Direct Testimony and Exhibits
Jill S. Tietjen

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

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Exhibits

Exhibit JST – 1	Resume, publications listing, testimony listing
Exhibit JST – 2	2007 Integrated Resource Plan

I. QUALIFICATIONS

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Jill S. Tietjen. My business address is 8547 E. Arapahoe Road, PMB J189, Greenwood Village, Colorado.

Q. BY WHOM ARE YOU EMPLOYED AND WHAT IS YOUR POSITION?

A. I am the President and CEO of Technically Speaking, Inc., a firm that provides engineering consulting services. I have held this position since the firm was incorporated in August of 2005. Previously, I was self-employed as an engineering consultant.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL AND WORK BACKGROUND.

A. I graduated from the University of Virginia with a BS in Applied Mathematics (minor in Electrical Engineering) in 1976. I began my career with Duke Power Company and spent five years as a Planning Engineer in the System Planning Department (1976-1981). While at Duke Power Company, I earned my MBA from the University of North Carolina at Charlotte in 1979. I subsequently joined Mobil Oil Corporation's Mining and Coal Division where I worked from 1981-1984 as a planning analyst. I became a registered professional engineer in Colorado in 1982. I joined Stone & Webster Management Consultants in 1984 and by the time I left in 1992 had progressed to Assistant Vice President. I served as Principal and leader of the utility planning practice at Hagler Bailly Consulting

during 1992-1995. In 1995, I rejoined Stone & Webster Management Consultants as an Assistant Vice President and office manager for the Denver office, a position that I served in through 1997. Since 1997, I have been self-employed as an engineering consultant. Also in 1997, I was elected as an outside director on the Board of Directors of Georgia Transmission Corporation and still serve in that capacity. I have served as a consultant to Black Hills Corporation on various projects for twenty years. My resume, testimony listing, and publications listing are attached to my testimony as Exhibit JST-1.

Q. HAVE YOU TESTIFIED PREVIOUSLY IN PROCEEDINGS BEFORE REGULATORY COMMISSIONS?

A. Yes. I have testified before regulatory commissions in Colorado, Illinois, Kansas, Kentucky, Maine, Missouri, Ohio, South Dakota, and Wyoming. I have testified on behalf of Black Hills Corporation subsidiaries in Colorado, South Dakota, and Wyoming.

II. PURPOSE OF TESTIMONY

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to provide the Commission with an understanding of how Black Hills Power, Inc. (Black Hills Power) determined that Wygen III was the resource that should be built to meet the electric needs of its customers in the most economic and reliable manner. I provide an overview of integrated resource planning. I then describe the specific analysis for the 2007 Integrated

Resource Plan including the input and assumptions made, the key results, and the sensitivity analysis conducted. I follow this with a discussion of how the results of the analysis might change with assumptions updated to 2009. I conclude with comments on how Wygen III fits as a Black Hills Power resource.

III. INTEGRATED RESOURCE PLAN OVERVIEW

Q. PLEASE PROVIDE AN OVERVIEW OF THE PROCESS OF INTEGRATED RESOURCE PLANNING.

A. Integrated resource planning is a process whereby an electric utility examines the future electricity requirements of its customers and determines the most economic and reliable set of demand-side and supply-side resources to meet those demands. The characteristics associated with all of the existing resources are modeled in utility software specifically developed for this purpose. Assumptions for a wide range of data must be made and input into the model. The categories of assumptions include:

- the peak demand and energy forecast
- projected coal, natural gas and market prices
- projected emission costs
- financial parameters over the planning horizon
- reserve margin requirements
- plant retirements

- characteristics for future possible supply-side resources including conventional and renewable resources
- characteristics for future potential demand-side resources

A base case is derived under an expected set of future considerations. Sensitivity analysis is undertaken to look at possible futures that differ from the base case projections such as lower or higher load forecasts and lower or higher natural gas prices. The end result is a portfolio of resources that meets the load obligations of the utility and the associated action plan.

IV. 2007 INTEGRATED RESOURCE PLAN

Q. PLEASE DESCRIBE THE 2007 INTEGRATED RESOURCE PLAN.

A. The 2007 Integrated Resource Plan (IRP), provided as Exhibit JST-2, examines the 2008-2027 planning horizon and determines the resources that should be selected to meet the load obligations of the combined systems of Black Hills Power and Cheyenne Light, Fuel and Power. The IRP Base Case demonstrated that Wygen III is the preferred resource to meet Black Hills Power's requirements for electricity starting in 2010. Other resources projected to be installed over the 20-year planning horizon include combustion turbines, 125 MW of wind, other coal units, and a biomass facility. This means that the modeling shows that both conventional and renewable resources are in the mix of resources that will be required in the future to provide electricity to the Black Hills Power customers.

Q. PLEASE PROVIDE A DESCRIPTION OF THE ANALYSIS THAT WAS UNDERTAKEN IN CONDUCTING THE IRP FOR BLACK HILLS POWER.

A. A load forecast of projected peak demands and annual energy consumption was developed for the planning horizon of 2008-2027. Assumptions were made for coal prices, natural gas prices, market prices for economy purchases and sales, financial parameters, the level of reserves required, emissions costs and levels of potential carbon dioxide taxes. Existing and future demand-side management (DSM) programs were identified. Characteristics required to model all existing resources were confirmed. New conventional resources that could be installed were identified and modeling parameters developed for each. Renewable resources that could be installed in or near the service territory were identified and cost and operational parameters identified for each type of renewable resource. Modeling was undertaken to examine each cost-effective potential resource for the base case assumptions. Transmission considerations were examined. Risk and sensitivity analyses were undertaken. The results were determined and an action plan was developed.

Q. WHAT WAS YOUR ROLE IN THAT ANALYSIS?

A. I worked cooperatively with Black Hills Corporation staff and an outside firm, Global Energy Decision (GED), now known as Ventyx, to perform the analysis. Black Hills Corporation staff defined the basic assumptions. GED, a worldwide

firm with more than 175 energy clients that use its software, prepared the needed load forecasts and performed the modeling. I was involved in all of these processes. I examined results of the modeling and helped shape the modeling process. I drafted the reports and presentations associated with the IRP.

Q. WHAT CATEGORIES OF ASSUMPTIONS UNDERLIE THE PREPARATION OF AN IRP?

A. A load forecast of projected peak demands and annual energy consumption is required. Assumptions are also needed for coal prices, natural gas prices, market prices for economy purchases and sales, financial parameters, planning reserve margin, emissions costs, and the potential level of carbon dioxide taxes.

Q. PLEASE DESCRIBE THE PROCESS USED TO DETERMINE THE LOAD FORECAST AND THE RESULTS.

A. GED developed load forecasts for each of the following entities: Black Hills Power; Cheyenne Light, Fuel & Power; and the City of Gillette, Wyoming. The peak demand and energy forecast needed for the Montana-Dakota Utilities' (MDU) Sheridan Service Territory was developed and provided to Black Hills Power by MDU. A forecast for the combined system was also developed by GED which looked at the coincidence of peak demands among the various systems and used the correlating coincidence factor to combine the loads for each individual system together. The load forecasts developed are described in the text and associated tables and figures shown on pages 12-20 of Exhibit JST-2.

Q. PLEASE DESCRIBE THE FORECAST USED FOR COAL PRICES.

A. A forecast was developed by Black Hills Power for coal mined in the Wyoming Powder River Basin. In addition, a forecast for the transportation costs required to get the coal from the mine to those power plants that are not located at the mine mouth was developed.

Q. PLEASE DESCRIBE THE FORECAST USED FOR NATURAL GAS PRICES.

A. The natural gas price projections for Henry Hub, the representative pricing point, included as part of GED's 2007 Spring Reference Case were used as the foundation for the natural gas price forecast. A basis differential was applied to the price projections at Henry Hub to more accurately reflect the cost of natural gas as actually delivered to generating facilities within the Black Hills Power service territory.

Q. PLEASE DESCRIBE THE FORECAST USED FOR THE MARKET PRICE OF POWER.

A. The GED 2007 Spring Reference Case forecast for prices of electricity in the Wyoming Region was used for pricing power in the market.

Q. WHAT ASSUMPTIONS WERE MADE IN THE IRP ABOUT THE ABILITY OF THE COMPANY TO TRANSACT ECONOMY ENERGY AND ECONOMY SALES?

A. Black Hills Power will purchase energy when it is cost effective to do so. This primarily occurs during hours when natural gas-fired units are on the margin and when generating units are out of service due to forced or scheduled maintenance outages. Black Hills Power will sell surplus energy when market conditions are conducive – meaning that Black Hills Power's cost to sell energy is lower than a counterparty's cost to generate that energy itself. Prices for purchases and sales of economy energy vary significantly between the on-peak and off-peak periods primarily due to the utilization of peaking generation (usually natural gas) being at the margin during on-peak hours and baseload generation (usually coal) being at the margin during off-peak hours.

Q. PLEASE DESCRIBE THE ASSUMPTIONS USED FOR FINANCIAL PARAMETERS.

A. Assumptions were required for discount rates, levelized fixed charge rates, and the book and tax lives for all conventional and renewable resources examined in the IRP. These assumptions were developed by Black Hills Power and GED working together.

Q. WHAT PLANNING RESERVE MARGIN ASSUMPTION WAS USED IN THE IRP?

A. A minimum planning reserve margin of 15% was used in the IRP based on the levels used by other utilities in the western region and on a level that is consistent with prudent utility practice. A maximum planning reserve margin of 25% was used to assure that the size of units added during the planning horizon were of a suitable size. The maximum planning reserve margin allows units to be installed that result in lumpiness. As described in the testimony of Jacqueline Sargent, lumpiness allows utilities to grow into units but does result in reserve margins greater than the targeted minimum level for several years as the utility's load grows.

Q. WHAT ASSUMPTIONS WERE USED FOR PROJECTING EMISSION COSTS AND CARBON DIOXIDE TAXES?

A. Emission allowance price projections for sulfur dioxide, nitrous oxides and mercury were obtained from the GED 2007 Spring Reference Case. A base level of carbon dioxide (CO_2) taxes was obtained from the GED 2007 Spring Reference Case. The level of carbon tax assumed in the high CO_2 tax case was estimated by Black Hills Power personnel.

Q. PLEASE DESCRIBE HOW DEMAND-SIDE MANAGEMENT (DSM) PROGRAMS WERE INCORPORATED INTO THE IRP ANALYSIS.

A. Projections of savings in demand (kW) and energy (kWh) due to known existing DSM programs are incorporated into the load forecast.

Q. PLEASE DESCRIBE THE EXISTING BLACK HILLS POWER RESOURCES MODELED IN THE IRP.

A. Black Hills Power's existing resources, described in more detail in the testimony of Ms. Sargent, include coal-fired generation at Ben French, Neil Simpson, Osage, and Wyodak; combustion turbine capacity at Ben French, Lange, and Neil Simpson; diesel units at Ben French, wind energy resources purchased from the Happy Jack facility outside of Cheyenne, Wyoming and power purchased from PacifiCorp.

Q. WHAT PLANT RETIREMENTS ARE MODELED IN THE IRP?

A. For purposes of this IRP, Black Hills Power has assumed that the three Osage units will all retire as of December 31, 2012. In addition, capacity under the Reserve Capacity Integration Agreement with PacifiCorp, described in more detail in the testimony of Ms. Sargent, will no longer be available as of 7/1/2012 and at that point, the equivalent capacity available from the Ben French CTs will be changed to 76 MW from the current 100 MW.

Q. PLEASE DESCRIBE THE RANGE OF NEW CONVENTIONAL RESOURCES EXAMINED IN THE COURSE OF PREPARING THE IRP.

A. Conventional resources that were options that could be considered by the model in developing resource portfolios over the planning horizon in this IRP included coal-fired capacity, combustion turbines, combined cycle, and integrated gasification combined cycle (IGCC). In addition, an assumption was made that up to 50 MW of firm purchased power would be available each year of the planning horizon in July and August.

Q. WHAT COST WAS ASSUMED FOR THE COAL-FIRED GENERATING UNITS MODELED AS AN OPTION IN THE IRP?

A. As shown in the IRP report (Exhibit JST-2) on page 30, Table 11, the coal-fired power plant resource modeled in the IRP reflected a capital cost of $2320/kW in 2006 dollars. Using the assumed rate of inflation for construction specified in the IRP of 3%, on page 9 as a note to Table 2, the 2010 $/kW capital cost for new coal-fired construction as modeled in the IRP is $2611/kW or $261 million for a 100 MW generating unit.

Q. PLEASE DESCRIBE THE OTHER PARAMETERS USED TO MODEL THE COAL-FIRED RESOURCE.

A. The other parameters used to model coal-fired generating resources are also shown on Table 11, page 30 of Exhibit JST-2. They include the earliest feasible year of

installation, capacity in MW, full load heat rate, fixed and variable operating and maintenance costs, equivalent forced outage rate, and time to construct.

Q. PLEASE DESCRIBE THE PARAMETERS ASSUMED FOR THE OTHER CONVENTIONAL RESOURCES.

A. Tables 12, 13, and 14 on pages 30-32 of Exhibit JST-2 contain the data for the combined cycle, combustion turbine, and IGCC units. In addition to their capital cost, the parameters for these units are the same as modeled for the coal-fired generating resource. The parameters used to model the firm purchased power are described on page 32 of Exhibit JST-2. The product is assumed to be available 16 hours a day, 6 days per week (Monday – Saturday, 6 am through 10 pm) and is available in two 25 MW blocks. The price of this firm purchased power is tied to the market price at Mid-C, the representative pricing point, which is based on a forecast of market prices provided by GED.

Q. PLEASE DESCRIBE THE RENEWABLE RESOURCES EXAMINED IN THE COURSE OF PREPARING THE IRP.

A. The renewable resources that were options that could be considered by the model in developing resource portfolios over the planning horizon in this IRP included wind, solar and biomass. These technologies were selected based on their market and technology maturity and availability within or near the Black Hills Power service territory. The parameters used to model the renewable resources are described on pages 36 and 37 of Exhibit JST-2.

Q. PLEASE DESCRIBE THE ANALYSIS UNDERTAKEN TO GET TO THE RESULTS OF THIS IRP.

A. The initial analysis looked at all conventional and renewable resource possibilities over the planning horizon and, based on the assumptions provided to the model, developed a resource portfolio that met the reserve margin requirements at the lowest present value of revenue requirements over that planning horizon. The resource portfolio that resulted from this analysis was labeled the "Base Case" and showed the addition of the Wygen III unit in 2010 as well as resource additions in later years. Subsequent sensitivity and risk analysis were conducted to determine the expected resource portfolios under future conditions different than those that were projected to occur in the Base Case.

Portfolios were developed for alternative futures that included: 1) no additional coal resources could be built, 2) higher carbon dioxide taxes were implemented, 3) a biomass resource was constructed in 2010, 4) higher capital costs for coal-fired units, 5) low and very low natural gas prices throughout the planning horizon, and 6) a combustion turbine in 2010 instead of Wygen III. Based on the resource portfolios that resulted from this sensitivity analysis, three cases were selected on which to run risk analysis: 1) the Base Case, 2) the No Coal case, 3) the Very High CO_2 case. Fifteen different variables were allowed to change in the risk analysis, with higher and lower values than the base assumptions. These differences were grouped into fifty different alternative future scenarios for which

the three resource portfolios were tested. The Base Case had the lowest expected cost and the lowest probable cost when compared to the No Coal and the Very High CO_2 cases.

Q. PLEASE SUMMARIZE THE IRP CONCLUSIONS.

A. Under a wide range of future scenarios that could occur over the 20-year planning period as examined in the sensitivity and risk analysis, Wygen III is the resource that should be selected in 2010 for 70% of those future scenarios. After consideration of the company's objectives, available conventional and renewable resources, the likely contributions of DSM, and this wide range of possible future scenarios, the conclusion that is reached in this IRP is that the next resource that should be built to meet the needs of Black Hills Power is Wygen III.

V. FINDINGS TO REFLECT CURRENT MARKET CONDITIONS

Q. PLEASE DESCRIBE SOME KEY MARKET CONDITION CHANGES SINCE THE 2007 IRP WAS COMPLETED.

A. Although natural gas prices increased significantly immediately after the 2007 IRP was completed, those prices have now fallen. Commodity prices have fallen from very high levels. There is a worldwide economic recession and customer load has remained flat or fallen in some areas of the country. The fall in the price of natural gas combined with the current economic conditions in the country has led to a decrease in market prices for electricity. The U.S. House of Representatives has passed a climate change bill that includes a cap and trade program for carbon

dioxide and the U.S. Senate is expected to act on similar legislation at some point in the future.

Q. HOW DO THE CURRENT PRICE PROJECTIONS FOR NATURAL GAS COMPARE TO THE VALUES FOR NATURAL GAS EVALUATED IN THE 2007 IRP?

A. The prices for natural gas as projected by Ventyx (formerly GED) in its Spring 2009 Reference Case vary from those used for the analysis in the 2007 IRP for the Base Case; for some months over the planning horizon they are higher and for other months they are lower. Because of the known volatility in the prices of natural gas, sensitivity analysis was undertaken when the 2007 IRP was prepared to look at higher and lower natural gas prices over the planning horizon. This analysis examined natural gas prices at 15% and 30% lower than the natural gas price forecast. The risk analysis examined prices in a range of 75% – 210% of base for the near term and 81% – 118% for the long term. These ranges correlate well with the differences seen between the price levels used in the 2007 IRP and those currently projected in the Spring 2009 Reference Case.

Q. HOW DO THE CURRENT MARKET PRICES FOR POWER COMPARE TO THE VALUES FOR MARKET POWER EVALUATED IN THE 2007 IRP?

A. The market power projections made by Ventyx in its Spring 2009 Reference Case are higher on-peak, off-peak and on average for every month of the planning

horizon. Market power price projections are tied to natural gas during the on-peak period and coal during the off-peak period. This means that the sensitivity analysis conducted and discussed above around changes in natural gas price has encapsulated this change in market power pricing in the most important period, the on-peak period.

Q. HOW DO CURRENT ESTIMATES FOR CARBON COMPARE TO THE VALUES FOR A CARBON TAX EVALUATED IN THE 2007 IRP?

A. The values used in the analysis for the IRP included both the middle column shown in Table 4, page 11 of Exhibit JST-2 (used for the Base Case) and the far right column of the same Table 4 which was used for the high carbon tax case analyses. Analysis conducted in June 2009 by the Environmental Protection Agency to evaluate the Waxman-Markey Bill (H.R. 2454) shows 2015 carbon price allowances of $13 per metric ton increasing to 2030 values of $26-$27 per metric ton. Since a metric ton equals 2205 pounds, the resulting $/ton values for 2015 and 2030 are $11.79/ton and $23.58-$24.49/ton, respectively. Although these 2015 values are higher than those evaluated in the Base Case, the 2030 values are lower. Both the 2015 and 2030 values are lower than those evaluated in the 2007 IRP in the High CO_2 tax case. Thus, my conclusion is that the 2007 IRP bracketed the current estimates of carbon prices being made by governmental agencies and the results of the 2007 IRP continue to be validated.

Q. HOW WOULD THE RESULTS OF THE IRP ANALYSIS CHANGE IF CURRENT CONDITIONS WERE REFLECTED IN THE ASSUMPTIONS?

A. Changes in market conditions were examined as part of the preparation for the IRP. In the sensitivity and risk analysis, alternative future scenarios were examined that included:

- Coal not available as a resource option
- High CO_2 taxes
- Biomass facility required to be installed in 2010
- Increase Wygen III capital costs
- Lower and much lower natural gas prices as well as higher natural gas prices
- Higher and lower load forecasts
- Higher capital costs for combustion turbines, combined cycle, and IGCC future units

The current economic, pricing, and legislative conditions are well within the assumptions used in the IRP analysis. Given the fact that these conditions are within assumptions considered in conducting the IRP analysis, no changes are expected for the results of the IRP. This leads to the conclusion that Wygen III was and still is the resource to be added in 2010 to meet Black Hills Power's customer requirements for economic and reliable electricity in 2010 and the years beyond.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.