Industrial Boilers for Canadian Oil Sands

Plant Description

Alberta's high-quality oil sands deposits are a major contributor to Canada's economy and North America's energy needs. Babcock & Wilcox (B&W) was selected to help advance one site's responsible development and efficient production of its estimated 4.6 billion barrels of recoverable bitumen resource.

Project Challenge

To most effectively, environmentally and reliably harness the naturally occurring petrochemical, the customer required a steam generation solution that provided:

- Maximum modularization to minimize field erection costs
- Ultra-low NO_x emissions (7.9 g/GJ)
- Minimum blowdown to comply with zero liquid discharge (ZLD) requirements
- High thermal efficiency
- Multi-fuel capability (gas and oil)
- High availability and reliability in a -45C (-49F) environment
- Fast load demand response, high turndown and ease of operation and maintenance

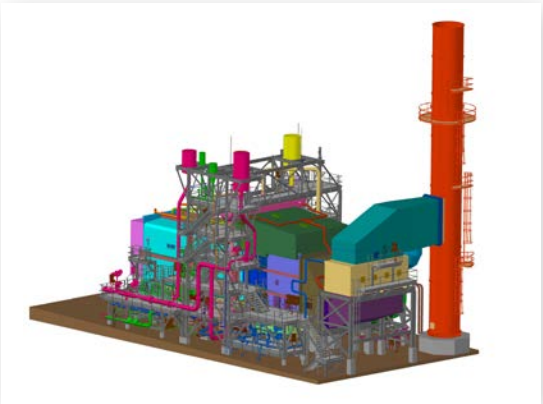
Solution

To achieve the project's goals, B&W supplied eight industrial water-tube boilers, each designed for a peak capacity of 286 T/h. To provide steam availability during power outages, two of each set of four boilers were engineered to operate without power from the grid. This was accomplished by driving the fans with steam turbines rather than motors and connecting all other required components to an uninterruptible power supply. To offset the impact of any natural gas interruption, one boiler in each set of four was designed to fire No. 2 oil to generate the full 260 T/h at 6500 kPag/432C (943 psi/810F). In the summer when steam demand is lower, the boilers can be rotated out of service for scheduled maintenance.

An oil sands facility in Alberta, Canada, selected B&W to supply a high-efficiency, high-reliability, low-emissions steam generation solution.

Scope

- Eight industrial boilers with a total capacity of 2080 T/h
- Economizers
- Fans, drives and lube skids
- Flues, ducts and stacks
- Steel, platforms and stairs
- Blowdown systems
- Piping and valves
- Burners and fuel trains
- Boiler control and burner management systems
- Instrumentation
- Insulation and electrical heat tracing



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Modularization

B&W has developed a modular solution ideally suited for steam-assisted gravity drainage (SAGD) and oil sands mining applications that handles large steam capacities, is easily transportable and reduces field labor costs. This project's boiler and balance of plant equipment modules were sized to comply with the shipping and weight allowances of Alberta's High Load Corridor. They were shop-tested, shipped to the jobsite and installed in sequence on pre-installed pedestals.

Metallurgy

The boilers and auxiliary equipment were designed to meet the -45C (-49F) minimum design metal temperature (MDMT) typical of most standard oil sands projects. B&W established guidelines for application to all boiler and associated equipment components on the basis of brittle fracture. Lug and weld materials and procedures, thermocouples on economizers' leading edge tubes and downcomer cross-over piping, structural steel, upgraded fan and turbine-drive shaft and rotor materials, damper drives, transmitters and instrumentation were all supplied to meet the established guidelines.

Blowdown

The all-welded design and multi-lead ribbed tubing used allowed faster response and reduced the potential for internal tube deposits, which increased reliability and availability and allowed the operator to optimize the boiler blowdown.

Ultra-Low NO_x Emissions

To meet the project's specified ultra-low NO_x emissions of 7.9 g/GJ (15 ppm), B&W tested, designed and installed custom burner, flue gas recirculation (FGR)and combustion

air temperature control features. The large furnace dimensions allowed for the larger burner openings needed for the ultra-low NO_x burners, but required a unique boiler wall tube pattern to lace the tubes in between the burner throat and outer firing ring. B&W also optimized the FGR damper position as well as the main intake and bypass dampers to provide combustion air temperature within the acceptable range.

Results

B&W successfully met the project's reliability, modularization and environmental requirements. All eight boilers continue to perform in accordance with all operating requirements as designed.

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