Project Update
Council Bluffs Energy Center – Unit 4

COAL-GEN

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INTRODUCTION

MidAmerican Energy Company competitively bid a turnkey EPC scope for a 790MW pulverized coal fired plant in 2002. They selected and awarded a contract to a team lead by Mitsui and Company Energy Development, Inc. on February 15, 2003. Mitsui assembled an international EPC team lead by Hitachi America, Ltd. Sargent & Lundy joined Hitachi's team as a subcontractor with the responsibility of overall plant design, detailed engineering and BOP equipment procurement support. Hitachi America, Ltd competitively bid the construction scope in three (3) packages (civil, boiler erection and BOP installation) and selected Aker Kvaerner Songer Inc. (AKSI) to supply all three scopes.

MidAmerican Energy Company was an early adopter of a supercritical steam cycle and recognized Hitachi as one of the world's leading suppliers of technology for their application. Hitachi has experience dating back to the 1970's that it has refined over the years into a very reliable design. Hitachi manufactures both the boiler at its Babcock Hitachi KK (BHK) subsidiary in Kure, Japan, near Hiroshima and the steam turbine generator from Hitachi Works in Hitachi City, Japan which is two hours by train from Tokyo.

Hitachi utilizes a 'standardized' plant design for the international market and based the design of the Council Bluffs plant on a 1050MW unit that Hitachi supplied for the Tokyo Electric Power Company at its Hitachi Naka plant near Hitachi City. This approach expedites the overall process allowing manufacturing of the major equipment to support an aggressive project schedule – in this case, 45 months. It should be noted that work began prior to the receipt of a final Air Quality Prevention of Significant Deteriorization (PSD) construction permit.

The MEC team responsible for developing this project was instrumental in fostering excellent state and local community relations, as well as strong labor relations with the local building trades. This foundation allowed the EPC team to work very closely and cooperatively with local City of Council Bluffs officials to ensure that the new plant will satisfy all local codes, including the International Building Code, which has been adopted by the city.

PROJECT EXECUTION TEAM

As was mentioned, Mitsui & Co. Energy Development, Inc. contracted with MidAmerican Energy Company for the EPC scope. Hitachi then contracted with Mitsui to build the plant. Figure 1 depicts the structure of the project team. The first box depicts the major equipment manufacturing and delivery plan with BHK being responsible for the boiler and Air Quality Control System scopes. Hitachi, Ltd.'s Thermal Engineering Department providing high level thermal design along with the power block's General Arrangement. The steam turbine and generator were manufactured in Hitachi, Ltd.'s Hitachi Works.

Sargent & Lundy assisted in the thermal design and site arrangement and then provided all other detailed design. They developed specifications for the BOP equipment and participated in the evaluation of the potential suppliers. Hitachi America, Ltd. procured the equipment along with those portions of the boiler not manufactured in BHK's Kure Works.

Finally, as was mentioned, Aker Kvaerner Songer was selected to supply construction services including foundations, boiler erection and BOP installation.

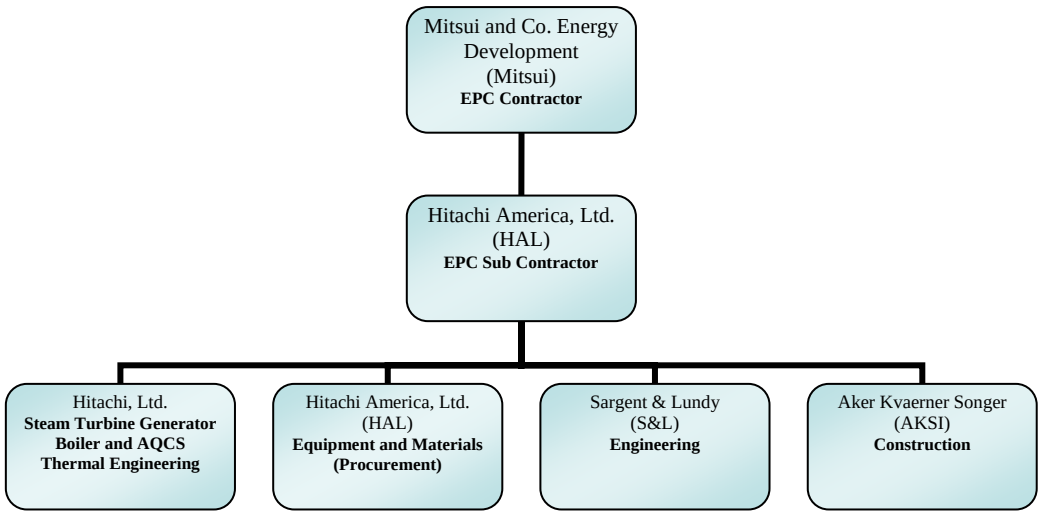

Fig 1

DESIGN & PROCUREMENT

Council Bluffs Energy Center is located on the Missouri River, within the city limits of Council Bluffs, Iowa, across the river from Omaha, Nebraska. In addition to the new Unit 4, the center consists of three coal-fired units of a 43 MW, 88 MW and 675, which are all still in operation. Powder River Basin (PRB) coal is used for all units and is delivered to the site via unit trains. Unit 4 will use the existing unloading, storage, and conveying facilities at the center. The scope of the Unit 4 work includes upgrading the existing coal crusher equipment and coal conveyors, currently used for Unit 3, to accommodate the additional capacity required for Unit 4. New transfer conveyors are being installed from Unit 3 to the new Unit 4 tripper room.

Unit 4 will consist of a Hitachi, Ltd. 1050 F/1100 F tandem-compound, four-flow turbine with 40” last-stage titanium blades, operating at 3675 psig. The Babcock-Hitachi boiler is a pulverized-coal-fired, supercritical steam generator designed for 5.5 million lbs/hr maximum continuous rating. A dry lime injection Flue Gas Desulfurization System was purchased from Babcock & Wilcox and GEA is supplying a 22-cell mechanical draft cooling tower for cycle cooling.

The plant main cycle consists of an HP heater above reheat port (HARP) cycle with two 50% turbine-driven boiler feed pumps and a motor-driven startup feed pump, supplied by Ebara Corporation. The eight stages of feedwater heating consist of one deaerating heater from Kansas City Deaerator Company and seven closed feedwater heaters from Thermal Engineering International. The condenser is designed by Hitachi, Ltd. and fabricated in Canada. Three 50% vertical condensate pumps are provided by ITT Gould Pumps. A full-flow condensate polisher by U.S. Filter Corporation is provided to maintain suitable water quality for the once-through supercritical steam generator. The main cooling cycle consists of a 22-cell mechanical draft, fiberglass cooling tower by GEA Power Cooling, Inc., and three 50% vertical wet pit circulating water pumps are also procured Ebara Corporation.

Makeup water for CBEC 4 is produced by 6 wells located within the site boundaries. Well water is pumped through clarifiers and a reverse osmosis demineralization system, provided by U.S. Filter Corporation, to a 500,000-gallon demineralized water storage tank. The demineralized water is used for main cycle makeup and for regeneration of the condensate polishers and the demineralization system mixed bed resins.

S&L utilized its 3D model system, PLADES, for detailed design work. Hitachi and S&L engineers worked closely at S&L's offices in Chicago during the entire design phase of the project. S&L managed the 3D model for the project by integrating models from all of the major equipment suppliers. The model served as the primary tool for walkthroughs, constructability reviews, interference checking, and for general communication with other organizations.

As with any "brown field" site, there were many design challenges to overcome. Due to limited space availability for the plant itself, close coordination was necessary with the construction team in order to sequence release of design work. Although adequate laydown space was available, its location was somewhat remote from the unit 4 location. Existing underground piping had to be partially excavated in order to establish exact coordinates for other design work in the area. Having Mosquito Creek in such close proximity, the design team needed to interface with the U.S. Army Corps of Engineers to discuss designs near the levies.

The AQCS's arrangement is at a 90% angle to the plant because of the location of the existing coal handling facilities. The air permit limits for design are:

- NOx 0.07 lb/MMBTU
- SO2 0.10 lb/MMBTU
- PM10 (F + C) 0.025 lb/MMBTU

To further complicate the site logistics, the available space was located on or adjacent to existing easements for underground city sewage and potable water lines, buried natural gas lines, and US Army Corp of Engineers levees and rights-of-way. As a result of construction issues and concerns over potential risks to the city, the EPC team decided to relocate

existing utility lines out of the main construction area. This included rerouting an existing 40-inch forced sewage main, which connects the entire community of Council Bluffs to the sewage treatment plant on the south side of the center. “Hot taps” were used to allow the sewage main to remain in service while the rerouting was being done. An additional complexity is that the water treatment facilities are located within the track loop for coal unit trains. Construction access to the area must be coordinated with coal deliveries to Units 1, 2 and 3.

PROJECT MILESTONES

As previously noted, the schedule for the project is 45 months from NTP. Critical path procurement included mill orders placed with Sumitomo Metals for alloy boiler components and rotor forgings with Japan Steel Works on October 2003 and boiler structural steel with CTIW in November 2003.

Construction work began in July 2003 with initial site preparation. Piling work began after a full Notice to Proceed was given to the team in September 2003. Foundation work began in February 2004 and the turbine pedestal was completed approximately a year after NTP.

Structural steel and ductwork delivery began in May 2004. One of the integral aspects of the delivery plan was the use of the Missouri River and, as such, a temporary barge unloading facility was constructed by the summer of 2004. This allowed for module shipments including box sections of boiler ductwork.

Hitachi's boiler erection process is called Simultaneous Erection. This means that boiler related components such as ductwork, piping and other pieces are erected along with the structural steel, which reduces the need to rig these components into place after the steel is erected. The Army Corps of Engineering placed some restrictions on when the river could be utilized for these deliveries based on river water levels and the team was able to work around the restrictions.

Boiler components began arriving in October of 2004. The steam turbine and generator were also delivered via the Missouri River in May 2005 and placed on their foundations by August.

The boiler top girders, a major milestone for a sliding pressure Benson type boiler, were set in February 2005. With these in place, the boiler proper erection work began. At the same time, other mechanical equipment (Condensers, Coal Mills and etc.) was installed. The crossover coal conveyor between Units 3 and 4 was ground assembled and lifted into place in May 2005.

The most recent major milestone to be achieved was the boiler hydro test, which was completed in June and first fire is planned in for late November. The project team is working hard to achieve Substantial Completion by next June.

The erection of the Air Quality Control System is the last major segment to be done. Currently construction activities are progressing at an aggressive pace of approximately 4% completion per month, with a work force of about 2,500 craft labor force. The EPC team anticipates that the work force will drop in the coming months, as we approach the Fall season.

The remaining construction milestone activities include completion of the AQCS system erection and initial fire of main boiler with oil, this year. First steam to the turbine, main boiler initial fire on coal, and substantial completion of project are slated for first half of next year.

In addition to construction activities, the EPC team has been busy providing training to MEC operators and maintenance staff. The EPC team created a formal operator training program to address unit design, the unique characteristics of the supercritical boiler, and the introduction of Japanese technology. The trainers addressed design issues ranging from major design considerations to the selection of various pieces of large equipment, vendor general arrangement drawings, the characteristics of various I&C systems, even pictures of actual operator DCS screens.

FINAL THOUGHTS

The Council Bluffs Energy Center, Unit-4 has been a very significant project for the EPC team. Although a local project in Iowa, it has brought a global team together to build a state-of-the-art power plant. The project has achieved many firsts, some of the major ones are as listed below:

- Supercritical boiler, with latest design features having 5.5M lbs/hr main steam flow
- 870 MW Steam turbine, largest Hitachi turbine outside of Japan
- Steam turbine generator, rated at 1,025 MVA, among the largest two-pole generators manufactured by Hitachi
- Piggy back coal handling system
- Dry FGD system with three spray dry absorbers, by B&W
- Lime handling including a vacuum/pressure system
- Mercury control with activated carbon injection
- Cooling tower with 22-cells back-to-back

As the construction efforts come to a close, the team looks forward to a successful completion of the remaining activities and plant operation.