Direct Testimony and Exhibits
Mark Lux

Before the South Dakota Public Utilities Commission
of the State of South Dakota

In the Matter of the Application of
Black Hills Power, Inc., a South Dakota Corporation

For Authority to Increase Rates
in South Dakota

Docket No. EL09-___

September 29, 2009

Table of Contents

Exhibits

I. INTRODUCTION AND QUALIFICATIONS

Q. WHAT IS YOUR NAME AND BUSINESS ADDRESS?

A. My name is Mark Lux. My business address is 350 Indiana St., Ste 400, Golden Colorado 80401.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CONTEXT?

A. I am currently employed by Black Hills Service Company, a wholly-owned subsidiary of Black Hills Corporation ("Black Hills Corporation"), as Vice President and General Manager of Power Delivery for Black Hills Corporation. In that role, I am responsible for the operation and construction of the electrical power generation and coal mining assets owned by Black Hills Corporation subsidiaries, including Black Hills Power, Inc. ("Black Hills Power").

Q. **ON WHOSE BEHALF ARE YOU APPEARING IN THIS APPLICATION?**

A. I am appearing on behalf of Black Hills Power.

Q. PLEASE DESCRIBE YOUR PROFESSIONAL EXPERIENCE.

A. I received a Bachelor of Science degree with honors in Mechanical Engineering from the South Dakota School of Mines and Technology in 1987. I have more than 25 years of experience working in the mining and electrical power industry, in both nuclear and fossil fuel power generation, including operating experience and power plant construction experience. I have been and continue to be involved in the development, engineering, construction and commissioning of the Wygen III plant as well as other coal fired power plants owned by subsidiaries of Black

Hills Corporation, including Neil Simpson II, Wygen I and Wygen II. I am also responsible for the Independent Power Production ("IPP") of Black Hills Corporation and have experience in the generation, project development and construction of IPP generation resources.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to discuss the construction, operation and maintenance costs for Wygen III.

II. HISTORY OF NEIL SIMPSON ENERGY COMPLEX

Q. WHERE IS WYGEN III LOCATED?

A. Wygen III is located at the Neil Simpson Energy Complex ("NSEC"), which is located approximately eight (8) miles east of the City of Gillette, Wyoming, on property owned by Wyodak Resources Development Corporation ("Wyodak Resources"), a wholly owned subsidiary of Black Hills Corporation.

Q. ARE THERE OTHER OPERATIONS LOCATED AT THE NEIL SIMPSON ENERGY COMPLEX?

A. Yes, there are currently five other operational coal fired power plants located at the NSEC. Those plants are referred to as Wyodak, Neil Simpson I, Neil Simpson II, Wygen I and Wygen II. In addition, two gas fired turbines are located at the site. Black Hills Power owns 100 percent of the Neil Simpson I and II plants, 20 percent of the Wyodak plant and 100 percent of one of the gas fired turbines. Based upon the assumptions being made in this application, as referenced in

earlier testimony, Black Hills Power will own 52 percent of Wygen III. Wygen I and Wygen II are owned by affiliates of Black Hills Power.

Located next to the power plants is the Wyodak coal mine (the "Wyodak Mine"), which is owned by Wyodak Resources. The Wyodak Mine provides the coal supply for the five existing coal fired power plants and will also supply coal to Wygen III. The aerial photo attached to the testimony of Thomas M. Ohlmacher as Exhibit TMO - 2 shows the relative locations of each power plant and the mine. The Wygen III power plant connects to the Donkey Creek substation, which is interconnected to the Wyodak 230-kV substation and Black Hills Power's integrated transmission system..

Q. PLEASE DESCRIBE THE EXISTING POWER PLANTS AT NSEC.

A. Neil Simpson I was built in 1969 and is a 21.8 megawatt ("MW") power plant. Neil Simpson I was the first air cooled power plant built in the United States and was the pilot plant for the larger 362 MW Wyodak plant built in 1978. Neil Simpson II began operating in 1995 and is a 90 MW capacity facility. Wygen I has been operating since 2003 and has a capacity of 91 MWs. Construction on Wygen II was completed in January 2008 and its capacity is 95 MWs. Wygen III is scheduled for completion on April 1, 2010 and will be a 110 MW capacity facility. The MW capacity referenced above for each plant is the "gross" capacity, meaning the amount of power generated at the plant, before a portion of the power generated is used to power the plant.

Q. WHAT IS THE HISTORICAL PERFORMANCE OF THE EXISTING POWER PLANTS AT NSEC?

A. Starting with Neil Simpson II, each coal fired power plant built at the NSEC has been one of the cleanest, most reliable, and most efficient coal fired power plants in the nation at the time it was built.

The efficiency and reliability of these plants is exemplified by their availability rates, which indicate the percentage of time that the plant is available to generate power. Neil Simpson II has averaged 96.39 percent availability since it began its first full year of operation in 1996. Wygen I was available 94.5 percent in its first year of operation and has averaged 96.4 percent availability thereafter. Wygen II achieved 93 percent availability in 2008, its first year of operation, and is trending to achieve 95 percent availability in 2009.

In addition, various industry groups have recognized the efficiency and reliability of the existing coal fired power plants at NSEC. Innovative Business Engineering ("IBE"), a benchmarking service company, consistently ranks Neil Simpson II, and Wygen I in the top 10 in "best of class" rankings among all coal fired power plants in the western United States in the North American Electric Reliability Corporation ("NERC"), Western Electricity Coordinating Council ("WECC") and Electric Reliability Council of Texas ("ERCOT") regions. These rankings consider the emissions, fuel cost and thermal efficiency of all coal fired power plants in these regions. The most recent reports from IBE are attached to this testimony as Exhibit ML-1.

Additionally, each of the plants at the NSEC has consistently exceeded the industry average for availability of coal fired power plants, which is approximately 88 percent as determined by the NERC Generating Availability Data System database, a recent copy of which is provided as Exhibit ML-2.

III. WYGEN III

Q. PLEASE DESCRIBE THE WYGEN III POWER PLANT.

A. Wygen III is an air cooled, coal fired power plant with a 100 MW net generating capacity and a 110 MW gross generating capacity. Wygen III is located adjacent to the Wygen II plant at the NSEC, on land owned by Wyodak Resources. Wygen III occupies approximately 12 acres of the NSEC. The Wyodak Mine is located adjacent to the Wygen III plant and will provide the coal for the plant. Wygen III shares certain facilities, support staff and equipment with other plant facilities, including the Wygen II plant. The costs associated with these shared facilities, equipment and staffs are managed pursuant to a written Shared Facility Agreement, which is attached to this testimony as Exhibit ML-3.

Q. PLEASE DESCRIBE YOUR ROLE ON THE WYGEN III PROJECT.

A. My role on the Wygen III project is similar to the role I played in the construction of Neil Simpson II, Wygen I and Wygen II. I am responsible for supporting the overall project development and responsible for the management of the construction of the Wygen III power plant. In that role, I oversee the preparation of plans and specifications, oversee the competitive bid process, manage the selection and sourcing of equipment, manage the construction project, and prepare

plans for the housing of construction workers. I also supported and in some cases led the process by which the required permits were obtained, including the air permit, the industrial siting permit and the Certificate of Public Convenience and Necessity from the Public Service Commission of Wyoming.

Q. WHAT ARE THE MAJOR COMPONENTS OF THE WYGEN III PLANT?

A. The major components of the Wygen III plant include the steam generator, turbine generator, air quality control system, air cooled condenser, boiler feed-water and condensate pumps, feed-water heaters, exhaust stack, plant control system, conveyor system, power switchgear and transformers, and the balance of plant equipment, including a fully automated state of the art control system. A diagram showing the major components of the Wygen III plant is attached to this testimony as Exhibit ML-4.

Q. DESCRIBE THE ANTICIPATED COSTS ASSOCIATED WITH THE WYGEN III PLANT.

A. The total construction cost of Wygen III was originally estimated at $255 million. The actual costs are anticipated to come in at approximately $247 million, which is approximately three percent (3%) under the original estimate. A comparison of the budgeted and estimated actual expenses as of July 2009 is set forth below:

	($ in Millions)		
		Budget	July 2009 Estimate To Complete
	Direct costs	$210.6	$212.8
	Indirect costs	$ 1.7	$ 5.7
	Sales Tax	$ 6.7	$ 6.7
	AFUDC	$ 28.0	$ 21.8
	Contingency	$ 8.0	
	Total	$255.0	$247.0

Q. HOW CONFIDENT ARE YOU OF THE UPDATED COST ESTIMATES?

A. We are very confident of these estimates because 99 percent of all the contracts entered into for the construction of the Wygen III plant are fixed price contracts. As of July 31, 2009 the project is 83 percent complete. A Progress Summary Report, attached to this testimony as Exhibit ML-5, provides additional detail on the work that has been completed.

In addition, we are confident of these anticipated costs because of our experience in constructing Neil Simpson II, Wygen I, Wygen II and other power plants owned by subsidiaries of Black Hills Corporation.

Furthermore, we hired some of the same contractors for Wygen III as were used on Wygen II, which has contributed to increased efficiency of these contractors,

and has allowed the project to proceed ahead of schedule. Our main risk at this point is being able to complete the construction project on schedule, which is largely contingent on the timely delivery of the turbine generator. At this time, everything is on schedule; however, any delay in scheduling will result in increased costs.

Q. WHO HAS MANAGED THE CONSTRUCTION OF THE WYGEN III POWER PLANT?

A. The construction of Wygen III has been managed by Black Hills Electric Generation, LLC, a wholly owned subsidiary of Black Hills Corporation, and a successor to Black Hills Generation, Inc. (Black Hills Electric Generation, LLC and Black Hills Generation, Inc. are collectively referred to as "BHEG"). Over the years, BHEG has managed the construction of approximately 1,000 MW of power plants, including Neil Simpson II, Wygen I and Wygen II as well as other affiliated power plants, including the most recent 149 MW Valencia power plant in New Mexico. A summary of BHEG's experience constructing power plants is shown on Exhibit ML-6. The coal fired power plants built at the NSEC have consistently been built on time and these plants have achieved an availability rate higher than the industry average.

BHEG's roles in the self-build capacity include coordinating the selection and procurement of equipment for the plant, managing the construction, start-up and commissioning of the plant, containing costs, implementing safety programs and procedures and maintaining the project cost and schedule. Through its experience

managing self-built projects, BHEG has developed project management expertise, relationships with technology providers, a positive reputation in the market place, and relationships with bidding vendors, all of which allow for efficient contracting and management of power plant construction projects. BHEG provides these services to Black Hills Power at its cost, without any profit mark-up.

Q. WHAT OTHER OPTIONS ARE AVAILABLE FOR THE MANAGEMENT OF A COAL FIRED POWER PLANT CONSTRUCTION PROJECT?

A. The alternative to self-building power plants is to hire a third party to assume the management of the construction project. This construction management strategy is referred to as Engineer, Procure, Construct, or an EPC build strategy. Based upon the information we have received from our engineers, as well as others in the industry, and based upon our own experience, EPC built projects typically cost 15-20 percent more than self-build options. This increased cost is because the EPC contractor bears all the risk of the project cost and will therefore build a risk premium into the total project cost.

Q. IS THERE AN INDUSTRY STANDARD FOR THE TYPICAL COSTS TO CONSTRUCT A COAL FIRED POWER PLANT?

A. Power plant costs vary depending on the site specifics and design requirements but yes, the industry benchmarks for coal fired power plants constructed in 2008 were as high as $3,200 per installed kW. *See* Exhibit ML-7. Using the self-build model has allowed BHEG to construct Wygen III at a competitive price as compared to even larger projects that achieve additional economies due to their size. Wygen III

was originally budgeted to cost $2,320 per installed kW and the updated cost forecast of $247 million will produce a rate of $2,245 per installed kW, which is below the industry standards for construction projects of this nature. We believe this cost per installed kW provides strong support for the decision to self-build Wygen III. It also demonstrates that the small plant size of Wygen III does not prevent Black Hills Power from building power plants in a cost competitive manner.

Q. WHAT HAVE BEEN BHEG'S RESULTS WHEN IT SELF-BUILDS COAL-FIRED POWER PLANTS?

A. Each power plant that BHEG has built at the NSEC was built on time. Construction on Neil Simpson II was completed in 1995, within the 26 months budgeted for the project and within the budgeted cost. Wygen I was completed within a record 24 months and Wygen II went into operation in January 2008 within the budgeted 28 months of construction.

Q. DESCRIBE THE PROCESS BY WHICH YOU SECURED CONTRACTS FOR THE CONSTRUCTION OF WYGEN III.

A. At the time we were preparing for the construction of Wygen III, we saw several key issues developing. First, on the global market, power plant costs and materials costs for power plants were escalating rapidly. The Report from Cambridge Energy attached to this testimony as Exhibit ML-8 details the dramatic increases in construction and materials costs since 2000. Second, the demand for key subcontractors was outstripping the supply of those subcontractors, creating a

market that favored subcontractors. For example, chimney erection subcontractors were projecting a two year lead time. Other subcontractors were refusing to enter into fixed price contracts, instead negotiating time and materials type bids. Third, Basin Electric announced that it would be building a large 400 MW coal fired power plant only a few miles away from the NSEC, which would have an adverse impact on the supply of local subcontractors and available labor for this project.

To address these concerns, BHEG took several key steps. First, BHEG secured fixed price contracts from some key subcontractors that had been involved in the Wygen II project and from whom BHEG had received competitive bids for their portions of that project. Using the competitive bids that were submitted on the Wygen II project as a starting point, we negotiated and entered into fixed price contracts with those key parties, allowing for reasonable price increases. Locking in these key contracts allowed BHEG to insure that the construction process could proceed in a timely manner with secured resources while avoiding the distinct potential of increased subcontract prices. Using contractors that were familiar with the project also has resulted in increased efficiency by those contractors and has contributed to the low Occupational Safety and Health Administration incidence rate on the project of 1.5, as compared to the industry average of 5.8.

Second, BHEG secured contracts with local trade contractors whenever possible. As part of the Industrial Siting Permit process, BHEG was required to make arrangements for adequate living quarters for all workers on the Wygen III project. By using local trade contractors, BHEG reduced the expense related to housing.

In summary, the Wygen III project strategy involved two elements: (i) securing key contracts early to establish a reliable schedule and reduce price risk and (ii) securing competitively bid fixed priced contracts for the remainder of the project.

Q. EXPLAIN HOW THE COMPETITIVE BID PROCESS WORKED.

A. BHEG hired Black & Veatch as the engineer of record for Wygen III. Black & Veatch prepared the specifications for the plant, and after BHEG reviewed and approved these specifications, Black & Veatch prepared requests for proposals, which were submitted to various vendors. Black & Veatch reviewed the bid proposals submitted by the vendors and made recommendations to BHEG regarding the bid proposals. BHEG also reviewed the bid proposals and ultimately accepted the bid proposals. All successful bidders were required to provide security for their performance, and no affiliates or subsidiaries of BHEG, Black Hills Power, or Black Hills Corporation were allowed to submit bid proposals. In general, only fixed price contracts were accepted.

Q. WHAT IS THE SIGNIFICANCE OF WYGEN III BEING "AIR COOLED" VERSUS WATER COOLED?

A. Air cooled plants use air to cool the steam generated by the burning of the coal, as opposed to using water. This allows Wygen III to use dramatically less water than water cooled plants. For example, a 100 MW water cooled plant uses approximately 2,000 gallons per minute to cool the steam, compared to an air cooled plant that uses only 100 gallons per minute.

Q. PLEASE EXPLAIN THE AIR QUALITY CONTROLS EMPLOYED AT WYGEN III.

A. Wygen III follows the tradition established by Neil Simpson II, Wygen I and Wygen II by employing state of the art air quality control technology. Like Neil Simpson II, Wygen I and Wygen II before it, Wygen III will be one of the cleanest operating coal fired plants in the nation when it begins operation.

The air quality controls incorporated into the Wygen III plant account for approximately thirty five percent (35%) of the overall cost of the Wygen III project, and generally control the emissions of Nitrogen dioxides (NOx), Sulfur dioxides (SOx), mercury (HG) and fly ash.

To control the emissions of NOx, Wygen III first employs low NOx burners. These burners control the temperature of the flame used to heat the coal, which in turn reduces the amount of NOx produced. The gas produced by the coal combustion then passes through a selective catalytic reduction ("SCR") component, which injects ammonia into the gas stream. The ammonia mixes with the gas stream and separates the NOx into water and nitrogen.

From the SCR, the gas travels to the SOx scrubber system which employs a spray dryer absorber and slurry absorption process to absorb the SOx. Lime slurry is mixed with the flue gas to convert the sulfur to sulfur phosphate. The sulfur phosphate is subsequently removed from the flue gas with the fly ash, as described below. Approximately 95 percent of all sulfur is removed during this process.

Between the SCR and SOx scrubber powder, activated carbon (pencil lead) is injected into the flue gas, which mixes with the flue gas to remove mercury. Through this process, the mercury is captured in the fly ash. Wygen III is the first plant at the NSEC to have an air permit limit for mercury emissions and is one of the first coal plants in the United States that will be operated with mercury control technology.

After passing through the scrubber systems, a pulse jet fabric filter baghouse collects the fly ash that has passed through the other processes. This baghouse is essentially a giant vacuum with approximately 5,000 synthetic bags that are each 20 feet long and 5 inches in diameter. The gas passes through these bags and the fly ash collects on the outside of the bags. Air jets periodically knock the fly ash off the bags to collection bins. From there, the fly ash is transported to the mine pit for permanent disposal.

Q. PLEASE DESCRIBE THE CURRENT STATUS OF WYGEN III

A. We are anticipating that construction will be completed and the plant will be operational by April 1, 2010. This is two months earlier than our initial estimates. The main factors that have allowed us to anticipate completing the project early and under budget include: (i) the key contracts that were locked up early in the process, (ii) efficiencies gained by using some of the same contractors as were used on Wygen II and (iii) the plant's major equipment, including the turbine-generator being delivered ahead of the initial schedule.

Q. DESCRIBE THE CONSTRUCTION PROGRESS.

A. Construction started the day we received the Certificate of Public Convenience and Necessity from the Public Service Commission of Wyoming, and has been progressing steadily since that date. We anticipate that the turbine will be delivered in mid-October 2009. It will take approximately four (4) weeks to install the turbine and begin testing the plant. The first fire on natural gas is scheduled for January 2010, and full load capacity is anticipated in March 2010. If construction continues at its present pace, Wygen III will be operational by April 1, 2010, if not sooner.

IV. OPERATIONS AND MAINTENANCE EXPENSE FOR WYGEN III.

Q. HAVE YOU ESTIMATED THE ANNUAL OPERATION AND MAINTENANCE COSTS FOR THE WYGEN III PLANT?

A. Yes, the annual operation and maintenance costs have been forecast and are included in the cost of service study in the application.

Q. WHAT ARE THE ESTIMATED ANNUAL O&M COSTS FOR WYGEN III AND HOW DID YOU ARRIVE AT THIS FORECAST?

A. We have estimated the total annual operation and maintenance costs for Wygen III to be $6.5 million. The forecast was done at the Federal Energy Regulatory Commission (FERC) account level and is included as Schedule H-6 of the application. This forecast utilizes the historical and budget information for the existing NSEC power plants, with appropriate adjustments for labor, various consumables and environmental costs.

Q. WHAT EXPENSES ARE INCLUDED IN THAT FIGURE?

A. That figure includes primarily (i) the cost of labor to operate the plant, (ii) the consumables such as the lime and ammonia used for scrubbing pollutants from the emissions, (iii) other maintenance and repairs and (iv) lease payments relating to the ground lease. That figure does not include the cost of the fuel for the plant.

Q. WHAT DO YOU ESTIMATE AS THE ANNUAL COAL USAGE AND COST FOR WYGEN III?

A. As noted in the testimony of Thomas M. Ohlmacher, the annual coal production at the Wyodak Mine will increase to approximately 6.5 million tons when Wygen III is operational. As referenced in Schedule H-7 to this Application, Black Hills Power estimates that Wygen III will use approximately 572,000 tons of coal per year, with an estimated annual cost of approximately $3.6 million.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.