BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF NORTH DAKOTA

In the Matter of the Application of	**)**	
OTTER TAIL CORPORATION, d/b/a	**)**	**Case No. PU-06-481**
Otter Tail Power Company, for an	**)**	
Advance Determination of Prudence	**)**	
for the Big Stone II Generating Plant	**)**	

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DIRECT TESTIMONY

OF

MARK ROLFES

PROJECT MANAGER

OTTER TAIL POWER COMPANY

DECEMBER 1, 2006

BEFORE THE NORTH DAKOTA PUBLIC SERVICE COMMISSION

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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, including the interconnection facilities that are required to accommodate interconnection of the unit to the transmission grid.

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 Unit 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 Unit 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: The purpose of my testimony is to provide an overview of the Big Stone Unit II generation project in South Dakota and to address the various generation technologies that were considered before selecting a supercritical pulverized coal plant.

Q: Please summarize your testimony.

A: The Big Stone Unit II Co-owners evaluated several different alternative generation technologies before selecting Big Stone Unit II. The analysis determined that several alternative technologies were not feasible, and several, including a combination of wind energy "firmed" up by natural gas, were more expensive than the pulverized coal technology. I describe the time schedule for construction of the proposed new plant, which anticipates completion of construction in 2011 and commercial operation in 2012.

III. BIG STONE UNIT II

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%; Great River Energy, Otter Tail, and Montana-Dakota Utilities Co. (Montana-Dakota) each owning 19.3%; Southern Minnesota Municipal Power Agency ("SMMPA") owning 7.8%); Central Minnesota Municipal Power Agency ("CMMPA") owning 5%; and Heartland Consumers Power District ("HCPD") owning 4.2%).

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 – 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 have 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.

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

A: Big Stone Unit II is being proposed to provide baseload electric generation for the seven Co-owners 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 Co-owners' retail and wholesale native load customers. It is expected that Big Stone Unit II will generate in excess of 4.85 million megawatt-hours of energy annually.

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 Unit I Plant. The project will generate approximately 630 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.

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: 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: 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 or a backup ground water source will need to be developed. 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: What is the estimate of the expected efficiency of the proposed Big Stone Unit II?

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 Co-owners have made the decision to go with a super-critical steam cycle because that technology delivers higher efficiency than a subcritical cycle. Current projected heat rate for Big Stone Unit II is 8,988 BTUs per kilowatt hour. This means it will take 8,988 BTUs of energy from fuel to produce 1 kilowatt hour of electricity. This translates into an overall thermal efficiency of approximately 38%.

Q: How much will Big Stone Unit II cost?

A: The proposed Big Stone Unit II facility is projected to cost approximately 1.6 billion dollars (in 2011 dollars): 1.36 billion dollars for the plant and 238 million dollars for the transmission upgrades associated with the plant. The Co-owners are continually refining these cost projections.

Q: Please describe the process for determining cost estimates for the Big Stone Unit II project.

A: The process of determining cost estimates for the Big Stone Unit II project is similar to most large construction projects. It begins with a feasibility study to determine the likelihood of the project being successful. To do this a cost estimate is established for a generic plant. That is what was done for Big Stone Unit II in 2004. The cost estimate that was established in 2004 was then modified based on changes in the in-service date and for major design changes. The most notable change during the period from the initial feasibility study until the fall of 2005 was the decision to install a wet, rather than a dry, scrubber. The scrubber is the device for controlling SO_2 emissions. A wet scrubber uses a liquid reagent and is more costly but does a better job of controlling emissions than does a dry scrubber process. The feasibility study work was done by the Burns & McDonnell engineering firm. When the Co-owners determined that a supercritical unit with a wet scrubber appeared as the best option for their baseload generation needs, they decided to solicit bids from engineering firms to do the actual design work.

In the summer of 2005, the Co-owners selected Black & Veatch to be that firm. In October of 2005, shortly after they began work on the project, the Co-owners asked

Black & Veatch to do a quick "sanity check" on the numbers that we were using, which were estimates that had been prepared by Burns & McDonnell, also a large, respected engineering firm. This sanity check was a very brief review of other projects that Black & Veatch was involved in versus the cost that we were estimating for the Big Stone Unit II project. This sanity check showed that the cost estimates were reasonable, as they were squarely within the same range as the other projects on which Black & Veatch was working. Then, in early 2006, the Co-owners began to tighten down on the actual design parameters for the Big Stone Unit II.

At that time the project was transformed from a generic plant to a custom-designed plant based on the specifications selected by the Big Stone Unit II project Co-owners. Once the design parameters were established - and these included such things as the number of feedwater heaters, the cycle temperatures, the type of feed pumps that we plan to use, and many other parameters, Black & Veatch did a cost estimate based on the design and current market conditions. This information was supplemented with actual bids for five major components of the plant and indicative budgetary bids for others components of the plant. Then, the information was compiled along with non-plant items such as land procurement, project development, insurance, etc. and a total projected cost for the plant was delivered to the Co-owners in a proposed budget in July of this year.

After this, more precise cost information was in hand, we continued the engineering work to evaluate the prudence of the decisions made during the design process and to evaluate whether the estimated cost increases were reasonable, and whether things could be done to lower those costs. While on a different scale, the process the Co-owners employed is not significantly different than when someone decides to build a house. You get price estimates, and you determine whether some of the items that you included in your original design remain prudent. Since obtaining more precise cost information, we have been refining and adjusting to make a better, more cost-efficient plant.

Based on our adjustments, the projected cost has been reduced by approximately $165 million from the Black & Veatch report that we received in July.

Also, it should be noted that modifications to the plant design reflected in the Black & Veatch report have yielded a more efficient plant. We expect the unit to be 4% more efficient than originally projected, this means 4% less fuel consumed, and 4% less emissions. To increase efficiency, design changes have been made that have increased initial cost but that will reduce fuel costs. These changes include such things as an additional feedwater heater, steam driven boiler feedpumps, higher operating temperatures for the boiler and other related changes. These changes will also reduce operational maintenance costs. We have also seen some slight decreases in other operation and maintenance costs because of this improved efficiency and the more efficient operation of the scrubber and other equipment.

In addition, design review now suggests that a unit approximately 5% larger than what the original estimate was based on will result in greater plant efficiencies. Despite the 5% increase in size of the unit, the Big Stone Unit II Co-owners have committed to keeping emissions from both Unit I and Unit II of nitrogen dioxide, sulfer dioxide, and mercury to no more than what is currently emitted from Unit I (a 450 MW unit).

Q: The Big Stone Unit II was originally sized at a nominal 600 MW. Now it is nominally sized at 630 MW. Please explain.

A: As stated earlier, the proposed Big Stone Unit II is now approximately five percent (5%) larger than originally envisioned. The size of a power plant is somewhat akin to the gas mileage of a car. It is dependent upon many variables and no one ever seems to have exactly the result that they anticipate. To the extent there is any confusion over the size of the Big Stone Unit II, that is normal. All projects that I am aware of go through the same thing as the engineering conditions are defined. The proposed Big Stone Unit II plant conceptually began as a nominal 600 megawatt generic unit, meaning generally that on an average day the unit would produce 600 megawatts. As we began the design process, the Co-owners felt that they needed to have a unit that would reliably produce 600 megawatts during summer extreme conditions, and resulted in us specifying a unit that would produce 600 megawatts on a day defined as a "1% day." That is a day that is 95 degrees dry bulb, 76 degrees wet bulb. This is a day that is very hot and very humid, that happens 1% of the time or less. This means that during more average conditions, the unit would likely be producing approximately 630 megawatts. Again, it must be remembered that the actual output of any unit is dependent upon many conditions, most notably ambient air conditions (e.g., temperature and humidity).

Q: What is the time schedule for construction of Big Stone Unit II?

A: Assuming the project meets current permitting, financing, and commercial schedules, the mobilization of equipment to the site will begin in early 2008. Also, early in 2008, site work would commence with site preparation and then foundation installation. We hope to complete that in time for steel work to begin in early 2009. In late 2009 erection of the boiler and turbine would commence. In early 2010, construction of the balance of the plant equipment would commence. Installation of the boiler and turbine would be completed by early 2011. 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 late 2011, with commissioning and checkout commencing late 2011, for commercial operation in late spring or early summer 2012.

Q: Did the Co-owners explore the possibility of generating power by means of renewable energy sources in this case?

A: Yes, we did. We considered hydro, wind, solar, geothermal, and biomass.

Q: Please describe the process the Co-owners followed to evaluate alternative energy sources?

A: The process began with 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, followed by an examination in more detail of only those options that appeared feasible. The Co-owners wanted to make sure that any generation alternative would 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.

Q: What was the result of this evaluation?

A: We determined that several renewable energy options were simply not feasible as a source of 600 MW of baseload generation; they did not meet the three basic objectives I described above. Hydro, solar, geothermal energy, landfill gas, fuel cells, microturbines, and wind too, were found to not meet these basic objectives.

Q: Were there any generation alternatives that were examined in more detail?

A: Yes, there were several. Importantly, it must be first remembered that each of the Co-owners determined through their respective resource planning processes whether a base load, pulverized coal unit such as Big Stone Unit II fit their respective resource needs, or more accurately, a portion of their needs. It is my understanding that each of those respective resource evaluations showed that such a resource was least cost.

After the Co-owners individually determined that they needed base load energy, and that a Big Stone Unit II was a fit for their needs, the Co-owners wanted to verify these separate conclusions. The Co-Owners hired Burns & McDonnell to evaluate in detail several generation alternatives, including a wind plus combined cycle natural gas combination, an integrated coal gasification combined cycle (IGCC) option, and 100% biomass option, although the biomass option was only for 50 MW. The 100% biomass option is surely a renewable energy source, the wind/gas combination is in part a renewable source since a portion of the power would be generated by wind. The Co-owners also had that analysis reperformed in October 2006, after they obtained cost projections based on the custom design of the plant. This updated analysis evaluated whether the Big Stone Unit II project remains a low cost baseload alternative.

Q: What were the results of the examination of these generation alternatives?

A: The results of the analysis are presented in the September 2005 Report entitled "Analysis of Baseload Generation Alternatives," and the October 2, 2006 report entitled "Revised Analysis of Baseload Generation Alternatives," both which are attached as Exhibit No. ______ (MR-1) and Exhibit No. ______ (MR-2), respectively. The analysis showed that a pulverized coal plant was the lowest cost option per unit of electricity of the alternatives examined.

Q: What did the analysis show with regard to a wind alternative?

A: Otter Tail, Montana-Dakota and the other Big Stone Unit II Co-owners recognize that wind will play a significant part in meeting the regional energy needs in the future.

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. 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.

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. Burns & McDonnell 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 as a combined cycle plant alone, 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 October 2006 Burns & McDonnell report assumes that the Co-owners 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 $60/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 $7.60/MMBtu gas, Burns & McDonnell calculated a busbar cost for wind plus CCGT of $80.78 for investor-owned utilities.

This is significantly more expensive than the supercritical pulverized coal option being pursued, which has a busbar cost of $69.62 for investor-owned utilities.

Q: Is a wind/natural gas combination less costly than the proposed Big Stone Unit II?

A: Our best estimate under what we believe are the most reasonable assumptions, is that a pulverized coal plant like Big Stone Unit II is the most economic technology to address the resource needs identified by the Co-owners' respective resource planners, given all the factors related to size, type, and timing.

Q: Does this conclude your testimony?

A: Yes it does.