Performance Test Data
2- Boswell 3 Multi-Emission Environmental Improvement Plan (October 2006)
3- Excelsior Energy, Mesaba Energy Project Part 70 Air Permit Application, June 16, 2006 Sections 3.4 & 5.4
Mercury is shown for direct comparison elsewhere because emission rates are much smaller than for PM, SO_2 and NO_x.

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There are, indeed, differences in the environmental performance for the three high environmental performance technologies (existing retrofit PC, IGCC and SCPC), but the significance of those differences would need to be determined by assessing whether any significant local environmental benefits are experienced or whether the cost to purchase emission allowances for reductions achieved at other locations justifies any cost premiums associated with providing for greater emission reductions at the plant location.

Q Is Minnesota in attainment with the National Ambient Air Quality Standards (NAAQS) established to be protective of human health and welfare with a margin of safety?

A. Yes. Minnesota has been in attainment with all the NAAQS for over a decade.

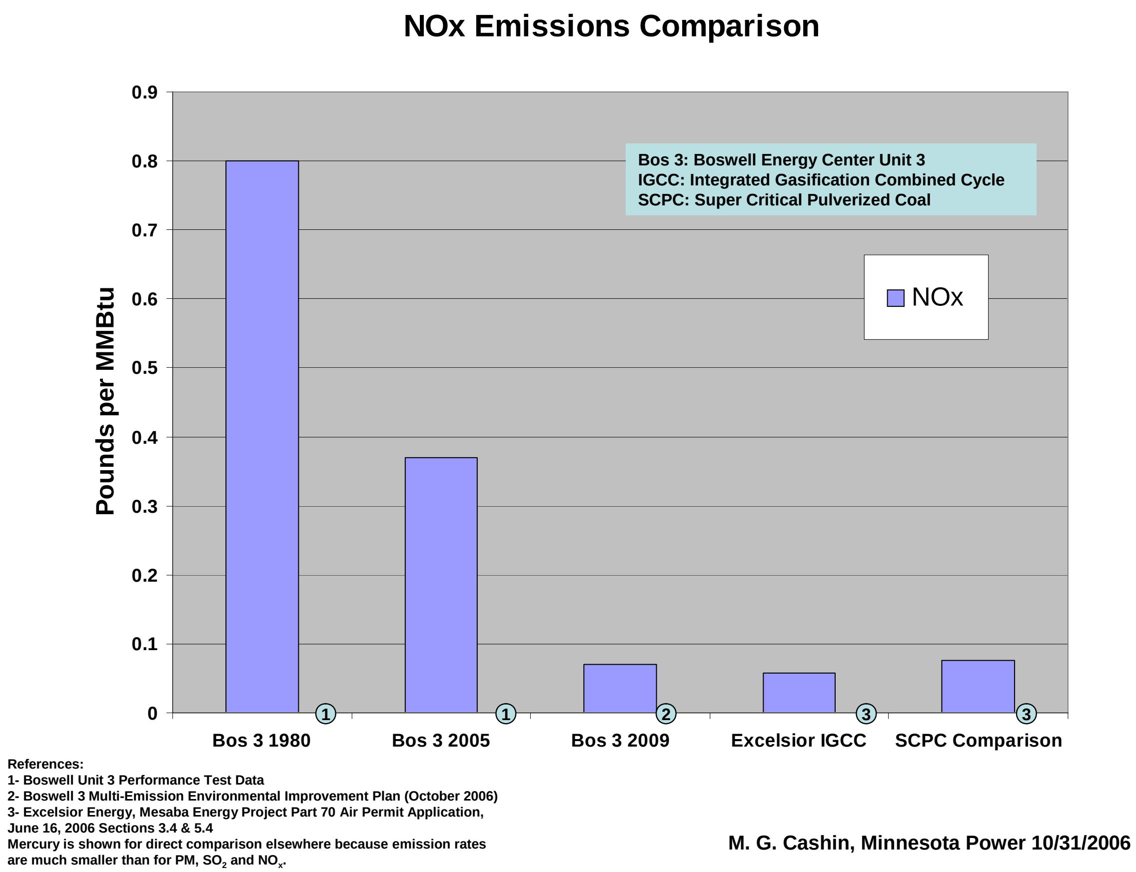
Q. Is an energy project in Northern Minnesota expected to result in emissions that would degrade Minnesota air quality such that it would violate the NAAQS?

A. No. Although both the NAAQS for ozone and fine particulates is targeted for being made more stringent, Northern Minnesota is well below the current NAAQS and is not expected to have attainment issues with the revised NAAQS. Air quality issues of local concern in Northern Minnesota are impacts on regional haze in nearby Class I Wilderness areas like the Boundary Waters Canoe Area and Voyageurs National Park, and contributions Minnesota emissions may be making to mercury in fish in mercury impaired waters.

Q. Is the difference between new plant NO_x emission rates significant for a Northern Minnesota facility?

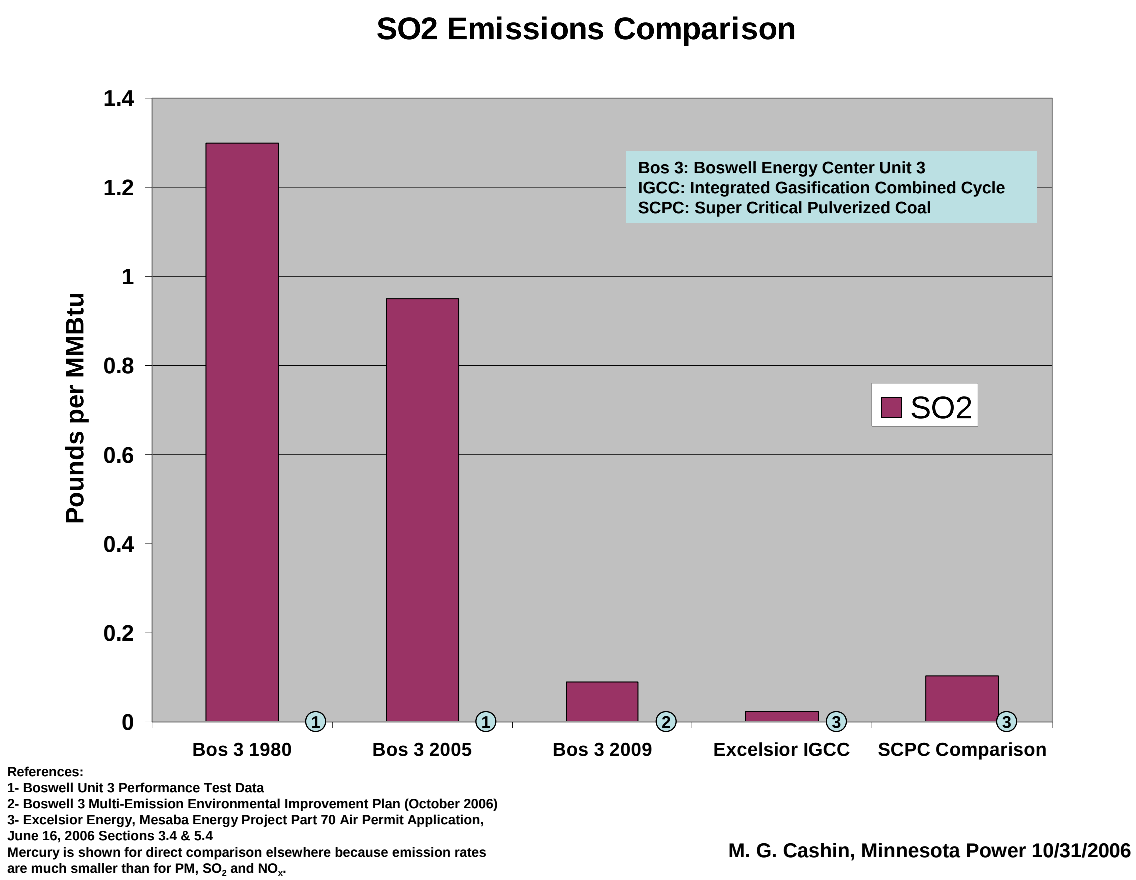
A. No. As shown in the diagram, NOx Emissions Comparison, emission rates are comparable. Excelsior Energy has indicated that their net heat rate is 9391 Btu/kWh and net capacity of 606 MWs (page 18 of Mr. Evan's Rebuttal Testimony). That is associated with 44.9 million MMBtus per year heat input if operating at a 90% capacity factor. A difference of 0.03 lbs NO_x per MMBtus then translates to 674 tons of NO_x per year. With current NO_x allowance pricing running below $1000 per ton, the difference in environmental performance can be compensated for with less than a $1 million annual NOx allowance purchase, which is not significance relative to differences in overall project costs.

Northeastern Minnesota is in attainment with air quality standards established as protective of human health and welfare, so purchase of allowances that provide for emission reductions within the CAIR region sufficiently addresses environmental impact differences.



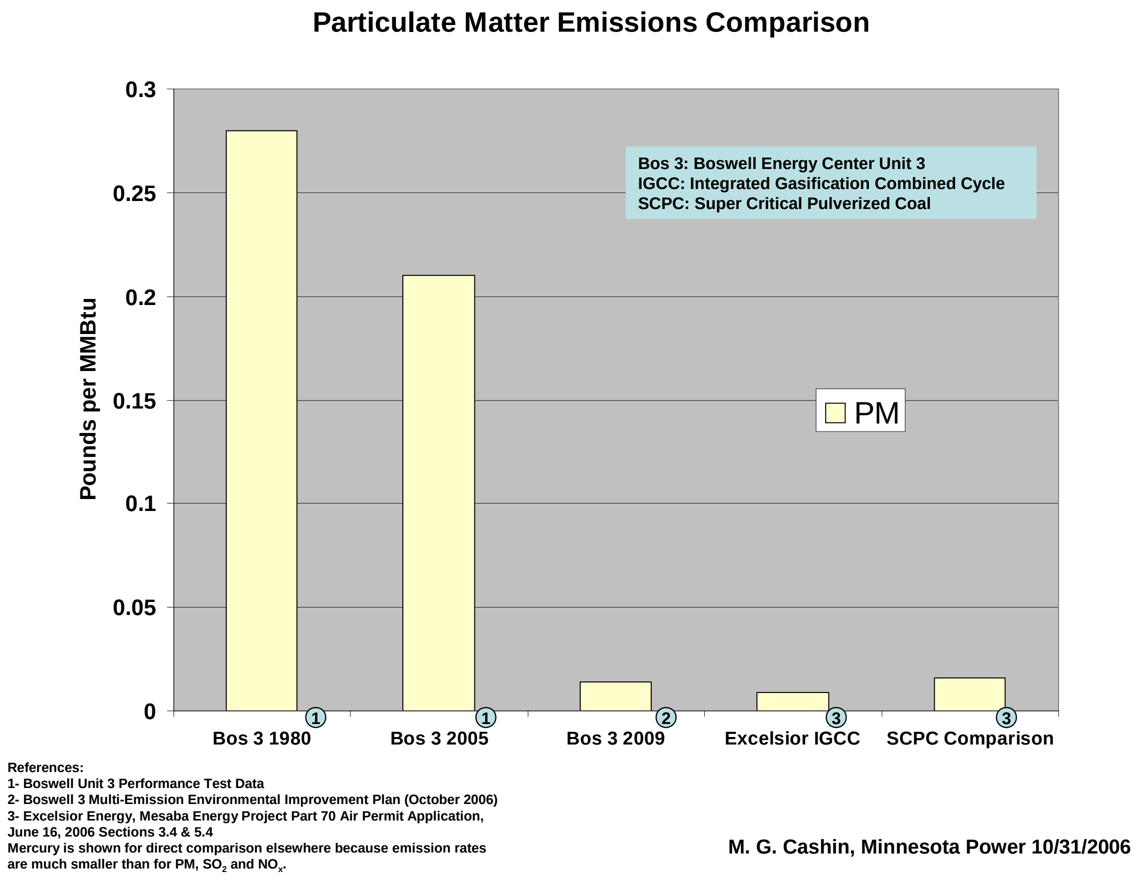
Q. Is the difference between new plant SO_2 emission rates significant for a Northern Minnesota facility?

A. No. As shown in the diagram, SO_2 Emissions Comparison, emission rates are comparable. Excelsior Energy has indicated that their net heat rate is 9391 Btu/kWh and net capacity of 606 MWs (page 18 of Mr. Evan's Rebuttal Testimony). That is associated with 44.9 million MMBtus per year heat input if operating at a 90% capacity factor. A difference of 0.07 lbs SO_2 per MMBtus then translates to 1573 tons of SO_2 per year. With current SO_2 allowance pricing running around $550 per ton, the difference in environmental performance can be compensated for with less than a $1 million annual SO_2 allowance purchase, which is not significant relative to differences in overall project costs. Northeastern Minnesota is in attainment with air quality standards established as protective of human health and welfare, so purchase of allowances that provide for emission reductions within the CAIR and Acid Rain Program region sufficiently addresses environmental impact differences.



Q. Is the difference between new plant particulate matter emission rates significant for a Northern Minnesota facility?

A. No. As shown in the diagram, PM Emissions Comparison, emission rates are comparable. Excelsior Energy has indicated that their net heat rate is 9391 Btu/kWh and net capacity of 606 MWs (page 18 of Mr. Evan's Rebuttal Testimony). That is associated with 44.9 million MMBtus per year heat input if operating at a 90% capacity factor. A difference of 0.01 lbs PM per MMBtus then translates to 225 tons of particulate matter per year. Particulate matter emissions are not controlled under a cap and trade program, so monetization is limited to recognition of emission fees assigned by the State, which are currently around $30 per ton. Contributions to regional haze from particulate matter are an environmental concern. Excelsior has cited emissions for other haze contributors (SO_2, NO_x and PM) as being under study (refer to Page 23 of Mr. Evans Rebuttal Testimony) and indicates Excelsior expects to resolve any issues with the Mesaba Project's modeled impacts on nearby Class 1 Wilderness Areas. Mesaba Project information regarding the significance of 225 tons per year of PM is not available for analysis for regional haze. Northeastern Minnesota is in attainment with air quality standards established as protective of human health and welfare and I would not expect PM emissions of this magnitude to be an issue for NAAQS attainment.

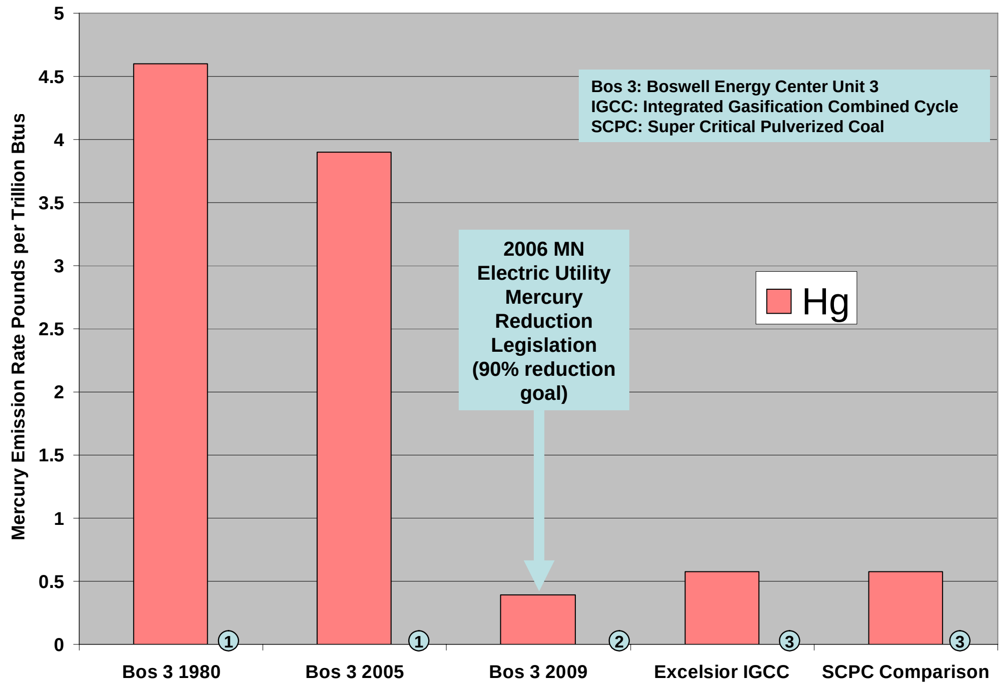


Q. Is the difference between new plant mercury emission rates significant for a Northern Minnesota facility?

A. No. As shown in the diagram, Mercury Emissions Comparison, mercury emission rates are comparable. The Boswell Unit 3 emission rate, following planned retrofits, is projected in an engineering analysis submitted in the Boswell 3 Environmental Improvement Plan filed with the Minnesota Public Utilities Commission under Docket No. E015/M-06on October 27, 2006.. Minnesota Power has proposed controls that are expected to allow the Boswell Unit 3 to achieve a goal of 90% mercury reduction relative to current plant emissions. This reduction would be made in addition to the Boswell Unit 3 shift to lower mercury content coal that was accomplished between 1980 and 2005 and the co-benefit removal of 16% to 21% of inlet mercury by the existing wet particulate scrubber equipment.

Excelsior Energy calculated the Mesaba Project's mercury emissions based on a presumed 90% reduction compared to the average mercury content of sub-bituminous coal, as is evident from their Part 70 Operating Permit Application. While the Boswell 3 retrofitted mercury emission rate would be lower than either IGCC or SCPC emission rates, the difference compared to IGCC or SCPC emission rates is not considered significant relative to overall new facility mercury emissions. Excelsior Energy has indicated that their net heat rate is 9391 Btu/kWh and net capacity of 606 MWs (page 18 of Mr. Evan's Rebuttal Testimony). That is associated with 44.9 million MMBtus per year heat input if operating at a 90% capacity factor. A difference of 0.1 lbs mercury per Trillion Btus then translates to less than 5 pounds of mercury per year. Even if mercury allowances trade as high as $100,000 per pound, which is about triple the EPA projected price under the Clean Air Mercury Rule (CAMR) trading program, the cost to purchase allowances and have reductions made in another part of the CAMR region is less than $1 million annually, which is not significant relative to overall project cost differences. Also, the difference amounts to less than 20% of the overall annual mercury emissions estimated by Excelsior for the Mesaba Project of 26 pounds.

Mercury Emission Performance Comparison



References:
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Q. Is it easier or more cost effective to remove mercury from a concentrated gas stream as is the case for IGCC compared to pulverized coal?

A. Not necessarily. IGCC mercury cleanup is a demonstration technology. While removal of mercury from a more concentrated source, in theory, should be easier, IGCC involves passing the mercury laden gas through a bed of activated carbon while the pulverized coal technology involves mixing powdered activated carbon with flue gas and removing the mercury laden activated carbon in the particulate removal systems. The Mesaba Project's IGCC technology would deliver the mercury concentrated gas stream intrinsic to its design, but IGCC itself carries a cost premium compared to conventional pulverized coal technology. A complete assessment of control costs would assign the capital cost premium for IGCC against emission control costs in addition to equipment components specifically required for emission controls. Excelsior has not provided such data for review.

Q. Is carbon capture and storage a realistic option for the Mesaba Project?

A. I maintain the answer is no. While Excelsior notes (reference Page 21 of Mr. Evan's Rebuttal Testimony) that Excelsior is presently engaged in efforts to identify options for managing its CO_2, including a study with the Plains CO_2 Reduction Partnership (PCOR), the measures cited by Mr. Steadman, Project Manager for the PCOR Project, that are applicable to Northern Minnesota include carbon sink options like restoring peat bogs that may be drying out and reducing associated natural release of methane. Such projects are typically categorized as offset projects and involve certification of prospective carbon credits and exchange of these credits through a carbon credit trading system. Minnesota Power also is a PCOR participant and has facilitated offset projects of its own, as reported under the Climate Challenge Program via Minnesota Power's annual EIA 1605(b) Voluntary Reporting of Greenhouse Gas Emissions filings. Minnesota Power considers such offset projects as valid for offsetting greenhouse gas emissions from fossil fuel combustion, but there is nothing related to such offsets that would not be available to any fossil fuel technology, be it IGCC or SCPC.

Excelsior also references the transport of carbon dioxide gas sequestered from the Mesaba Project via a pipeline at 1500 psig to serve enhanced oil recovery in North Dakota. While transporting CO_2 waste from Minnesota to North Dakota is a physical option, the Mesaba Project (or any Minnesota electric generation facility) does not have the benefit of a Minnesota long term CO_2 storage repository. The capital cost for transport of high pressure CO_2 to North Dakota was roughly estimated by Excelsior energy to be about $1 billion (See September 28, 2006 Excelsior Energy Excelsior Energy's Responses to MCEA's Information Request Nos. 8 & 9).

Excelsior Energy has indicated that the Mesaba Project's net heat rate is 9391 Btu/kWh and net capacity of 606 MWs (page 18 of Mr. Evan's Rebuttal Testimony). That is associated with 44.9 million MMBtus per year heat input if operating at a 90% capacity factor. Per the Department of Energy, sub-bituminous coal has uncontrolled carbon dioxide emissions of about 212.7 lbs CO_2/MMBtu. Thus, the Mesaba Project operating with a 90% capacity factor and no CO_2 removal would involve emissions of about 4.77 million tons of CO_2 annually. Presuming carbon capture of 90% after retrofitting the $1 billion in carbon capture equipment and pipeline equipment cited by Excelsior, the Mesaba Project would need to transport about 4.3 million tons of CO_2 from Northern Minnesota to North Dakota annually. Simply assigning a 20% factor for annualizing the cost for the $1 billion in capital equipment (with no consideration of energy lost for CO_2 capture, compression and transport), the effective cost for the Mesaba Project's Carbon Capture and Storage would be about $50 per ton CO_2. That is equivalent to about a $42 per net megawatt hour CO_2 CCS premium for the Mesaba Project's electricity generation to just service the capital cost component. The Mesaba Project's cost for CO_2 capture and transport, not including operational costs, is more than double that of the CO_2 Trading Scheme market in Europe, established under the Kyoto Protocol. Minnesota Power considers such cost dynamics to be unrealistic for application at a Northern Minnesota IGCC generating facility, considering generation could also be built in closer proximity to natural geologic CO_2 storage in other states serving the regional power market at a lower cost.

Q. Does the Mesaba Project clearly provide for significant emission reductions that are unrivaled by any conventional coal-fueled steam electric generating technology?

A. No. There is carbon capture and sequestration technology being developed that can be applied to conventional pulverized coal, such as Electro Catalytic Oxidation, CO_2 capture and use of conventional CO_2 scrubbers using solvents such as methyl ethyl amine. Just as the Excelsior is projecting that Carbon Capture and Storage (CCS) will become available at some future date for IGCC, CCS can be projected as becoming available for conventional technologies in a similar time frame. As indicated in the analysis cited in this Surrebuttal Testimony, conventional PC can already deliver environmental performance comparable to IGCC, using conventional technologies while carrying less project risk than that involved with an IGCC facility constructed in Northern Minnesota.

This point is reinforced in an October 4, 2006 Paper Presentation by Mr. Dale Simbeck, SFA Pacific, Inc. to the Gasification Technologies Conference, "Gasification: Moving from an Environmental Push to an Economic Pull." See

Exhibit MGC-2. On slide 10, Mr. Simbeck highlights emission rate differences between IGCC compared to pulverized coal and assigns an IGCC advantage in terms of cost per MWh. The environmental advantage cited for IGCC translates to only a $1.40 per megawatt hour savings relative to allowance market replacement costs. Mr. Simbeck concludes that there is little difference that can justify the capital cost and technology risk premium associated with IGCC.

Q. Does this conclude your surrebuttal testimony?

A. Yes.