Direct Testimony and Exhibits
Diane Crockett

Before the Public Service Commission
of the State of Wyoming

Joint Application of
Cheyenne Light, Fuel and Power Company
and Black Hills Power, Inc.
For a Certificate of Public Convenience
and Necessity for a Gas-Fired
Electric Generating Power Plant and
Related Facilities

Docket No. 20003-___-EA-11
Record No._____

Docket No. 20002-____-EA-11

November 1, 2011

EXHIBIT
13

Table of Contents

I. Introduction and Background 1

II. Purpose of Testimony 2

III. Ventyx's Experience and Role in the Black Hills Power and Cheyenne Light IRP Process 2

IV. Software Technology Used to Perform Capacity Expansion And Production Cost Modeling 4

V. Integrated Resource Planning Analysis 4

VI. Results For The Cheyenne Light IRP 8

VII. Results For The Black Hills Power IRP 9

I. INTRODUCTION AND BACKGROUND

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Diane Crockett. My business address is 3301 Windy Ridge Parkway, Suite 200, Atlanta, GA 30339-5618.

Q. By whom are you employed and what is your position?

A. I am a Lead Consultant for Ventyx Inc. Advisors' Resource Planning Practice.

Q. FOR WHOM ARE YOU TESTIFYING ON BEHALF OF TODAY?

A. I am testifying on behalf of Cheyenne Light, Fuel and Power Company (Cheyenne Light) and Black Hills Power, Inc. (Black Hills Power).

Q. PLEASE DESCRIBE YOUR EDUCATIONAL AND WORK BACKGROUND.

A. I graduated from Missouri Western State University with a B.S. degree in business in 1992. I worked for Kansas City Power & Light, from 1987 – 2001 in power plant operations, resource planning and finance. As a corporate finance analyst I developed and maintained an EVA Economic Analysis Model for corporate wide use, developed and maintained transfer prices between business units and prepared monthly financial reports. In resource planning, I utilized various production cost models and assisted in the filing of KCPL's Integrated Resource Plan, KCPLAN94, as well as other regulatory filings. I joined M.S. Gerber and Associates as a consultant in 2001. M.S. Gerber and Associates merged with Global Energy Decisions in 2005 which was then acquired by Ventyx, Inc. in 2008. In my current role as lead consultant for Ventyx Advisors'

1 Resource Planning Practice I provide client support for Ventyx's Strategic
2 Planning software including consulting services. In addition, I have prepared and
3 managed several Integrated Resource Plan (IRP) projects using capacity
4 expansion screening modules to optimize resource selection; performed asset
5 valuations; and developed deterministic, scenario based, and stochastic market
6 prices. I have also performed risk analysis to quantify the risk of certain events
7 and to meet the objectives of regulatory rules.

8 **Q. HAVE YOU TESTIFIED PREVIOUSLY IN PROCEEDINGS BEFORE**
9 **THE WYOMING PUBLIC SERVICE COMMISSION (THE**
10 **COMMISSION)?**

11 **A.** No, I have not.

12 **II. PURPOSE OF TESTIMONY**

13 **Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

14 A. The purpose of my testimony is to provide the Commission with an overview of
15 the process that Ventyx used to forecast prices, complete the capacity expansion
16 and production cost modeling and risk analysis necessary for the Cheyenne Light
17 and Black Hills Power IRPs.

18 **III. VENTYX'S EXPERIENCE AND ROLE IN THE BLACK HILLS POWER**
19 **AND CHEYENNE LIGHT IRP PROCESS**

20 **Q. PLEASE DESCRIBE VENTYX'S EXPERIENCE PROVIDING PRICE**
21 **FORECASTS, LOAD FOECASTING, IRP MODELING AND RISK**
22 **ANALYSIS FOR OTHER UTILITY COMPANIES.**

1 A. Ventyx Advisors is a leading North American advisory group that has experience
2 doing market analysis, resource planning and investment analysis since the early
3 1980s. Their market price forecasts are the industry standard for independent
4 market analysis. Ventyx Advisors has worked with or completed IRPs for clients
5 in many states and a few international clients. In the past five years Ventyx
6 Advisors has assisted or completed multiple IRPs for nine clients and single
7 engagements with several more clients

8 **Q. PLEASE DESCRIBE YOUR EXPERIENCE PROVIDING LOAD**
9 **FORECASTING, MODELING AND RISK ANALYSIS SERVICES IN THE**
10 **PAST.**

11 A. Since 2001, I have assisted or prepared IRPs for seven different utilities. For two
12 of these utilities, I have completed the full IRP process four times which consisted
13 of assisting with the load forecast, capacity expansion modeling, portfolio
14 modeling and risk analysis.

15 **Q. WHAT WAS VENTYX'S ROLE IN CHEYENNE LIGHT'S AND BLACK**
16 **HILLS POWER'S IRP PROCESSES?**

17 **A.** Ventyx was contracted separately by Cheyenne Light and Black Hills Power as a
18 consultant to provide expert load forecasting, capacity expansion and production
19 cost modeling, and risk analysis for the Cheyenne Light and Black Hills Power
20 IRP processes. In addition, natural gas and electric market price forecasts
21 developed by Ventyx were used in each company's IRP. To complete the

capacity expansion and production cost modeling in each IRP, Ventyx used its *Strategic Planning* software.

Q. HAVE YOU WORKED WITH CHEYENNE LIGHT AND BLACK HILLS POWER IN THE PAST TO COMPLETE AN IRP?

A. I provided analysis for Cheyenne Light's and Black Hills Power's 2007 IRP and am familiar with Cheyenne Light's and Black Hills Power's loads and resources.

IV. SOFTWARE TECHNOLOGY USED TO PERFORM CAPACITY EXPANSION AND PRODUCTION COST MODELING

Q. PLEASE DESCRIBE THE SOFTWARE USED TO COMPLETE THE CAPACITY EXPANSION AND PRODUCTION COST MODELING AND THE RISK ANALYSIS.

A. I utilized Ventyx's Strategic Planning software to complete the capacity expansion modeling, the production cost modeling and the risk analysis. The Strategic Planning software includes five modules: Markets Module, Portfolio Module, Capacity Expansion Module, Financial Module and the Risk Module. Since the market price forecasts used were from the Ventyx 2010 Fall Power Reference Case for Cheyenne Light IRP and the Ventyx 2011 Spring Power Reference Case for Black Hills Power IRP, the Strategic Planning Markets Module was not utilized for the Cheyenne Light and Black Hills Power IRP analyses. See Appendix A in Exhibit ES-1 of Eric Scherr's testimony for further information about the software used in the analysis

V. INTEGRATED RESOURCE PLANNING ANALYSIS

1 **Q. PLEASE PROVIDE A DESCRIPTION OF THE ANALYSIS THAT WAS**
2 **UNDERTAKEN IN CONDUCTING THE CHEYENNE LIGHT AND**
3 **BLACK HILLS POWER IRPs.**
4 A. For both plans, a load forecast of projected peak demands and annual energy
5 consumption was developed for the 20-year planning horizon. Assumptions were
6 made for coal prices, natural gas prices, market prices for economy purchases and
7 sales, financial parameters, the level of reserves required, and emission costs.
8 Existing and future demand-side management (DSM) programs were identified.
9 Characteristics of existing resources, new conventional resources and renewable
10 resources that could be installed were identified and modeling parameters,
11 including cost and operational parameters, developed for each. Capacity
12 expansion modeling was undertaken to determine the expansion plan for each set
13 of assumptions and production cost modeling was completed to forecast the cost
14 and associated risk exposure of each expansion plan. Extensive risk analysis was
15 conducted through stochastic modeling and stress tests. Results were examined
16 and an action plan developed.
17 **Q. PLEASE DESCRIBE THE PROCESS USED TO DETERMINE THE**
18 **LOAD FORECAST.**
19 A. Ventyx developed separate load forecasts for Cheyenne Light and Black Hills
20 Power by trending historical peak demands and annual energy and modifying the
21 results to reflect expected load gains. The trended growth rate for Cheyenne

Light is 1.5% for both peak demand and annual energy. For Black Hills Power, the trended growth rate was 1.0% for both peak demand and annual energy.

Q. HOW DOES VENTYX DEVELOP PRICE FORECASTS?

A. Each year in the Spring and Fall Ventyx develops electricity, fuel, and environmental price forecasts for its North American Power Reference Case. Ventyx relies on a fundamentals based integrated approach where market-based power forecasts, fuel, emission allowance, and renewable energy credit prices are internally consistent with one another; that is 1) natural gas and coal prices are internally consistent with the associated power sector consumption of each fuel; 2) capacity additions, retirements, and retrofits are internally consistent with the allowance and fuel prices; 3) electric energy and capacity prices are internally consistent with the capacity additions, and allowance and fuel prices; and 4) renewable energy credit prices are internally consistent with state renewable portfolio standards and electric energy and capacity prices.

Q. WHAT IS CAPACITY EXPANSION MODELING?

A. Capacity expansion modeling is a process used to determine the appropriate type, size, and timing for economic resource additions for utilities. The utility's existing generation resources and future resource alternatives are input into a capacity expansion model with a forecasted load. The model simulates utility operation and serves the forecasted load with the utility's existing resources and economically "selects" additional resources from the list of available resource alternatives. Capacity expansion plans are developed for scenarios that vary

assumptions to simulate changing market and load conditions. Typical IRPs include a base scenario, environmental scenarios, high and low gas pricing scenarios, high, low and alternate load growth scenarios, firm market availability scenarios and retirement scenarios.

Q. WHAT IS PRODUCTION COST MODELING?

A. Production cost modeling is used to forecast system cost and risk exposure. A production cost model includes an hourly dispatch model, with a load forecast and fixed resources to serve that load. The model simulates a load every hour, then economically serves that load with the available resources, and captures the associated cost. Production cost modeling can also be completed using multiple iterations with changing variables. The typical criterion for evaluation is the expected present value of revenue requirements (PVRR) subject to meeting load plus reserves and various resource planning constraints. This form of modeling provides a measure of risk associated with the modeled plan subject to changing variables.

Q. PLEASE DESCRIBE STOCHASTIC ANALYSIS.

A. The stochastic analysis conducted by Ventyx examined a wide range of uncertainties that resulted in 50 unique future scenarios for price determination and evaluation of a given portfolio of resources. The scenarios are driven by variations of market price drivers (e.g. peak demand and energy forecast, natural gas price, oil price, coal price, unit availability and capital costs) and take into

account statistical distributions, correlations and volatilities. This type of analysis reflects standard industry practice for IRP and resource selection.

VI. RESULTS FOR THE CHEYENNE LIGHT IRP

Q. PLEASE DESCRIBE THE CAPACITY EXPANSION AND PRODUCTION COST MODELING ANALYSIS.

A. The different scenarios described in Section 7.1 of Exhibit ES-1 of Eric Scherr's testimony, were run through the Capacity Expansion module of Ventyx's *Strategic Planning* software to determine the economic resource portfolio required to serve the load subject to the assumptions of that scenario. Each of the resource portfolios was then run through a production cost model, using the base case scenario assumptions to determine the comparable present value of revenue requirements (PVRR).

Q. WHAT WERE THE RESULTS OF THE CAPACITY EXPANSION AND PRODUCTION COST MODELING?

The results of the capacity expansion modeling varied between scenarios and are shown in Table 7-1 of Exhibit ES-1. The results of the production cost modeling are shown on Figure 7-2 of Exhibit ES-1. With the exception of the step load and low load scenarios, the PVRRs for the scenarios are within approximately 2% of each other.

Q. PLEASE DESCRIBE THE STRESS TEST ANALYSIS.

A. Three stress tests were conducted to further evaluate Cheyenne Light's risk exposure due to future uncertainty and are described in Section 8.3 of Exhibit ES-

1. These three stress tests involved the consideration of a step load in 2014, the examination of results if no firm energy market were available, and an environmental stress test.

Q. WHAT WERE THE RESULTS OF THE STOCHASTIC ANALYSIS?

A. Ventyx provided cumulative probability distributions, also known as risk profiles, to visually assess the results of the stochastic analysis. Figure 8-1 of Exhibit ES-1 shows that with the exception of the low load case, the risk profile for the preferred plan is to the left and lower than any other case except that labeled the "base plan."

Q. ARE THE RESULTS OF THE MODELING AND RISK ANALYSIS REASONABLE WITH RESPECT TO THE ASSUMPTIONS USED?

A. Yes, the results are in line with respect to the assumptions used.

Q. **THIS CPCN APPLICATION PROPOSES ONE COMBUSTION TURBINE UNIT AND ONE JOINTLY-OWNED COMBINED CYCLE UNIT TO BE BUILT IN CHEYENNE. DID YOU COMPLETE ANY MODELING THAT EVALUATES THIS DECISION?**

A. Yes, I completed a production cost model for Cheyenne Light that showed that the present value of revenue requirements (PVRR) for the plan that included one combustion turbine, one jointly-owned combined cycle unit and allowed up to 50 MW of market capacity purchases in all months is $15.55 million lower than the PVRR of the original preferred plan that included installation of three CTGs.

VII. RESULTS FOR THE BLACK HILLS POWER IRP

Q. PLEASE DESCRIBE THE CAPACITY EXPANSION AND PRODUCTION COST MODELING ANALYSIS.

A. The different scenarios described in Section 7.1 of Exhibit ES-2, were run through the Capacity Expansion module of Ventyx's *Strategic Planning* software to determine the economic resource portfolio required to serve the load subject to the assumptions of that scenario. Each of the resource portfolios was then run through a production cost model, using the base case scenario assumptions to determine the comparable present value of revenue requirements (PVRR).

Q. WHAT WERE THE RESULTS OF THE CAPACITY EXPANSION AND PRODUCTION COST MODELING?

The results of the capacity expansion modeling varied between scenarios and are shown in Table 7-2 of Exhibit ES-2. The results of the production cost modeling are shown on Figure 7-2 of Exhibit ES-2.

Q. PLEASE DESCRIBE THE RESULTS OF THE STOCHASTIC ANALYSIS.

A. Ventyx provided cumulative probability distributions, also known as risk profiles to visually assess the results of the stochastic analysis. Figure 8-1 of Exhibit ES-2 shows that with the exception of the low gas and the environmental scenarios, the risk profile for the base plan is to the left and lower than any other case. As explained in Section 8.2 of Exhibit ES-2, the end effects of generation additions in later years are influencing the low gas and environmental scenario risk profiles.

Q. ARE THE RESULTS OF THE MODELING AND RISK ANALYSIS REASONABLE WITH RESPECT TO THE ASSUMPTIONS USED?

1 A. Yes, the results are in line with respect to the assumptions used.

2 **Q. DOES THIS CONCLUDE YOUR TESTIMONY?**

3 A. Yes.