Technical Paper

Indonesian Coal-Fired Power Project Recovers After Five-Year Delay

A. Vargo and M. Cherniuk
The Babcock & Wilcox Company
Barberton, Ohio, U.S.A.

Presented to:
2006 Power-Gen International
November 28-30, 2006
Orlando, Florida, U.S.A.

Indonesian Coal-Fired Power Project Recovers After Five-Year Delay

Aaron Vargo and Michael Cherniuk
The Babcock & Wilcox Company
Barberton, Ohio, U.S.A.

Presented to:
2006 Power-Gen International
November 28-30, 2006
Orlando, Florida, U.S.A.

BR-1789

Abstract

After a five year project suspension and storage of major components, caused largely by the late 1990s Indonesian currency crisis, the 1320 MW Tanjung Jati B Power Station on the island of Java achieved commercial operation in the fall of 2006. Design and manufacturing of the boiler island equipment was approximately 75 percent complete at the time of project suspension in May 1998.

Tanjung Jati B features two 660 MW (net) pulverized-coal-fired boilers, electrostatic precipitators, wet flue gas desulfurization (FGD) systems and coal and ash handling systems provided by The Babcock & Wilcox Company (B&W), in consortium with Black & Veatch International. The Consortium is currently under contract to Sumitomo Corporation of Japan to supply the boiler islands including fans, firing systems including B&W-89G Roll Wheel™ pulverizers and DRB-XCL® low NO_x burners, instruments, burner management logic, and the precipitators. B&W is also supplying the FGD systems while Black & Veatch is supplying the ship unloaders, stacker reclaimers, coal and ash handling, structural steel, and balance of plant for the boiler islands.

Project history and suspension

The Tanjung Jati B Project was initially bid in June of 1994, and in September of 1994 a Power Purchase Agreement was signed between the project developer and PT PLN (Persero),

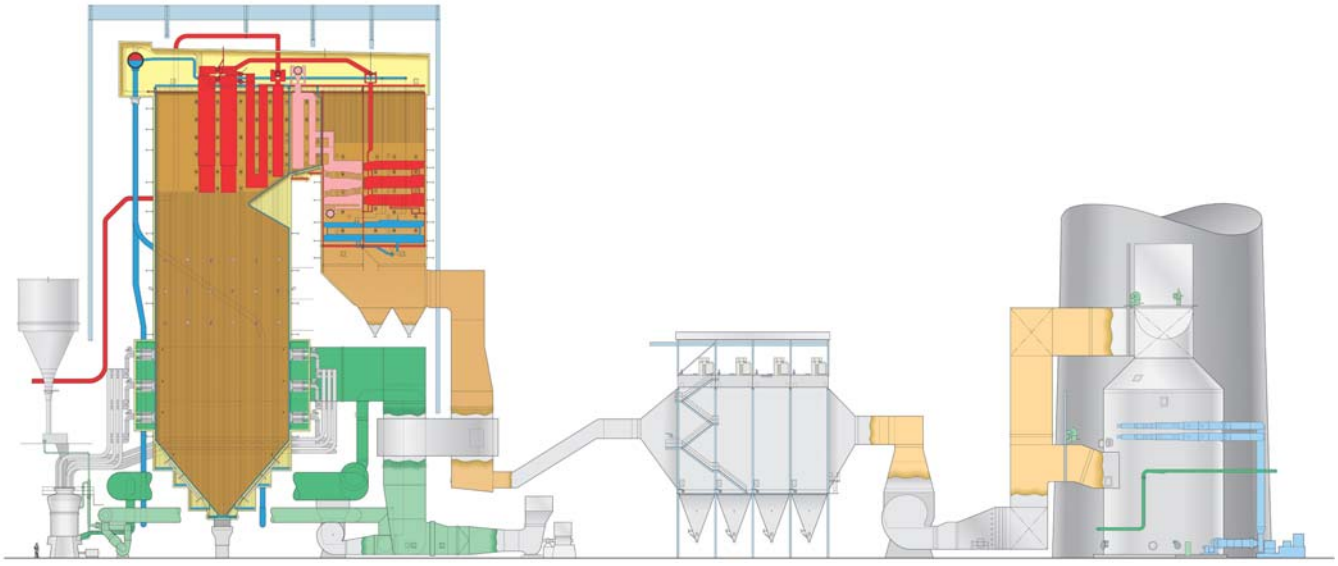

Fig. 1 Tanjung Jati B 660 MW coal-fired boiler.

the state electricity corporation owned by the government of Indonesia which started this 1320 MW power facility to support the increasing power requirements of Indonesia. Under Sumitomo Corporation's leadership, main contractors were assembled to prepare the engineering, procurement and construction (EPC) contract which covered the turbine island, boiler island, stack and the civil works for this green field project. Through a team approach with Sumitomo Corporation, the technical specification, scope of supply, division of works, and the EPC contract were developed to the mutual agreement of all parties for the execution of the Tanjung Jati B project. The EPC contract was signed in September 1995 between the developer and Sumitomo Corporation with supporting subcontracts signed with each of the main suppliers. Shortly after, the project went into brief suspension due to delays in land acquisition and financing. Engineering work was started in late 1995 and the Consortium continued to support the project through this period. In April 1997, the contract officially commenced with the procurement of materials and fabrication of the components.

The Babcock & Wilcox Carolina Radiant Boiler, electrostatic precipitator (ESP) and wet flue gas desulfurization (FGD) system components (see Fig. 1) were fabricated in many different locations throughout the world. The boiler water walls, economizers, superheaters and reheaters were being built at PT Babcock & Wilcox Indonesia's (PTBWI's) manufacturing facility on Batam Island, Indonesia. The steam drums, large headers, burners and pulverizers were being fabricated in B&W's Cambridge, Ontario, Canada, facility. Boiler buckstays, flues, ducts, windboxes and casing, as well as the ESP structural components, the platework for the FGD absorber towers, and field-erected tanks were released for sublet fabrication in Indonesia.

The regenerative air heaters would contain parts fabricated in the U.S.A. and Indonesia; electrostatic precipitators' collector plates and electrodes were made in Europe. The absorber internals, main pumps and auxiliary equipment were sourced from the U.S.A. Black & Veatch International was obtaining the coal handling equipment and ship unloaders from Spain and Italy respectively with some fabrication of components in Indonesia. During this period the progress of the project was building momentum in support of an aggressive project schedule with vendor equipment being procured from various parts of the world.

Civil work was well under way and structural steel erection started on Unit 1 at the project site (see Fig. 2). The Unit 1 steam drum was just loaded and on the water for delivery to the Tanjung Jati B site when Sumitomo contacted the various parties and put the project in suspension.

The Asian currency crisis in the spring of 1998 had caused devaluation of the Indonesian currency and in turn, caused crisis and turmoil throughout Indonesia. As a result, Sumitomo was forced to suspend the project. All shipments were immediately stopped and held at either their fabricator's shop, shipping port or in the vendor shops.

The contractors were now faced with the challenge of what needed to be done with the equipment and materials for

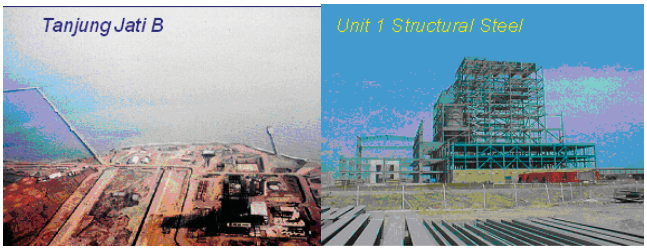

Fig. 2 Tanjung Jati site at the time of project suspension.

storage and preservation. Purchase orders in progress had to be cancelled, and engineering, fabrication and shipments stopped. B&W had equipment in various stages of completion in 75 locations throughout the world which needed to be addressed (see Table 1). Negotiations commenced with the customer to determine what was needed to store and preserve the equipment until project resumption. All the contractors on the project were faced with the same dilemma, as well as how their efforts were going to be compensated.

Agreements were reached between Sumitomo and the contractors to store and preserve the equipment during the suspension. Contractors were now able to give instructions to vendors and their own shops to store and preserve. One of the major shipping ports for B&W was in the port of Montreal, Canada. Arrangements were made to rent warehouse space at the port to store equipment and materials already deployed to the port for shipment to Indonesia. Certain materials required a climate controlled environment. Modifications to the warehouse therefore had to be performed and a climate controlled environment was maintained for the goods being stored for the length of the suspension period. The Unit 2 steam drum which was nearing completion needed to be stored and preserved. Structural steel, materials and equipment already delivered to the project site also had to be stored and preserved. It is important to note that the location of the project site is in the tropics just 7 degrees south of the equator next to the ocean. Concerns were raised about corrosion of materials not only on the project site but at the Babcock & Wilcox Batam Island facility where the boiler water walls were being prepared for outdoor storage. Arrangements for stor-

Table 1
Storage Locations for B&W Equipment

	No. of Sites
Canada	
Manitoba	1
Nova Scotia	2
Ontario	5
Quebec	2
	10
Europe	
Denmark	1
Finland	1
France	3
Germany	1
UK	1
	7

	No. of Sites
USA	
Ohio	1
Pennsylvania	2
Texas	5
13 Other States	2
	51
Far East	
Indonesia	1
Japan	1
Taiwan	3
Germany	1
UK	1
	7
Total	75

age and routine inspections where made to keep the equipment in a like-new condition through the expected suspension period.

The suspension period lasted from May 1998 to July 31, 2003. Several attempts were made to restart the project during that time but due to the crisis, economics and financing the project could not regain momentum. During this time continued inspections and storage/preservation fees were maintained to keep the equipment in like-new condition.

In 2002, the economy in Indonesia was stabilizing and the need for more power was increasing. It was not unusual to be in the country and have the power go out at a major hotel. Some of the major hotels were procuring generators for backup power as a result of the power shortages being experienced.

Through the persistent efforts of Sumitomo Corporation and the need for power in Indonesia, agreements were reached between PT PLN (Persero) and Sumitomo to restart the project. In July 2003 the project was officially resumed. Again the contractors were assembled to work out the details of the resumption.

Project restart

During the resumption process, schedules were reworked along with scope changes. Engineering coordination meetings were set up monthly by and with the customer. The project teams, both home office and field for all of the contractors, needed to be re-established and manufacturing restarted. All vendors who had been issued purchase orders prior to suspension had to be contacted, advised of the resumption and agreements reached for the completion of the work. A massive effort was now underway to get the momentum moving once again after five years of dormancy.

Major issues were the completion of the underground cooling water system for the condenser and stack construction which could cause delays in the schedule. The transmissions lines also had to be installed from the plant to the main trunk that fed the island.

During the time of suspension and restart of the project, it became evident that the customer was unable to supply the range of coals specified that set the original design. Countless hours were spent re-evaluating coals from various mines in Indonesia and several from Australia that would achieve the desired performance and meet the emissions requirements of the plant.

Shipments that were once ready to move had to be re-inspected and in some cases restored to completely like-new condition and retested for transport to the Tanjung Jati B site. Inspection teams were formed and dispatched to various locations throughout the world for this purpose. Drawings, files and correspondence had to be re-established.

The resumption process presented some interesting challenges for B&W as well as the other main contractors. During the suspension period, several of the vendors that B&W used had declared bankruptcy, were sold or became insolvent. Some technologies had changed from the onset of the project and during the suspension. Manufacturing facilities were full and PTBWI's manufacturing facility on Batam Island was changing to support work needed by B&W's parent company. As a result, alternate fabrication facilities needed to be located and utilized to support some of the boiler work.

Efforts were now focused on buying new motors that were once under purchase order but not 100% completed. Sublet fabrication of the unit 2 boiler water walls and pressure parts outside of the B&W shops had to be considered. Although complete, the limestone offloading conveyor was no longer supported by the vendor and now became the sole responsibility of B&W. Even with these unexpected challenges, the project regained momentum for a Fall 2006 commercial operation date.

Tanjung Jati major equipment

The Tanjung Jati B project includes two (2) 5,099,000 pound per hour steam generators and auxiliaries along with the necessary support equipment to meet environmental control requirements. In addition to the boiler, combustion systems, air heaters and fans, environmental equipment includes a first of a kind seawater/limestone wet flue gas desulphurization system for SO_2 control, and an electrostatic precipitator for particulate control. The steam generator and turbine equipment were designed to meet a net plant output of 660 MW per unit.

The B&W natural circulation, balanced draft, sub-critical boiler is designed to fire Indonesian pulverized coal with oil ignition (Fig. 1 and Table 2). The oil igniters are able to support up to 13% of maximum boiler load and are used mainly to light off the pulverized coal. The boiler has a water-cooled, dry bottom furnace, and superheater, reheater, economizer and air heater components. The boilers are designed to burn coal pulverized to a fineness of 70% passing through a 200 mesh (75 micron) screen.

The horizontal convection pass and vertical pendant heat transfer surfaces allow for high temperature supports outside of the flue gas stream. This also allows for minimal motion between the boiler roof penetrations and more control of pendant section spacing in the design**.** The design provides for a lower furnace height as compared to other pulverized coal boilers and affords savings in structural steel and erection costs.

Table 2
Boiler Specifics

Main Steam Flow:	2313 Mkg/h (5099 Mlb/h)
Main Steam Temp:	541C (1006F)
Main Steam Pressure:	174.2 barg (2527 psig)
Reheater Outlet Flow:	1895 Mkg/h (4178 Mlb/h)
Reheater Outlet Temp:	539C (1001F)
Reheater Outlet Press:	37.9 barg (549 psig)
Fuel	Indonesian Coal
Boiler Type	B&W Carolina Radiant

Both Tanjung Jati B Units 1 & 2 have six B&W-89G Roll Wheel Pulverizers (Fig. 3). Each of these pulverizers is fed coal from a coal silo by a coal feeder. Within each pulverizer the coal is pulverized, dried and transported to six B&W DRB-XCL low NO_x burners. The pulverizers are also equipped with DSVS classifiers for enhanced performance and reduced unburned carbon.

The B&W low NO_x burners (see Figure 4 and Table 3) produce a relatively low temperature flame, thus reducing the generation of nitrogen oxides from fuel bound nitrogen and nitrogen in the combustion air. To support full load operation of the Tanjung Jati B plant, the Carolina Radiant Boiler was equipped with 36 DRB-XCL burners located on the front and rear wall of the units, three levels with 6 burners per level.

The B&W DRB-XCL burner incorporates fuel staging technology along with air staging. Air flow is regulated to the burner by a sliding disk.

Tanjung Jati B is equipped with B&W Electrostatic Precipitators, two per each boiler train. See Fig. 5. The precipitators are arranged in the split flue gas stream between the air heaters and induced draft fans. The precipitators are two casings with 4 fields per casing and one casing per flue gas stream. The particulate emissions are collected by the precipitator. The equipment is designed to remove the particulate from the flue gas and discharges the flyash collected for disposal which is pneumatically conveyed to flyash silos where it is combined with the economizer ash and transported to an onsite landfill. The ESP's do not collect all of the flyash. The balance of the flyash is removed by the wet FGD absorber provided for SO_2 control.

Fig. 3 B&W Roll Wheel™ pulverizer.

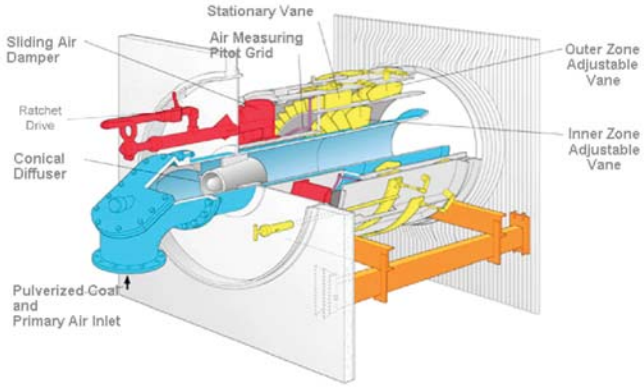

Fig. 4 Tanjung Jati features the B&W DRB-XCL® coal-fired low NO_x burner.

Table 3
Burner Details for Tanjung Jati

Item	Units	Value
Carbon Dioxide	Kg/hr	1832.4
Sulfur Dioxide	Kg/hr	516.24
Nitrogen Oxides	g/GJ	172
Total Suspended Particulate	Mg/Ncm	50

The SO_2 control for the Tanjung Jati Power plant is achieved with the use of two B&W wet flue gas desulfurization systems. See Fig. 6. Each forced oxidation FGD system is comprised of the following sub systems:

- Limestone unloading and handling system (limestone is barged to the plant and offloaded from a jetty)
- Reagent preparation where the limestone is sized and mixed with sea water for introduction into the absorber vessel.
- Absorbers (for SO_2 control); one absorber module per boiler
- Dewatering system for the disposal of the gypsum
- Sea water makeup

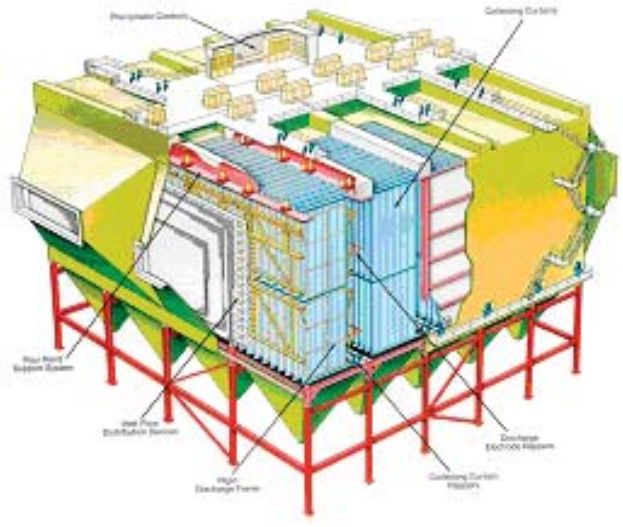

Fig. 5 Electrostatic precipitator for Tanjung Jati B.

The wet limestone FGD system is unique due to the fact that it utilizes seawater for makeup.

The absorber vessel is made of carbon steel and is flake glass lined and consists of one level of C276 trays and two levels of mist eliminators located above the trays. Seawater and limestone are used to remove the sulfur and ash from the system.

Conclusion

Tanjung Jati B Units 1 and 2 in Indonesia are now operating successfully producing 1320 MW of power (Fig. 7). This important power project represents a significant team effort lead by Sumitomo and supported by the main contractors, all material and equipment suppliers, the financial institutions, and PT PLN. The five-year delay was not anticipated when the project began, but all participants understood the Indonesian currency crisis and worked together to overcome the issues of supply, storage and preservation of the many components from throughout the world.

Tanjung Jati B Units 1 and 2 represent not only a significant challenge, but a remarkable success in communications, cooperation and engineering. The power from Tanjung Jati B is now helping relieve the ever-increasing power demand in Indonesia.

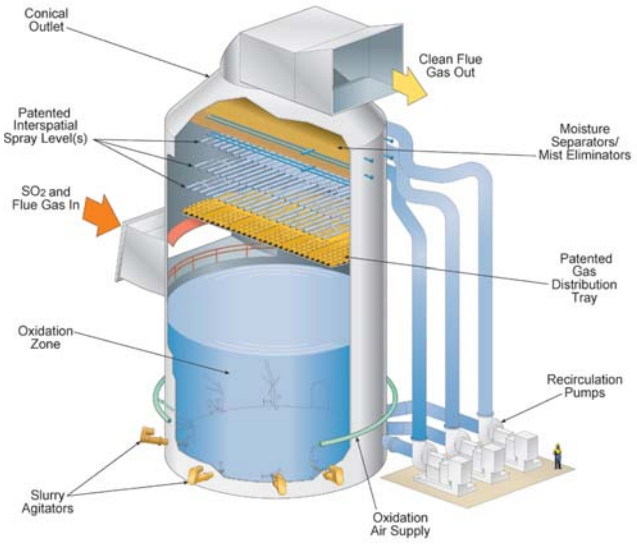

Fig. 6 Typical B&W absorber module for Tanjung Jati B.

Fig. 7 Tanjung Jati B Units 1 and 2 in operation.

Disclaimer
Although the information presented in this work is believed to be reliable, this work is published with the understanding that The Babcock & Wilcox Company and the authors are supplying general information and are not attempting to render or provide engineering or professional services. Neither The Babcock & Wilcox Company nor any of its employees make any warranty, guarantee, or representation, whether expressed or implied, with respect to the accuracy, completeness or usefulness of any information, product, process or apparatus discussed in this work; and neither The Babcock & Wilcox Company nor any of its employees shall be liable for any losses or damages with respect to or resulting from the use of, or the inability to use, any information, product, process or apparatus discussed in this work.