

## **SUMMARY OF PAWNEE SELECTIVE CATALYTIC REDUCTION ("SCR") AND SCRUBBER PROJECT**

### **Project Overview:**

The Pawnee Station Project ("Project") involved the installation of emissions control equipment to comply with the Clean Air – Clean Jobs Act ("CACJA"). The Project was placed in service in August 2014.

### **Project Scope:**

The Project consisted of the installation of a Selective Catalytic Reduction ("SCR") system to control nitrogen oxide emissions ("NOx") and a Lime Spray Dryer ("LSD" or "Scrubber") to control sulfur dioxide ("SO<sub>2</sub>") emissions. Several plant systems were modified, including the Fabric Filter Dust Collector ("FFDC") system, plant electrical system, waste ash system, digital control system ("DCS"), compressed air system and water treatment system. The Project also required the installation of a new tubular air heater and steam coil air heater and the replacement of existing Induced Draft Fans ("ID Fans").

### **Project Description:**

The purpose of the Project was to install an SCR for ("NOx") emission reductions and an LSD for ("SO<sub>2</sub>") emission reductions. This equipment was designed and supplied by Babcock & Wilcox ("B&W"). Several plant systems were also upgraded as part of the Project.

The FFDC compartments were coated to prevent corrosion. The FFDC bags were replaced, and the individual FFDC compartment structural support systems were upgraded due to the changes in operating pressure, temperature and flue gas constituents.

Much of the boiler ductwork and support steel required upgrading due to the change in operating pressure, as well as the increased weight of new equipment.

The waste ash system was upgraded with the installation of a larger waste ash silo, new ash compressors, and higher capacity fly ash feeders to handle the increase in fly ash volume associated with the LSD. This equipment was supplied by United Conveyor Corporation.

New ID Fans supplied by Howden Variax were installed due to the increased pressure drop associated with the new ductwork and equipment installed in the flue gas path. New ID Fans were chosen over booster fans to reduce the length of the outage required to install the fans.

Many medium and high voltage breakers were replaced, and new breakers were installed to provide power to new equipment. Current limiting reactors were installed to

protect the plant electrical system in the event of a fault in the ID Fan motor power circuits.

New steam coil air heaters were installed to increase the flue gas temperature during periods of low load operation when ambient temperatures are low. This installation was necessary to assure proper operation of the SO<sub>2</sub> scrubber under these conditions.

A tubular air heater was installed to reduce the flue gas temperature entering the SCR during periods of high ambient conditions. This installation was necessary to maintain SCR inlet temperatures below maximum catalyst design temperatures.

Construction was performed by The Industrial Company ("TIC"). Design services for the ductwork stiffening, fault current reactors and existing system modifications were provided by Sargent & Lundy. Startup was performed by the Company with support from B&W, TIC and Sargent & Lundy.

**Key Changes Since the CPCN Filing (Proceeding No. 11A-325E):**

As the design of the SCR and Scrubber were being developed, it was determined that the operating characteristics of the Pawnee boiler would prevent reliable operation of the new emissions control equipment over the entire load range of the unit. This meant that additional equipment not included in the original estimate would be required to assure reliable operation (i) at low loads in the winter to provide more flexibility for future operation with higher renewable levels and (ii) at high loads during the summer.

More specifically, steam coil air heaters were added to heat boiler inlet air to provide adequate temperature at the inlet to the scrubber during low temperature and low load operation. A tubular air heater was also added to remove excess heat from the flue gas exiting the boiler at high loads in order to avoid exceeding temperature limits of the catalyst in the SCR. These new components also required larger ID Fans, as well as large motors and fault current limiting reactors for the fans. These changes increased the overall construction cost of the Project.

In addition, the extensive reinforcement of the structural steel required by the increased Project scope required lead abatement costs that exceeded the original budget by nearly \$3 million.

The original cost estimate was exceeded due to these scope additions and higher-than-estimated construction costs. However, lower than estimated equipment costs partially offset these higher costs. The final Project cost was \$272 million, or \$20 million higher than the original estimate of \$252 million. The \$252 million estimate was derived from the budget approved with the Pawnee CPCN,<sup>1</sup> plus a 2.5% escalation. A detailed comparison of the spending to date, current projections of total capital expenditures and

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<sup>1</sup> The original CACJA estimates were expressed in 2010 dollars.

the projected total capital expenditures provided in the CPCN proceeding is included as Attachment 1 to this Exhibit.

**2019 Activities – Overall Status Update:**

The Project was placed in service in August 2014 and completed in 2014. The equipment is performing as designed, and the plant is meeting air permit emission limits.

There were no capital expenditures in 2019 through September 30, 2019.

**Overall 2020 Financial Information:**

The 2020 estimated revenue requirement and the overall 2020 financial information for this Project is included in Exhibit 3, “Clean Air-Clean Jobs Act (“CACJA”) Overall Project Summary”, in Table 1.

**Specific 2020 Project Activities:**

The Project has been completed and there are no additional capital expenditures anticipated.

**2020 Variable Non-Fuel O&M:**

See Exhibit 7, “Summary of Variable Non-Fuel Operation and Maintenance (“O&M”) Costs” for the variable non-fuel O&M expenses for Pawnee.

**Timeline:**

The Project was completed in 2014.