APPLICANTS' EXHIBIT 8

SOUTH DAKOTA PUBLIC UTILITIES COMMISSION

CASE NO. EL05-022

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

DIRECT TESTIMONY

OF

MARK ROLFES

PROJECT MANAGER FOR THE BIG STONE UNIT II PROJECT

OTTER TAIL POWER COMPANY

MARCH 15, 2006

BIG STONE II

PARTNERS IN GENERATION

TESTIMONY OF MARK ROLFES

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BEFORE THE SOUTH DAKOTA PUBLIC UTILITIES COMMISSION

DIRECT TESTIMONY OF MARK ROLFES

I. INTRODUCTION

Q: Please state your name and job title.

A: My name is Mark Rolfes. I am the Project Manager for the Big Stone Unit II Project, employed by Otter Tail Corporation d/b/a Otter Tail Power Company.

Q: Describe your job duties.

A: I am responsible for the overall coordination and implementation of the development of the Big Stone Unit II Project.

Q: Describe your educational background.

A: I graduated in 1977 from North Dakota State University with a Bachelor of Science degree in Mechanical Engineering.

Q: Please summarize your professional work history.

A: I have been employed by Otter Tail for over 28 years in the Power Generation area. I began my career in coal-fired generation in 1977 as a Plant Engineer at the Big Stone I site. In 1980 I became the Electrical Supervisor for Big Stone Unit I, responsible for the electrical, control and instrumentation functions of the Big Stone Unit I. In 1987 through 2001 I was Plant Manager of Big Stone I, responsible for the overall operation and maintenance of the plant. From 1998 until 2001 I also had responsibility for the management of the Hoot Lake Station, a coal-fired plant located in Fergus Falls, Minnesota. In 2001 I was appointed to the position of New Business Development for Otter Tail, which later transitioned into Project Manager for the Big Stone Unit II Project.

Q: Are you a licensed professional engineer?

A: Yes I am. I am a licensed Professional Engineer in the states of South Dakota and Minnesota.

Q: What other professional experience have you had?

A: I served on the Governor's Advisory Task Force on Hazardous Waste Management in the State of South Dakota. I have also served on numerous Electric Power Research Institute and Edison Electric Institute committees.

II. PURPOSE AND SUMMARY OF TESTIMONY

Q: What is the purpose of your testimony.

A: As Project Manager, I provide information in my testimony on a variety of subjects related to state regulatory requirements for an energy conversion facility siting permit.

Q: Please summarize your testimony.

A: I describe in my testimony the various alternate energy sources and six alternative sites that were considered before a supercritical pulverized coal facility at the Big Stone site was selected. The coal for Big Stone Unit II will come from the Powder River Basin in Wyoming and Montana and will be shipped to the Plant by rail. I describe the time schedule for construction of the new plant, which anticipates completion of construction in 2010 and commercial operation in 2011. Big Stone Unit II is estimated to cost in excess of $ 1 billion. At this time no future expansions for the site are contemplated.

Q: What regulations relating to the proposed Big Stone Unit II are covered in your testimony?

A: The following Administrative Rules of South Dakota are discussed in my testimony:

- ASRD 20:10:22:07 Name of owner and manager

- ASRD 20:10:22:08 Purpose of facility
- ASRD 20:10:22:09 Estimated cost of facility
- ASRD 20:10:22:11 General site description
- ASRD 20:10:22:12 Alternative sites
- ASRD 20:10:22:22 Time schedule
- ASRD 20:10:22:25 Future additions and modifications
- ASRD 20:10:22:26 Nature of proposed energy conversion facility
- ASRD 20:10:22:27 Products to be produced
- ASRD 20:10:22:28 Fuel type used
- ASRD 20:10:22:29 Proposed primary and secondary fuel sources and transportation
- ASRD 20:10:22:30 Alternate energy sources reviewed
- ASRD 20:10:22:32 Estimated of expected efficiency
- ASRD 20:10:22:33 Decommissioning

III. NAME OF OWNER AND MANAGER (ASRD 20:10:22:07)

Q: Please explain how the Applicants intend to own Big Stone Unit II.

A: Big Stone Unit II is intended to be owned as tenants in common, with each utility having an undivided interest in the entire project. The goal of the project's Ownership Agreement is to give all participants a voice in the decision making process and prohibit any utility from dominating the process. The expected ownership shares of Big Stone Unit II are as follows; Western Minnesota Municipal Power Agency (through Missouri River Energy Services) owning 25% (150 MW); Great River Energy, Otter Tail, and Montana-Dakota Utilities Co. each owning

19.3% (116 MW); Southern Minnesota Municipal Power Agency ("SMMPA") owning 7.8% (47 MW); Central Minnesota Municipal Power Agency ("CMMPA") owning 5% (30 MW); and Heartland Consumers Power District ("HCPD") owning 4.2% (25 MW).

Q: Explain how the Big Stone Unit II owner's group was formed.

A: Two of the Big Stone Unit II ownership group – Otter Tail and Montana-Dakota Utilities – are participants in the existing Big Stone I power plant and also in the Coyote Unit located in Beulah, North Dakota. The agreements that govern these units has proven to be very successful for the many years these two plants have been in operation. Given this success, these agreements were a starting point for discussion on how Big Stone Unit II would be owned and managed.

Q: Please explain what arrangements have been made between the Applicants on who would operate and maintain the proposed plant.

A: The Applicants have entered into an Operating and Maintenance Agreement that governs the proposed operations of Big Stone Unit II. Under that agreement, Otter Tail would operate and maintain the unit. Otter Tail currently does this function for the existing Big Stone Unit I. It is planned that the two units would be operated together as a single facility. The Operating and Maintenance Agreement allows for the future change of an operating agent if the owners so desire.

IV. PURPOSE OF FACILITY (ARSD 20:10:22:08)

Q: Describe the general purpose for which the Big Stone Unit II is being proposed.

A: Big Stone Unit II is being proposed to provide baseload electric generation for the seven participants of the project. Baseload generation is generation available 24 hours a day, seven days a week. It is dispatchable, so that the output can be controlled by the participants to meet system needs. The energy is expected to serve the Applicants' retail and wholesale native load customers.

V. NATURE OF PROPOSED ENERGY CONVERSION FACILITY (ARSD 20:10:22:26)

Q: Describe the nature of the proposed energy conversion facility.

A: The proposed Big Stone Unit II is a super-critical pulverized coal-fired electric power generating unit to be constructed adjacent to the existing Big Stone Plant Unit I.

The project will generate approximately 600 megawatts (MW) net of electricity from a new coal-fired steam generation unit. Fuel for the project will be Powder River Basin (PRB) coal from a number of mines located in Wyoming and Montana, which is the fuel currently being burned at Big Stone Unit I. The facility will be designed to burn opportunity fuels in the new boiler, if feasible.

Electricity from the project will be transmitted via an interconnection to the 230 kV transmission system. The interconnection will accommodate the output from both Big Stone Plant Unit I and Big Stone Unit II.

More information on the nature of the proposed energy conversion facility can be found in detail in the Application.

VI. ESTIMATED COST OF THE FACILITY (ARSD 20:10:22:09)

Q: How much will the proposed Big Stone Unit II cost?

A: The proposed Big Stone Unit II facility will cost slightly in excess of 1 billion dollars in 2011 dollars.

Q: Are the Applicants continuing to look at the projected cost of Big Stone Unit II?

A: Yes, costs are continually being looked at. As we approach a more defined design stage, it is possible to prepare a more refined cost estimate for the plant. The Applicants expect to have a new cost estimate prepared by mid-summer 2006. To date, our ongoing work has not indicated any significant increases in original estimated costs.

VII. GENERAL SITE DESCRIPTION (ARSD 20:10:22:11)

Q: Please provide a general site description of the Big Stone Plant.

A: The proposed site is adjacent to the existing Big Stone Unit I. The Big Stone Unit I site is located in northeastern South Dakota near Big Stone City, in Grant County. The site is approximately two miles northwest of Big Stone City, 1.7 miles from the nearest point of Big Stone lakeshore and approximately two miles from the Minnesota border. Because of the existing power plant, the site already has road access and rail access and has a plant makeup water facility that pumps water from Big Stone Lake to the Plant site. It has potable water and sanitary sewer, and it has existing transmission corridors.

Q: Have the Applicants prepared maps showing prominent features in the area of the Big Stone Plant?

A: Yes, there are several maps in the Application showing cities and lakes and rivers in the area and other prominent features.

VIII. ALTERNATIVE SITES (ARSD 20:10:22:12)

Q: Please describe the general criteria used by the Applicants to select alternative sites for the proposed project?

A: Because of the service territories of the project participants, the first criterion considered was that the site should be located in one of three states – Minnesota, North Dakota, or South Dakota. The first review was to eliminate areas that were not suitable for consideration. These included places such as residential areas, National Parks, and recreational areas. The next criterion was the availability of infrastructure, such as rail lines, transmission corridors, and water supply. These were to provide the three main requirements for the plant site – a way to transport the fuel in, a way to ship the electricity out, and water needed for cooling. We also considered the potential environmental impacts associated with the plant site.

Q: What process was followed for identifying candidate sites?

A: Using the primary criteria described above, the Applicants conducted an initial screening to identify potential sites. Maps were prepared showing the various features that were important. From this work, the Applicants identified 38 potential sites. From this list, the Applicants narrowed the choice down to eight primary locations based on which potential sites best met the objectives described above. Next, these eight sites were inspected to better ascertain the availability of land, local land use, the existence of residences and other structures to the site, quality and quantity of transportation, access for rail delivery, and other infrastructure. Two of the eight sites were eliminated because of nearby residences and other developments and lack of sufficient land for development. The remaining six sites were retained for further analysis. Each of the six sites was evaluated for all of the criteria and ranked.

Q: What six sites survived the initial screening and were ranked under the criteria?

A: The six sites are:

- Big Stone - Grant County, South Dakota
- Coyote - Mercer County, North Dakota
- Dickinson - Wright County, Minnesota
- Fargo - Cass County, North Dakota
- Glenham - Walworth County, South Dakota

- Utica Junction - Yankton County, South Dakota

Q: Please describe how these criteria were measured and weighted.

A: Table 3-5 in the Application shows the way the various criteria were measured and weighted. Generally, water supply, fuel lines, and transmission were each given a weight of 20% and environmental issues and air quality specifically were each given 15%, and other factors such as highway access were given 10%.

Q: What were the results of the ranking?

A: The Big Stone site received the highest weighted score.

Q: What are the advantages of the Big Stone site over the other five sites?

A: The advantages of the Big Stone site are numerous. Most of them are due to the existing infrastructure. For the cooling water needed for the Plant, the existing pump-house and pipeline are adequate to support Big Stone Unit II without any changes. Big Stone Lake, the water source for Big Stone I, has adequate water availability. For fuel delivery, the existing rail spur and unloading facilities are adequate for a second unit without any modifications, thus also providing a substantial advantage. For solid waste, there is an existing ash disposal area that has adequate storage for both units for a number of years. There are also additional advantages to the site with the existing roadways, and the existing plant staff. Another advantage is that existing transmission corridors should minimize the impact of transmission additions. Another advantage of the site is the fact that residents in the area have gone through a plant construction and lived with the existing Plant for over thirty years. Last, the addition of a second unit at Big Stone provided an opportunity to construct a single common wet scrubber for both Unit I and Unit II. Because of the common scrubber, we expect sulfur dioxide emissions to be less from the two units than the current sulfur dioxide emissions from Unit I.

Q: Are there any disadvantages to the Big Stone site as compared to the others?

A: Yes, there are some disadvantages to the Big Stone site. One disadvantage of the site is the nature of the water supply. Water availability is dependant on lake elevation. The source of water for the project is Big Stone Lake; the water availability is set by South Dakota statutes for lake elevation. Thus, a certain amount of water storage for drought tolerance will be needed for the unit, even though there is more than adequate water during average conditions. Another potential disadvantage for the site is that it is served by a single rail carrier; it does not have rail competition. Another relatively minor disadvantage is that construction might be a little more difficult than at a new site because of the existing structures that will need to be worked around.

Q: Do the Applicants anticipate that any land will have to be taken through eminent domain for construction of Big Stone Unit II?

A: No. A real advantage of the Big Stone site is that no land will have to be obtained through eminent domain. The current site has approximately 2200 acres of land, which will accommodate all of the needs for the plant expansion with the exception of water storage ponds. It is anticipated that approximately 900 acres of land to the southwest of the existing site will be procured for this water storage pond. This property for the water storage pond has already been purchased or is under option by the Applicants.

IX. TIME SCHEDULE (ARSD 20:10:22:22)

Q: What is the estimated time schedule for the accomplishment of major events in the commencement and duration of construction of the proposed facility?

A: In the Application, there is a table entitled Key Construction Milestones (Table 2-5). I can summarize the timeframe presented in that table. Based on the assumption that all needed permits are received in a timely manner, the first major procurement agreements would be signed in early spring of 2007. In mid-spring 2007, mobilization would begin with support equipment being moved to the site. During summer of 2007, site work would commence with site preparation and then foundation installation. This would be completed so that steel work could commence in early 2008. In late 2008 erection of the boiler and turbine would commence. In early 2009, construction of the balance of plant equipment would commence. Installation of the boiler and turbine would be completed by early 2010. Once the boiler and turbine have been completed, preparation for the commissioning of this equipment would be started by a series of checkout procedures. The first time the unit would operate would then be mid-year 2010, with commissioning and checkout commencing late 2010, for commercial operation in late spring 2011.

X. FUTURE ADDITIONS AND MODIFICATIONS (ARSD 20:10:22:25)

Q: Are there any plans for future modifications or expansion of Big Stone Unit II?

A: At this time no future expansions for the site are contemplated. However, in the design of Big Stone Unit II, consideration is being given to allow enough space between Big Stone Unit I and Big Stone Unit II to accommodate any future modifications that may be required because of changing laws and regulations.

Q: Are there any plans to modify or expand Big Stone Unit I?

A: At this time there are no expansion or modification plans for Big Stone I, with the exception that the exhaust gases from Unit I are planned to be rerouted to a common scrubber that will be constructed as part of Unit II. This will include fans, ductwork, and dampers to accomplish this. The common scrubber is addressed in more detail in the Direct Testimony of Terry Graumann.

XI. PRODUCTS TO BE PRODUCED (ARSD 20:10:22:27)

Q: What will the electrical production from the proposed Big Stone Unit II be?

A: Because Big Stone Unit II is being designed to be a base load facility, it will run at high capacity levels. It is expected that the unit will annually produce in excess of 4.6 million megawatt hours of energy.

Q: Will there be any other products or byproducts produced by the unit?

A: The burning of solid fuel will produce ash, a combustion by-product. The unit is being designed and the fuel is being selected with the expectation that the fly ash produced will be sold into the cement replacement market, thus yielding a very valuable byproduct. The waste from the wet scrubber will be a gypsum material. If a market can be found, this product may be sold into the wallboard manufacturing area. The remaining ash is expected to be land filled.

XII. FUEL TYPE USED (ARSD 20:10:22:28)

Q: What will be the primary fuel used at Big Stone Unit II?

A: The proposed fuel for the unit is subbituminous coal from the Powder River Basin.

Q: What is the heat content of the fuel?

A: The coal to be burned in Big Stone Unit II is the same coal that is being burned in Unit I. Analysis of the Unit I coal over the last five years or so shows a heat content of a minimum of 7,980 Btu per pound and a maximum of 9,500 Btu per pound.

Q: What is the chemical composition of the coal?

A: The chemical analysis of Big Stone Unit I coal is shown in Table 2-1 (Coal Analysis Design Ranges). We expect the chemical composition in the coal for the Big Stone Unit II to be similar.

Q: Will there be other fuels burned at Big Stone Unit II?

A: Yes. Number two fuel oil will be used for igniting the fuel on initial startup and for flame stabilization. Biodiesel could be substituted for number two fuel oil and we are investigating that possibility. We expect this to be a small amount relative to the overall fuel requirements. Also, the nature of a solid fuel boiler would accommodate some other fuel, such as agricultural waste, or some processed wood waste, though this too would be a relatively small percentage of the fuel mix.

XIII. PROPOSED PRIMARY AND SECONDARY FUEL SOURCES AND TRANSPORTATION (ARSD 20:10:22:29)

Q: Where will the subbituminous coal that will be the primary fuel for Big Stone Unit II come from?

A: The coal will originate from the Powder River Basin that extends from southern Montana into Wyoming. This fuel is contemplated to be procured from any of a number of mines that are located in this region.

Q: How will the coal be transported to the Big Stone site?

A: Transportation to the facility from the coalfields will be by unit trains by the Burlington Northern Santa Fe Railroad. The Big Stone site is only served by the Burlington Northern Santa Fe; it does not have rail competition at this time.

Q: Have the Applicants prepared a map showing the location of the coal and the method of transportation?

A: A map is being prepared and one will be available at the time of hearing.

XIV. ALTERNATE ENERGY RESOURCES (ARSD 20:10:22:30)

Q: Did the Applicants consider other energy resources besides coal before selecting the proposed facility?

A: Yes.

Q: Describe the screening process the Applicants undertook as they reviewed alternative energy resources.

A: The decision to pursue construction of a 600 MW coal-fired second unit at the Big Stone plant is one that resulted from extensive analysis by the Applicants. Each of the Applicants considered various different types of generation, both fossil fuel-fired and renewable energy sources, before selecting Big Stone Unit II to meet their baseload needs.

In considering all the different ways in which electricity can be generated, the Applicants made a qualitative assessment of each alternative's capability to meet the underlying objective of providing approximately 600 megawatts of baseload capacity by 2011 at a reasonable cost to their customers. The Applicants also took into account potential environmental and community impacts associated with any project.

This is the same type of qualitative assessment that most utilities regularly undertake and which is undertaken, to my knowledge in similar permitting applications. First, the Applicants conducted an initial screening of various alternatives to determine whether the alternative has the potential to address the need to be served by the proposed project, and then examined in more detail only those options that appeared feasible.

Here the Applicants wanted to make sure that any generation alternative be able to satisfy three basic objectives for a baseload generation unit – the technology must be applicable; the facility must be available for service when needed; and the facility should enhance the overall reliability of the bulk electric system.

Costs, economic effects, and environmental impacts are certainly legitimate project objectives, but if an alternative is not feasible, these other factors are of little significance. That is, if an alternative is not feasible, there is no reason to develop cost estimates.

Our analysis, further discussed below, showed that there are no renewable generation options available to address the need for 600 MW of baseload power within the timeframe required, and that other fossil fuel sources are more expensive and less desirable.

Q. Did the Applicants' analysis include other types of base load power generation technologies at the Big Stone site?

A: Yes. As a part of our overall analytic process, we retained the well-known engineering firm of Burns & McDonnell Engineering Co. to examine alternative baseload generation technologies that could be developed at the Big Stone site. Burns & McDonnell completed this report, termed the "Phase I Report," in July 2005. The Phase I Report examined the following generation technologies (1) 600 MW supercritical PC unit, (2) 450 MW supercritical PC unit, (3) 300 MW subcritical PC unit, (4) 600 MW subcritical circulating fluidized bed (CFB) unit, (5) 450 MW subcritical CFB unit, (6) 300 MW subcritical CFB unit, and (7) 500 MW Combined Cycle Gas Turbine (CCGT) unit. The Phase I Report concluded that a 600 MW supercritical pulverized coal plant represented the lowest cost generation alternative of the technologies evaluated for the Big Stone station site on a life-cycle basis considering capital and operating costs. The Phase I Report is discussed in more depth in the testimony of Jeffrey J. Grieg and Stephen Gosoroski of Burns & McDonnell and is Applicants' Exhibit 24-A.

Q: Has the Applicants' analysis of potential generation alternatives both at the Big Stone site and other possible sites been confirmed?

A: Yes. As part of the Certificate of Need Application to the Minnesota Public Utilities Commission, the Applicants asked Burns & McDonnell to examine alternative generation technologies regardless of where these technologies might be constructed. The analysis is contained in the September 2005 Report entitled "Analysis of Baseload Generation Alternatives," which is sponsored and discussed further in testimony by Jeffrey J. Grieg and Stephen Gosoroski of Burns & McDonnell and is Applicants' Exhibit 23-A. The report confirmed our analysis that a super-critical pulverized coal plant is the least-cost most appropriate way of meeting the base load power needs of the participants.

Q: Please describe the Applicants' overall analysis of alternative technologies that were considered.

A: We considered the following technologies.

Wind

The Applicants recognize that wind will play a significant part in meeting the regional energy needs in the future. For example, GRE stated in its Resource Plan that it filed with the Minnesota Public Utilities Commission that, "wind energy is currently the most cost-effective renewable energy resource. The wind resource is viable within [Minnesota], and there has been particular success in developing wind energy on the Buffalo Ridge in southwestern Minnesota." GRE Resource Plan at 82.

Nonetheless, there are several reasons why wind cannot replace the Big Stone Unit II project. The major reason is that wind cannot be relied on to satisfy a base load demand for 600 MW. Electricity produced from wind is an intermittent resource. Wind turbines typically are only capable of achieving capacity factors in the range of 30 to 40 percent if properly sited in an area with adequate wind resources. This means that wind turbines only generate 30 to 40 percent of the megawatt hours that would have been generated if the units had run at full load continuously for the year. Base load generation is typically required to achieve capacity factors closer to 90%, and provide reliable energy on an around the clock basis. As a result, wind generation is not suitable to meet baseload capacity and energy needs.

Baseload resources are also required to be dispatchable, meaning that they can be scheduled to run at a specified load for a given duration. Since wind power is intermittent based on wind velocities, it is not dispatchable and not suitable as a baseload capacity and energy resource.

Area regulators have recognized that wind is an intermittent resource and cannot provide baseload power. For instance, in its December 2004 Quad Report, the Minnesota Department of Commerce stated, at p. 30:

> Wind energy technologies that generate electricity have become the most visible form of renewable energy in Minnesota. Minnesota has a very significant wind resource, especially in the part of the state that experiences the greatest consistent wind speeds, the area commonly known as the Buffalo Ridge in very southwestern part of Minnesota. The only major drawback of wind energy from an energy standpoint is that the wind energy is an intermittent resource – the wind does not blow, or blow consistently, throughout the day or throughout the year. As a result, wind energy, by itself, cannot be relied upon for baseload or peaking purposes – it cannot be "dispatched" (turned on or off as needed).

In order to even consider wind for base load power, it is necessary to have a backup source of generation to rely on when the wind is not blowing at the necessary speed. Normally, natural gas would be considered the backup fuel because gas plants can be fired up quickly. In this case, that would mean that a gas plant would have to be built somewhere in the area, probably at the Big Stone Plant site. Of course, a gas plant creates its own problems of fuel cost and availability. The other backup possibility is existing generation facilities, but even assuming that these facilities were available to be dispatched, they would be less economic to run than a new Big Stone Unit II and would have less emission controls.

The Applicants agree that wind power has come down in price, but the analysis in this case shows that Big Stone Unit II is the cheapest of the various alternatives per unit of electricity. In addition, the cost of wind power is affected greatly by the federal production tax credit (1.9 cents per kilowatt hour, adjusted for inflation) and while Congress has recently extended the credit for another two years, it is unclear that it will continue beyond 2007.

Biomass

The Burns & McDonnell Analysis of Baseload Generation Alternatives Report demonstrated that biomass is not a feasible alternative. Burns & McDonnell concluded that it would take approximately 600,000 acres of land to support such a plant if it were to burn whole trees, a land size nearly double the size of Big Stone County, Minnesota. The report found that biomass is not economically viable for base load energy production compared to Big Stone Unit II.

Hydropower

Hydropower was another generation option that was considered and rejected by the Applicants because there was not enough hydropower to satisfy the projected need.

Recent analysis by state regulators in Minnesota showed that neither Minnesota (with undeveloped capacity of 137 MW of hydropower) nor North Dakota (with only 50 MW of availability) would be able to satisfy the Applicants' need.[1] The analysis also showed that South

[1] Testimony of Dr. Steve Rakow, at p.16, Minnesota Department of Commerce, *In the Matter of the Application of Xcel Energy for a Certificate of Need, Blue Lake Generation Plant Expansion Project*, PUC Docket No. E002/CN-04-76.

Dakota had the potential for 695 MW of hydropower at 33 different sites, three of which are on the Missouri River that had a potential capacity greater than 50 MW. Id. However, it would take nearly every watt of hydropower potential in South Dakota to satisfy the 600 MW demand and the Missouri River Basin is presently suffering through a long-term drought. Id. As a result, the Applicants concluded that hydropower is not a realistic option.

Solar

Solar power is not a viable option to the proposed Big Stone Unit II. The Applicants need base load energy – which means electricity that is capable of running at very high capacity factors – e.g., better than 90%. As found in similar proceedings, solar has been recognized not to be an option in this region because it is an intermittent resource that cannot be counted upon to be dispatched. Id. This is the same conclusion reached by OTP and GRE in their recently filed Resource Plans, and the same conclusion reached by the Applicants here.

Landfill gas

OTP and GRE analyzed the possibility of landfill gas in their Resource Plans. Both concluded that landfill gas was not a viable option because no sources are available that would satisfy the need for additional base load generation. The Applicants reached the same conclusion here.

Geothermal Energy

Geothermal energy was dropped from consideration by the Applicants because there are no such resources available to meet the demand in the Applicants' service areas.

Distributed Generation

Fuel cells and microturbines are two methods of distributed or dispersed generation. Neither option passed the screening analysis because the technology is not compatible with base load energy.

Atmospheric Circulating Fluidized Bed (ACFB)

A fluidized bed unit uses a different type of technology to burn the coal. The combustion process occurs in a suspended bed of solid particles in the lower section of the boiler. Combustion occurs at a slower rate and at lower temperatures than a conventional pulverized coal boiler. This technology allows a wide variation in fuel size and type and heat content. The coal normally burns cleaner than in a pulverized boiler but state-of-the-art control equipment is still required.

A fluidized bed unit costs about 5% more than a pulverized coal unit. Also, the largest atmospheric fluidized bed boilers in operation are approximately 300 MW in size, and all ACFB boilers built to date are of sub-critical design; thus their efficiency is considerably less than the super-critical pulverized coal design.

Combined Cycle Natural Gas Turbine

The basic principle of the combined cycle gas turbine is to utilize gaseous fuels, such as natural gas, to produce power in a gas turbine, which is used to generate electricity, and to use the hot exhaust gases from the gas turbine to produce steam in a heat recovery steam generator to produce more electricity from the steam. Combined cycle operations can obtain efficiencies in the 50 to 58% range.

A natural gas combined cycle plant is less expensive to construct than a pulverized coal plant. However, the busbar cost of the electricity (the cost of electricity at the point of delivery from the generation source without any transmission or distribution costs) is significantly higher. The Burns & McDonnell Analysis of Baseload Generation Alternatives Report confirms this. That report shows a busbar cost of $77.94 for investor owned utilities and $75.61 for public power companies for combined cycle units, as opposed to $58.81 and $47.37 for a super-critical pulverized coal unit.

In addition, the availability and price volatility of natural gas were a concern to the Applicants. The Burns & McDonnell report assumes a $7.00/MMBtu cost (2011 dollars) based on the NYMEX futures price in calculating the cost of electricity from the combined cycle plant. The price of natural gas, however, recently traded at a record price of over $11/MMBtu and there are concerns that a $7.00/MMBtu natural gas price assumption in 2011 is unrealistic. The concern is not just the price of natural gas on the day Big Stone Unit II first operates but the fact that natural gas prices have proven to be highly volatile on the high side and unpredictable. In contrast, coal prices tend to be more stable and predictable. In addition, because there is no pipeline presently running to the Big Stone plant, the cost of a natural pipeline would have to be considered.

The Burns & McDonnell report also didn't include the cost of No. 2 fuel oil for backup in the event natural gas was not available, as would actually be required.

More information about a natural gas combined cycle plant can be found in the Burns & McDonnell Report.

Wind Plus Combined Cycle Natural Gas

As discussed, relying on a 600 MW wind farm alone for baseload needs is infeasible. Burns & McDonnell's Analysis of Baseload Generation Alternatives Report, however evaluated a combination of 600 MW of wind, backed-up by a 600 MW combined cycle gas turbine. Wind energy would be utilized when it was available and the combined cycle unit would operate as necessary to back-up the wind's intermittency.

Under this scenario, the combined cycle natural gas plant would have the same economic and environmental implications described in Section 6.3.3.3, including the volatility of and increased price of natural gas. Because the plant would be required to operate at part load dispatch levels, its heat rate would also be higher than a baseload CCGT unit. The "load following" required by the CCGT unit would also likely cause additional O & M costs over a baseload CCGT because of stresses due to continued turbine cycling.

The Burns & McDonnell report assumes that the Applicants would not own the wind turbines, but would have power purchase agreements for 600 MW of wind. The report also assumes no extension of the federal production tax credit of 1.9 ¢/kwh (adjusted for inflation) beyond 2007, though the report does include sensitivity analysis that assumes PTC extension.

The report assumes a price of $50/MWh for wind, which models show to be a good estimate of future wind prices without the PTC. With that assumption and assuming no costs for transmission and $7.00/MMBtu gas, Burns & McDonnell calculated a busbar cost for wind plus CCGT of $72.89 for investor owned utilities and $70.57 for public power companies.

This is significantly more expensive than pulverized coal.

Integrated Coal Gasification Combined Cycle

Integrated Gasification Combined Cycle (IGCC) technology is a system that produces a syngas from a fossil fuel such as coal and utilizes the gas to generate electricity in a conventional combined cycle plant. The Applicants asked Burns & McDonnell in its Analysis of Baseload Generation Alternatives Report to confirm the performance and costs and other features of an IGCC system.

The proposal as examined called for a 535 MW IGCC generating station comprised of two coal gasifiers, two "F" class gas turbines, each coupled with a heat recovery steam generator and a single, reheat steam turbine. Because there are no IGCC facilities in the United States that have ever used subbituminous western coal, as proposed for Big Stone Unit II, Burns & McDonnell assumed that bituminous Illinois coal would be used. Also, because an IGCC unit would require natural gas as backup, Burns & McDonnell assumed that an IGCC facility would not be located at the Big Stone Plant, because there is no natural gas supply at that location.

Burns & McDonnell found that an IGCC plant had higher construction costs than a coal plant. Burns & McDonnell calculated a busbar cost (the cost of electricity at the point of delivery from the generation source without any transmission or distribution costs) of $58.81 for a super-critical pulverized coal plant and $83.84 for an IGCC facility for investor owned utilities, and $47.37 and $71.05 respectively, for public utilities. An IGCC plant would cost 43% and 50% more than a coal plant for the two types of utilities.

In addition, historically, IGCC plants have not achieved high capacity factor operations. In addition, as discussed further by Burns & McDonnell, IGCC is still a developing technology.

While the Applicants recognize that IGCC has potential, it is not a feasible option to Big Stone Unit II. The discussion in the South Dakota Application, about IGCC, ends, "In conclusion, IGCC is considered a developing technology that has not performed reliably in commercial operation to date. Therefore, as we state in the Application, IGCC is not considered feasible for the Project." Application at p. 75.

XV. ESTIMATE OF EXPECTED EFFICIENCY (ARSD 20:10:22:32)

Q: What is the estimate of the expected efficiency of the proposed Big Stone Unit?

A: The exact efficiency of the proposed project is not known at this time because final design determinations have yet to be made. Decisions on the particular equipment and vendors selected for the project will determine the final outcome of the project's efficiency. However, the decision to go with a super-critical steam cycle was done because it delivers higher efficiency than a subcritical cycle. We have used in our calculations for the feasibility of the unit, a value of 9,392 BTU's per kilowatt hour. This means it will take 9,392 BTU's of energy from fuel to produce 1 kilowatt hour of electricity. This translates into an overall thermal efficiency of greater than 36%. We are confident that the final design for the unit will yield a heat rate and efficiency number that are better than the conservative numbers predicted at this time.

XVI. DECOMMISSIONING (ARSD 20:10:22:33)

Q: Describe the Applicants current analysis with respect to decommissioning of the proposed Big Stone Unit II.

A: At this time, the Applicants will comply with the laws and regulations that are in place for decommissioning at the time Big Stone Unit II would be decommissioned. Because the expected life of Big Stone Unit II is quite long, it is difficult to predict what these requirements will be, but many of the Applicants have gone through decommissioning efforts in the past and are fully prepared to comply with whatever requirements there are for the decommissioning of Big Stone Unit II.

Q: Does this conclude your testimony?

A: Yes it does.