Deer Creek Station Project

Project Description

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Revision B

Prepared for:

Basin Electric Power Cooperative

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EDAW | AECOM

Contents

Figures

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1.0 Introduction

Basin Electric Power Cooperative (Basin Electric) is proposing to construct and own a 300-megawatt (MW) (net) combined-cycle natural gas generation facility and associated linear facilities, referred to as the Deer Creek Station Project, in South Dakota. Figure 1.0-1 provides a vicinity map and overview of the project area.

Preliminary design efforts for the Deer Creek Station Project are underway. Information contained within this document is based on these efforts and are typical for this stage of project development.

2.0 Project Description

2.1 Natural Gas Combined Cycle Technology

Combustion turbine generators (CTG) fueled by natural gas are used in both simple-cycle and combined-cycle configurations (Kennebeck 2008). In a simple-cycle configuration, gas turbines are used to power an electric generator without any recovery of heat from the exhaust gases (NPCC 2008). Gas turbine generators in a simple-cycle configuration are commonly used for peaking power applications during peak summer and winter months. The advantage of simple-cycle configurations is that the turbines can be brought online or taken offline quickly in response to changing electric demand. The key disadvantage of the simple-cycle configuration is its lower efficiency compared with the combined-cycle configuration.

In a combined-cycle configuration, the exhaust from the CTG passes through a heat recovery steam generator (HRSG) that extracts waste heat from the turbine exhaust. This waste heat is used to generate steam that then passes through a steam turbine generator. The recovery of the waste heat greatly increases the efficiency of the combined-cycle configuration. Natural gas combined cycle (NGCC) generators are commonly used in both intermediate and baseload power generation.

Most of the new baseload fossil-fuel fired power plants built in the United States since the early 1990s have used NGCC technology and have demonstrated high reliability and low maintenance costs. Figure 2.1-1 provides a schematic diagram of a typical natural gas combined cycle.

There is a wide range of gas turbine sizes available with outputs ranging from approximately 1 MW to 240 MW and higher ("G" and "H" class machines). Gas turbines for electric utility services generally range from a minimum output of 20 MW for peaking service to the largest outputs for use in combined-cycle mode (Basin Electric 2005).

The Deer Creek combined cycle natural gas generation facility would produce a gross of 309 MW and a net of 300 MW at 43 degrees Fahrenheit ambient with duct firing. The heat input maximum would be approximately 2,100 million British thermal units per hour (mmBtu/hr)at lower heating value.

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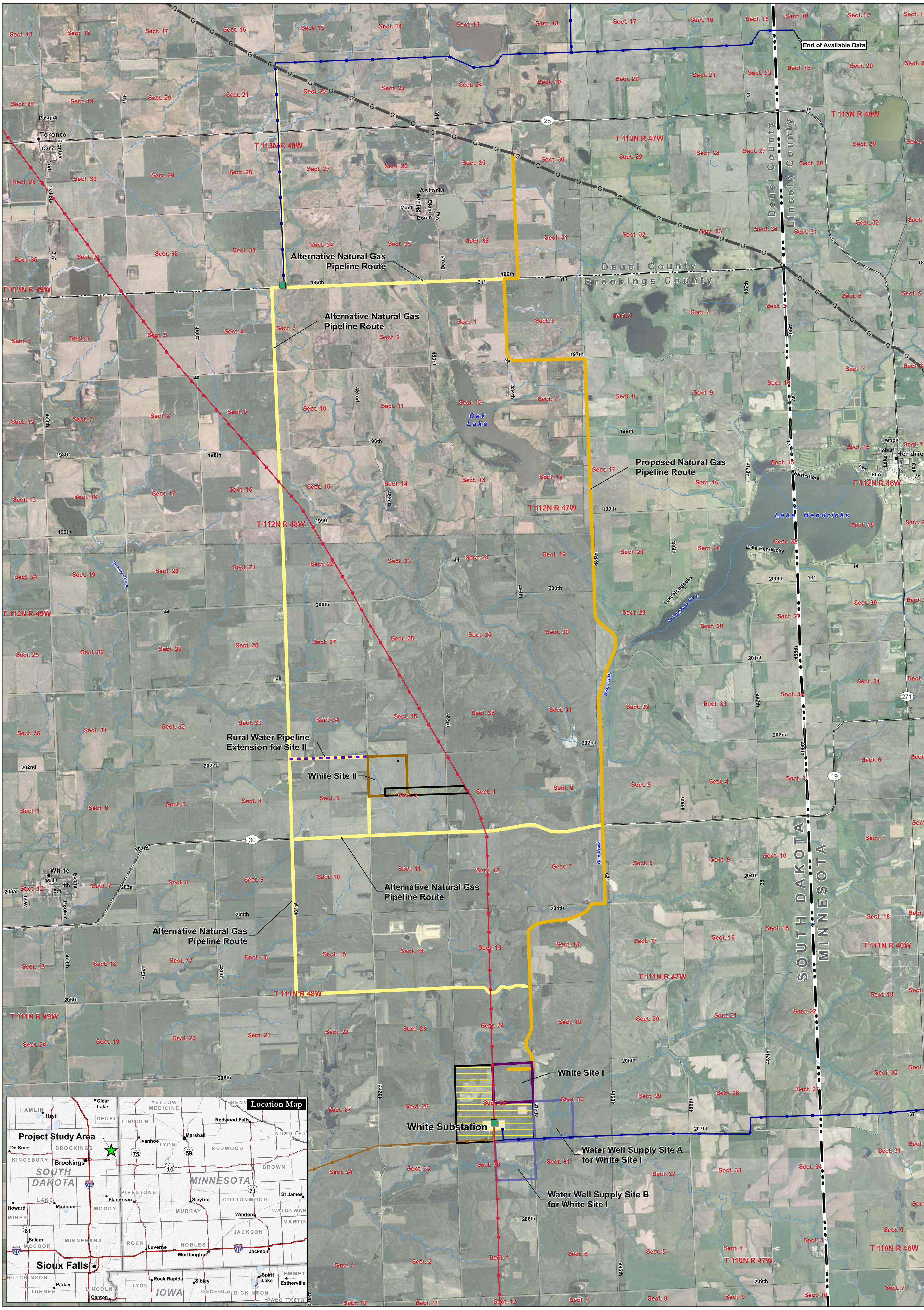

Deer Creek Station Project

0 0.5 1 2 Miles

Project Features

- Proposed Natural Gas Pipeline Route
- Alternative Natural Gas Pipeline Route
- White Site I
- White Site II
- Northern Border Pipeline
- Groundwater Well Supply Area
- Rural Water Pipeline Extension
- White Site I Transmission Corridor
- White Site II Transmission Corridor

Existing Electric

- Existing Substation
- East River Distribution

WAPA Transmission

- Unknown kV
- 345kV

Transportation

- State Highway
- Major Road
- Local Road

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Source: USDA NAIP 2006; USGS NHD 2006; ESRI 2006; Basin Electric 2008

Figure 1.0-1 Project Study Area Map

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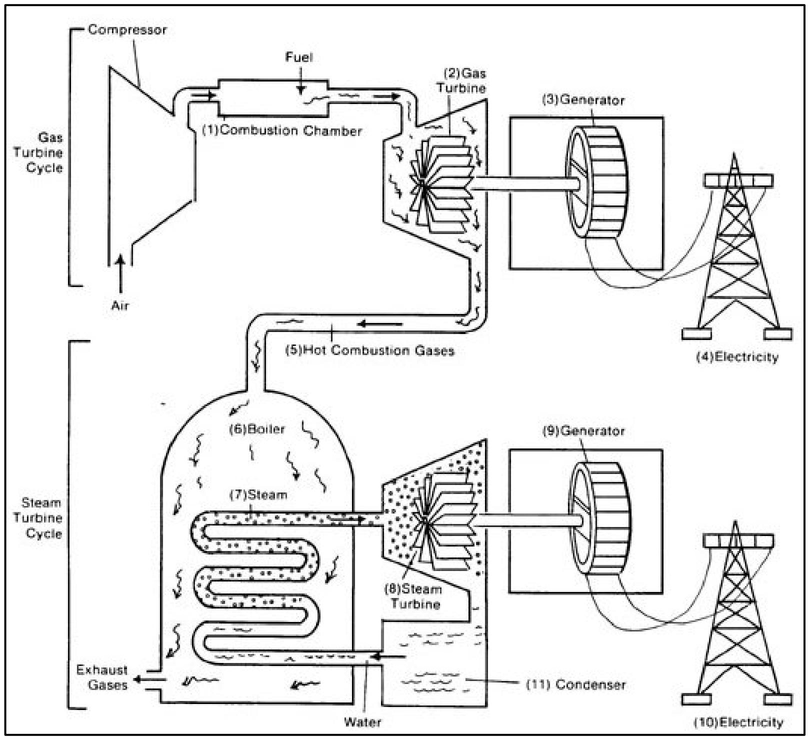


Source: Arizona State University (2006)

Figure 2.1-1: Typical Natural Gas Combined Cycle Process

2.2 Site

Basin Electric has identified two site alternatives in South Dakota approximately 20 miles east of Brookings and 60 miles northeast of Sioux Falls:

- The White Site I (Brookings County, T111N R48W, Section 25 NE Quarter)
- The White Site II (Brookings County, T111N R48W, Section 2 NW Quarter)

Basin Electric selected these areas to locate the new generation facility in proximity to the fuel delivery source and an available water source and to take advantage of the existing transmission system for the delivery of the power to its members. The plant site would consist of an area of approximately 100 acres; the plant would occupy approximately 40 acres within the site.

Site components associated with White Sites I and II are shown on Figure 2.2-1 and Figure 2.2-2, respectively. White Site II would include the construction of an on-site substation; an onsite substation would not be part of White Site I development.

Two tanks sized approximately 500 gallons each would be used on site to store diesel for the generator and fire pump. Additional tanks such as an ammonia tank to support to the

Selective Catalytic Reduction (SCR) system and various water and wastewater storage tanks will be present. All tanks will be aboveground or will be in a vault type structure to minimize the potential for subsurface contamination. Additionally their will be miscellaneous lubricants and hydraulic oils also stored on site in appropriate storage areas.

2.3 Fuel

The natural gas to be used for the combined cycle electricity generation would be sourced from the Northern Border Pipeline via a pipeline estimated to be 10-inch-diameter. The operating pressure for the pipeline would range between 1,435 pound-force per square inch gauge (psig) (Northern Border Pipeline maximum operating pressure) and 550 psig (combustion turbine maximum supply pressure).

A proposed pipeline route and alternative pipeline route have been identified. The proposed pipeline route would intersect with the Northern Border Pipeline at Valve Site 42 in Deuel County located in Section 30 of Township 113N, Range 47W, and would extend approximately 14 miles to White Site I. An alternative pipeline route would utilize a new valve site in Deuel County in Section 22 of Township 113N, Range 48W, and would extend approximately 10 miles to White Site II. Various configurations of alternatives, as shown in Figure 1.0-1, could result in the final alignment for the project.

2.4 Transmission

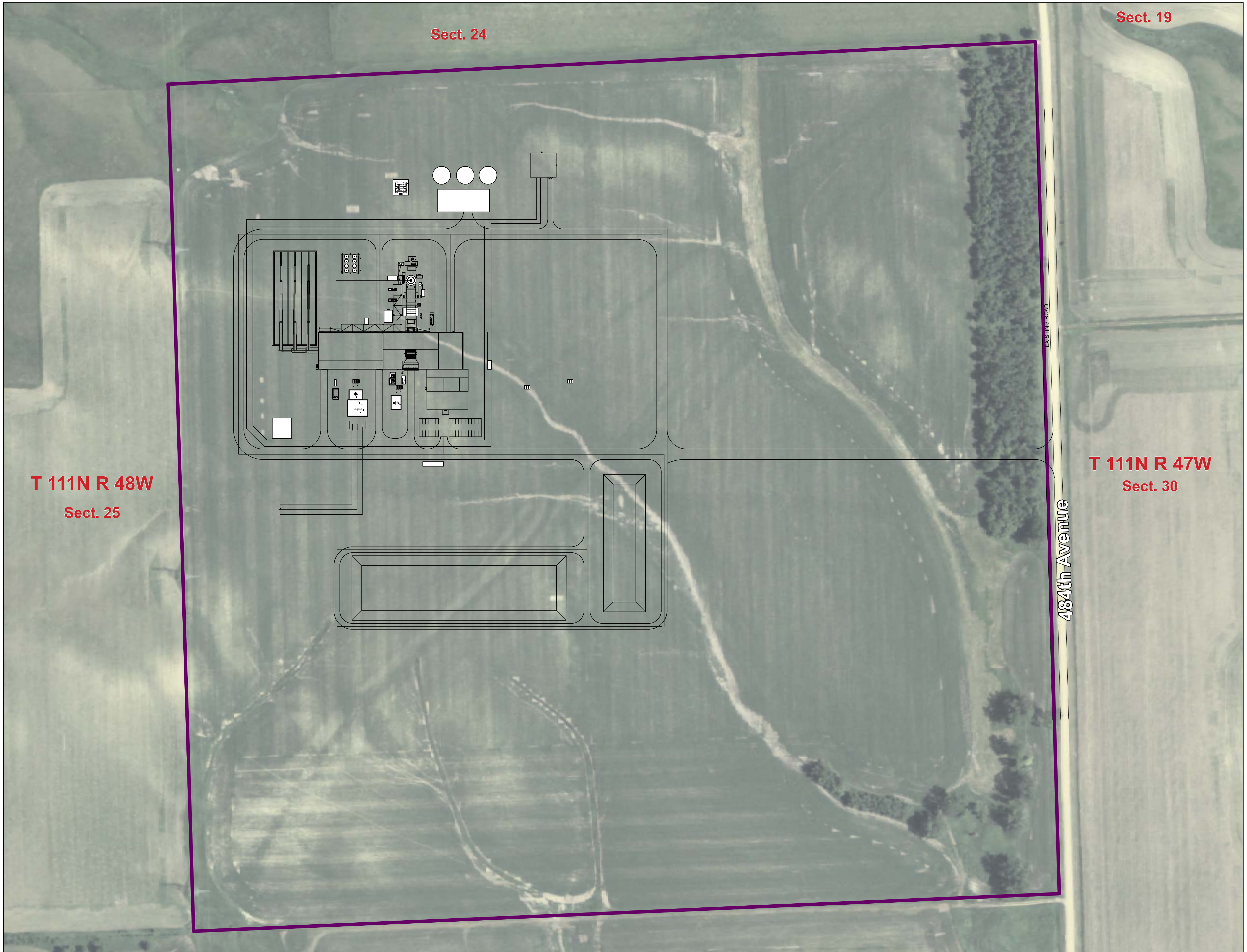
For White Site I, electric power generated by the proposed Deer Creek Station would require the construction of a 345kV single circuit transmission line, approximately ¾ mile in length so that the power generated could be transmitted to the existing Western Area Power Administration (Western) White Substation.

White Site II would include construction of an on-site substation. A double circuit 345-KV transmission line would be needed to transmit power from the on-site substation to the existing 345-kV transmission line, located approximately 1/2 mile east of the White Site II. Figure 1.0-1 shows the transmission corridor areas considered for the Project.

The 345-kV single-circuit transmission line structures would be constructed of a single-pole steel configuration and would be approximately 120 feet tall. The arms on each side of each structure would be 20 feet long. These structures would have a circular concrete foundation base of 6 to 8 feet in diameter. The typical span between structures would be approximately 800 to 900 feet.

The 345-kV double-circuit transmission line structures would be constructed of a single-pole steel configuration and would be approximately 145 feet tall. The arms on each side of each structure would be 20 feet long. These structures would have a circular concrete foundation base of 6 to 8 feet in diameter. The typical span between structures would be approximately 800 to 900 feet.

Generation interconnection requests have been submitted to Western as of September 2008.



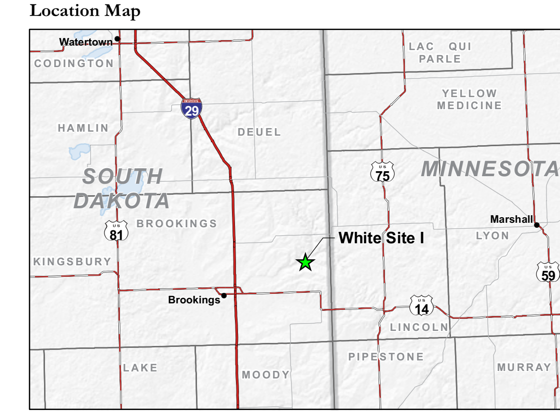
General Site Arrangement
White Site I

Project Features

White Site I

0 150 300 600 Feet

Location Map



Revised: December 4, 2008

Source: USDA NAIP 2006; USGS NHD 2006; ESRI 2006; Basin Electric 2008

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Figure 2.2-1

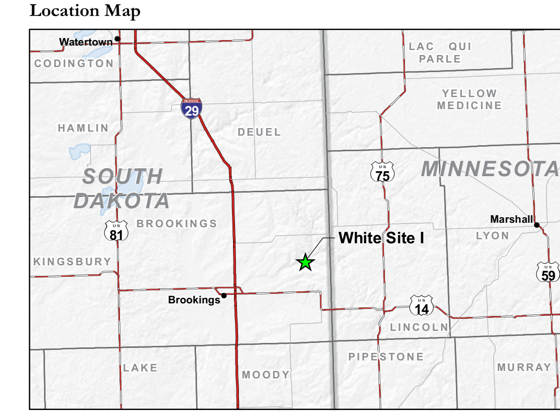
General Site Arrangement
White Site II

Project Features

White Site II

0 150 300 600 Feet

Location Map



Revised: December 4, 2008

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Deer Creek Station Project

Figure 2.2-2

2.5 Water and Waste

At White Site I, well water from the Big Sioux Aquifer would be used for processing and the Brookings-Deuel Rural Water Supply would be used for potable water. Two well water supply sites adjacent to White Site I have been identified as shown on Figure 1.0-1. Actual location of the groundwater supply well and associated water pipeline route for White Site I has not yet been finalized. It is anticipated that the pipeline from the well supply site would be no more than 1 mile in length to the site boundary. Connection to the Brookings-Deuel Rural Water Supply from White Site I currently exists.

White Site II would use water from Brookings-Deuel Rural Water Supply for both process and potable water. White Site II would require approximately 1 mile of pipeline to connect to the Brookings-Deuel Rural Water Supply as shown on Figure 1.0-1.

Consumptive water use is anticipated to be a daily maximum of 60 gallons per minute (gpm) during peak use periods. The estimated annual average use is anticipated to be 6 million gallons. The pipe delivery system has not been engineered but it is anticipated that it will be 6 to 8 inches in diameter. Potable water would support 25 to 30 on-site permanent staff during operation. The potable water use rate is estimated as 1 gpm. Sanitary waste would flow to an on-site drain field. Operation of the generation facility would produce approximately 12 gpm of process wastewater discharge. The Process wastewater would be held in on-site water processing tanks and process ponds.

Combustion turbines do not generate solid waste for disposal. Office and lunchroom-type waste would be disposed of on site in dumpsters and then hauled away by local waste management services for placement in permitted facilities. Construction debris would be removed and taken to the nearest permitted landfill in South Dakota; Brookings Landfill is the closest to the project area and Watertown Landfill is also nearby.

2.6 Air Pollution Control

It is anticipated that the final air emissions control technologies that would be installed would include the following equipment:

- Dry low-NO_x combustion system and selective catalytic reduction for control of nitrogen oxides
- Combustion controls/optimization and oxidation catalyst if necessary (space will be reserved for the oxidation catalyst within the heat recovery steam generator)

The natural gas from Northern Border Pipeline that would be used at the facility is estimated to have the following sulfur dioxide (SO_2) content:

- Average 0.083 grains/100 standard cubic feet (scf)
- Maximum 0.126 grains/100 scf
- Minimum 0.060 grains/100 scf

Although the maximum SO_2 content specified for the natural gas is 0.126 grains/100 scf, the expected air emission rates for the project have been estimated based on 0.5 grains/100 scf. It is anticipated that at 0 degrees Fahrenheit ambient, without duct firing, the facility would emit 2.6 pounds/hour (0.0014 pound/mmBtu), and at 94 degrees Fahrenheit ambient, with duct firing, the facility would emit 3.26 pounds/hour (0.0015 pound/mmBtu).

At 15 percent oxygen at a temperature of 0 degrees Fahrenheit ambient, without duct firing, the expected air emission rate for NOx would be 23.5 pounds/hour (0.013 pound/mmBtu). At 94 degrees Fahrenheit ambient, with duct firing, the expected air emission rate for NOx would be 29.4 pound/hour (0.014 pound/mmBtu).

2.7 Schedule

Construction is anticipated to start in July 2010 and end in July 2011. Startup and commissioning is expected to take 10 months and commercial operation is anticipated in December 2011. Approximately 350 workers will be needed during construction. The permanent operational work force is estimated to be between 25 and 30 full-time workers.

3.0 Basin Electric Overview

Basin Electric is a regional wholesale electric generation and transmission cooperative owned and controlled by the member cooperatives it serves. Created in May 1961 as a result of regional efforts by electric distribution cooperatives and the Rural Electrification Administration, now Rural Utilities Service, in Washington D.C., the cooperative comprises 120 rural electric systems and is one of the largest electric generation and transmission cooperatives in the United States.

Basin Electric’s service territory covers two of the three main electric power grids that comprise the nation’s electric system. Each power grid is subdivided into North American Electric Reliability Council regions. Basin Electric’s service territory falls within two of these regions, the Western Electricity Coordinating Council and the Midwest Reliability Organization, formally called the Mid-Continent Area Power Pool. Figure 3.0-1 shows Basin Electric’s service territory within these two regions. Basin Electric serves approximately 2.5 million customers in 430,000 square miles covering portions of nine states: Colorado, Iowa, Minnesota, Montana, Nebraska, New Mexico, North Dakota, South Dakota, and Wyoming.

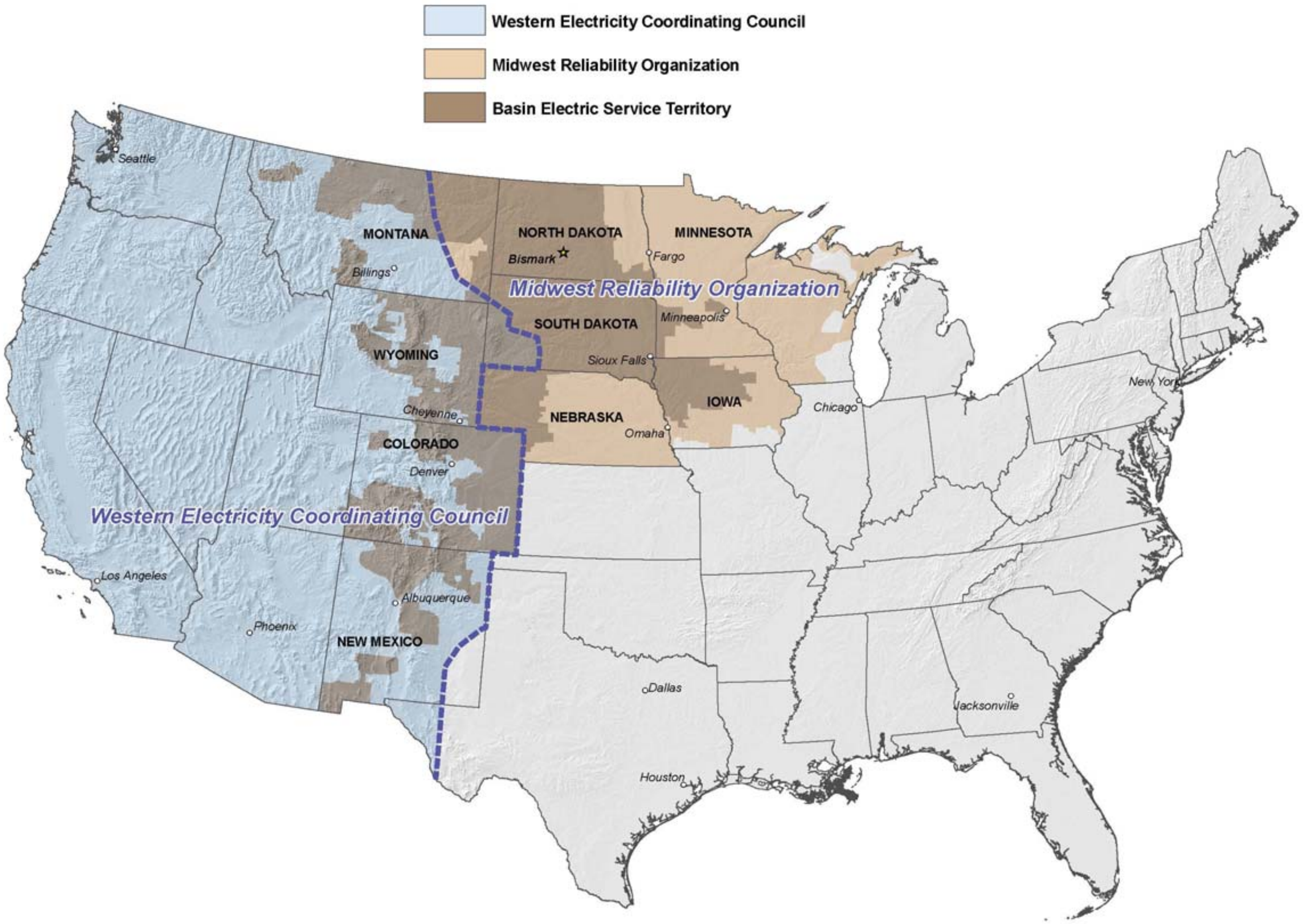

Figure 3.0-1: Basin Electric's Service Territory

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Basin Electric is one of the few utilities that supply electricity on both sides of the national electric system. As a result, there are constraints associated with transfers between Basin Electric's eastern and western service territories. Direct-current (DC) ties, or interties, bridge the national electric system separation by taking alternating current electricity on one side, converting it to direct current, and then converting it back to alternating current so that it is in sync with the alternating current of the other side of the system separation (Figure 3.0-2).

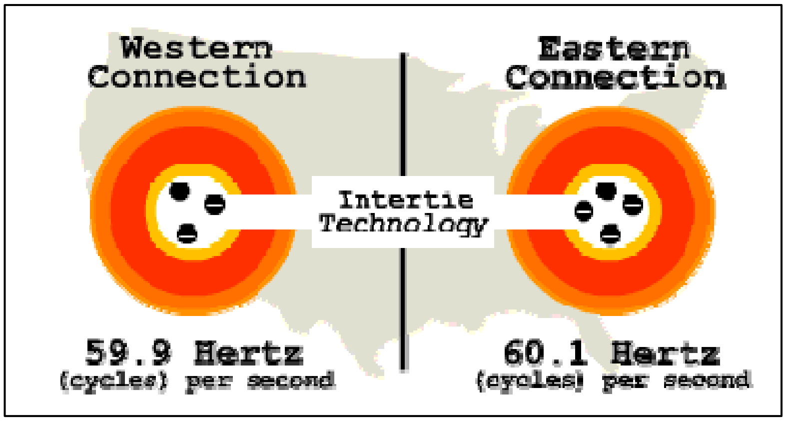


Figure 3.0-2 Direct Current Ties

Every generator east of the electrical transmission separation drives and affects the eastern system and every generator west of the separation drives and affects the western system. Electricity is generally transmitted at alternating current of 60 Hertz (cycles) per second. The slightest upset, such as an electric generating unit abruptly separating from the system, changes the standard 60 Hertz per second just slightly. The lower load density in the central part of the country as compared to the east and west coasts of the United States has resulted in the development of lower amounts of generation and high voltage transmission facilities. Consequently, the two systems are not synchronized and cannot be connected directly.

Basin Electric has several DC ties that bridge the national electric system. Miles City Direct Current Tie (MC Tie) connects the eastern and western transmission grid together near Miles City, Montana. Western owns 60 percent of the facility and Basin Electric owns the remaining 40 percent. Basin Electric has a significant amount of the transmission rights across the 200-MW tie in the east to west direction. Although the Stegall Direct Current Tie (Stegall Tie) near Stegall, Nebraska, is owned by Tri-State Generation and Transmission Association Inc., Basin Electric has all of the contractual rights across the tie. The tie has 110 MW of transfer capability in both directions. The Rapid City Direct Current Tie (RC Tie) was placed in commercial operation in October 2003. The tie was jointly built by Basin Electric and Black Hills Power & Light. It connects the eastern and western transmission grids together just south of Rapid City, South Dakota. The tie is capable of transferring 200 MW in either direction; Basin Electric owns 65 percent of the facility and has transfer rights up to 130 MW in either direction. In total, Basin Electric has ownership or capacity rights to transfer 240 MW in the west-to-east direction and 410 MW in the east-to-west direction.

4.0 Purpose and Need for the Project

Basin Electric's primary mission is to provide electrical power to its member owners. The projection of future electrical requirements serves as one of the main planning tools in determining the cooperative's future operating strategy. In 2007, Basin Electric developed a Power Supply Analysis (PSA) to assess projected needs of its members (Basin Electric 2007).

The purpose of the Deer Creek Station is to help serve the increased intermediate generation demand for electric power in the eastern portion of Basin Electric's nine-state service area as identified in the PSA. The need for additional generating capacity is being driven by the increasing use of electricity given three factors:

- Industrial growth
- Energy-sector (coal, oil, and gas) development
- New rural residential development

Figure 4.0-1 shows Basin Electric's actual peak demand from 1971 through 2006 and Basin Electric's forecasted peak demand from 2007 through 2021. Between 1999 and 2006, Basin Electric's total system peak demand increased 752 MW (from 1,195 MW to 1,947 MW), or approximately 107 MW per year.

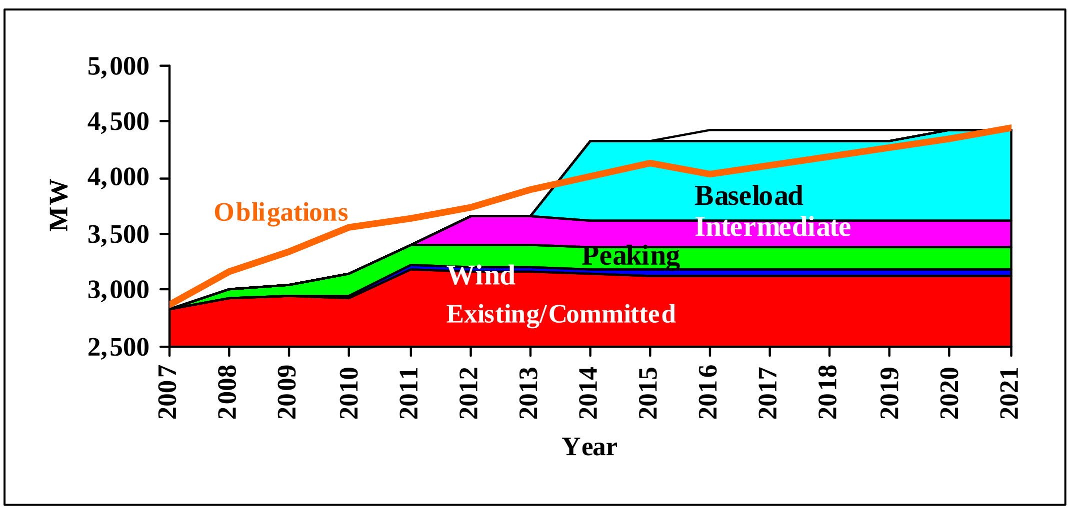


Figure 4.0-1: Basin Electric's Preferred Resource Expansion Plan

Basin Electric prepared a forecast showing load and capability surpluses and deficits through the year 202, illustrated in Figure 4.0-2. The forecast predicts that by 2014, there will be an anticipated deficit of 700–800 MW for the eastern portion of its service area.

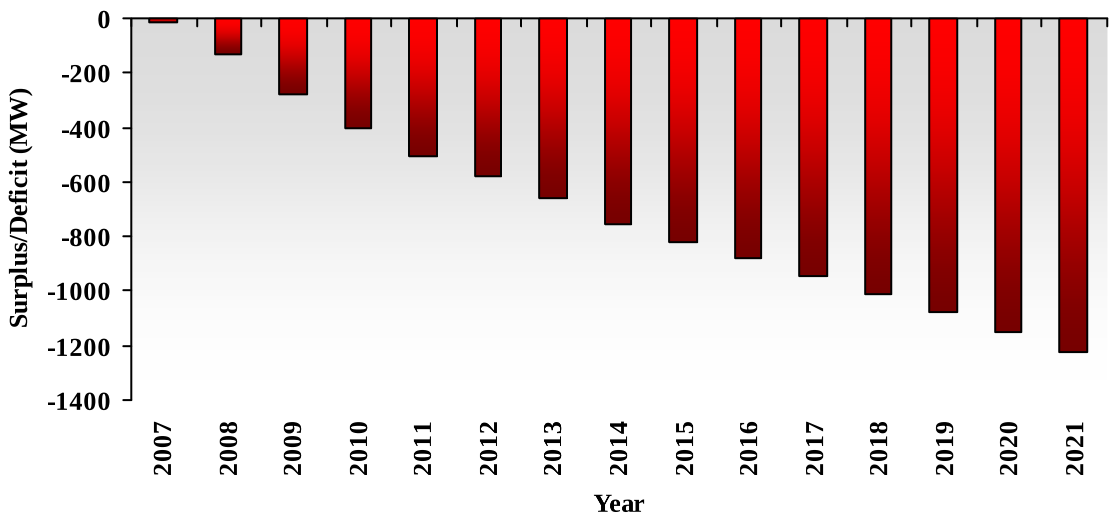


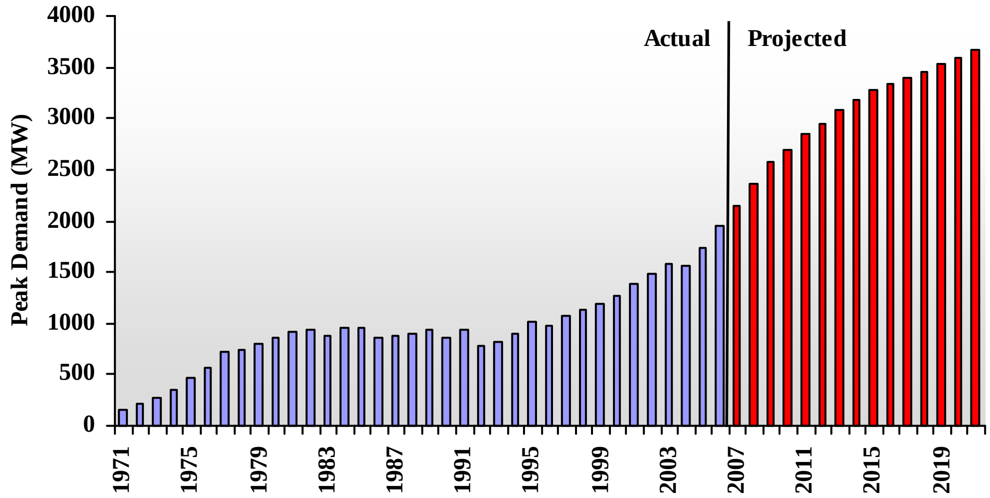
Figure 4.0-2: East System Load and Capability

According to the PSA, Basin Electric is proposing to meet this increased demand by implementing a resource expansion plan that includes:

- 300 MW of wind generation (2011)
- 200 MW of peaking generation (2009)
- 250 MW of intermediate generation (2012)
- 600 MW of baseload generation (2016)

Figure 4.0-3 shows the preferred resource expansion plan identified in the PSA. One recommendation of the PSA was that Basin Electric should move ahead with the development of 250 MW of intermediate generation (Figure 4.0-3), such as a combined-cycle combustion turbine within Basin Electric's eastern system. The Deer Creek Station Project has been identified as a means to meet the determined need for 250 MW of intermediate generation by 2012.

Figure 4.0-3: Basin Electric's Peak Demand



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