

Construction of Coal-fired Supercritical Pressure Power Plant in India by Boiler and Turbine-generator Joint Venture Company with Larsen & Toubro (L&T)



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For the construction of a high-reliability/high-efficiency coal-fired supercritical pressure power plant for India, which was facing serious power shortages while achieving rapid economic growth, Mitsubishi Hitachi Power Systems, Ltd. (MHPS) established a joint-venture boiler company (LMB: L&T-MHPS Boilers Private Ltd.) and a joint-venture steam turbine generator company (LMTG: L&T-MHPS Turbine Generators Private Ltd.) with Larsen & Toubro Limited (L&T) of India in 2007. Our cooperating generator manufacturer Mitsubishi Electric Corporation (MELCO) is also affiliated with LMTG as an investor.

High level of quality achieved by transferring excellent Japanese technology to the joint-venture companies under a technological license agreement, as well as by establishing the Japanese manufacturing mind in those companies, 4 boilers and 5 steam turbine generators started commercial operation by March 2015.

In the future also, MHPS intends to enhance role of LMB/LMTG not only for the coal-fired supercritical pressure power plant projects within India, but also for the worldwide business of MHPS as the production bases of boilers/steam turbines.

1. LMB the JV for boilers and LMTG the JV for turbines with L&T of India

1.1 History of joint-venture companies

After signing a Technical license agreement for boiler in 2006, LMB and LMTG were established as joint-venture companies with L&T in 2007. Furthermore, with the establishment of LMTG an agreement for a technology license for turbine generator was concluded. Construction of boiler, pulverizer, turbine, generator and casting factories started in 2008 at Hazira of Gujarat state which is the western part of India, followed by production at factory in June 2010, and the opening ceremony of the Hazira Plant was held in January 2011 (Figure 1). Later on, expansion of factory facilities and smooth production of boiler, turbine and generator products continued, in Jan 2014 commercial operation of Rajpura no.1 unit also started which was the first coal-fired supercritical pressure for LMB/LMTG.



Figure 1 Aerial view of Indian joint venture's Hazira shop (Left: Turbine/generator factory, Right: Boiler/pulverizer factory)

1.2 Efforts for the realization of high quality

By means of technology transfer, MHPS has not only introduced the latest technology (Figure 2), but also by deputing the consultant technical adviser of design, quality assurance, manufacturing, construction and project execution, it realized the establishment of the high quality, high performance power plant through laying the roots of Japanese “MONOZUKURI” mind (Figure. 3). Moreover, not restricting itself only to the shop level technology introduction, selected directors from MHPS penetrated the necessity of smooth PJ operation /management and efforts for quality improvement to the management of LMB/LMTG.



Figure 2 Turbine high-speed balancing facility



Figure 3 Technical instructions at construction front

2. Construction of coal-fired supercritical pressure power plants in India

2.1 Features of coal-fired supercritical pressure power plants in India

Coal-fired Supercritical-pressure power plants in India is having two plant capacity of 660 & 800 MW, 25MPa class pressure of steam condition, 566°C/593°C-class temperature with other standard specification. The required specifications of boilers and turbines are also standardized due to the history of the Indian market for subcritical pressure power plants, which have been monopolized by a domestic company. In line with such standardized conditions in the Indian market, MHPS introduced standardized design of boiler and turbine for the Indian projects so that smooth technology transfer was enabled, consequently realized continuous improvement of the standard design by reflecting the experience gained by the manufacturing of preceding machines.

As for boiler, special consideration was required for Indian coals which have extraordinary high ash contents and tends to cause ash adhesion or erosion on the heating tubes. It was also required to prepare provisions for replacement of the eroded tubes securing spaces for transportation of the same. As for turbine, the line-up has been developed with combination of standard frames, of which low pressure turbine frames were designed to be suitable for the Indian level of condenser vacuum based on natural draft cooling towers, and high and middle pressure turbine frames were designed to be common for 660MW and 800MW. Designing based on the combination of standardized frames enabled the continuous manufacturing of the same turbines frames at the shop in LMTG, contributing to smooth technology transfer.

2.2 Plant construction and operation

In 2008 through 2010, orders were received for 7 boilers and 9 steam turbines. After that Indian market stagnated for a while, but then it recovered and additional orders for 6 boilers and 4 steam turbines received in since 2013 (**Figure 4**). In January 2014, NPL Rajpura unit 1 started commercial operation as the first unit manufactured by LMB/LMTG, and total 4 boilers and 5 turbines successfully started commercial operation by February 2015.

By deputing a lot of consultants and technical advisors from the early stage of the site construction, MHPS safety management, material control, installation methods, schedule control, quality control, foreign material prevention, welding management etc. handed down through practical experiences. In recent RRVUNL Chhabra project, as the outcome of the technical handed down in previous projects (**Figure 5**). MHPS way of project management activities are duly in practice without existence of MHPS consultants/technical advisors

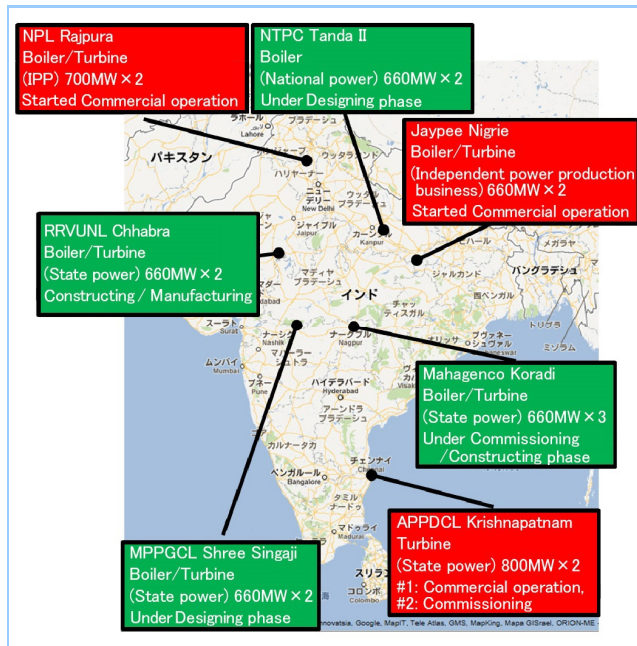


Figure 4 Coal-fired supercritical pressure power plants supplied by LMB/LMTG



Figure 5 Construction site of Indian power plant project

3. Global utilization of Indian joint-venture companies

3.1 Global strategies for utilization

As mentioned above, business process to ensure the high quality in designing, manufacturing, site construction, and commissioning for Indian projects is being established. Active utilization of JV not only for India but as a global procurement resource of boiler pressure parts, pulverizer and turbine parts of MHPS domestic and export projects is also on the way.

For example, by February 2015, shipping has completed for boiler pressure parts and steam turbines for Saudi Arabia's Rabigh project Phase II, boiler pressure parts for Egypt project, and steam turbine components for GTCC of the U.S. project. As of March 2015, boiler pressure parts, pulverizers, and steam turbines for projects in Japan, the U.S., and the Philippines are in manufacturing phase at LMB/LMTG Hazira shop. Sales promotions are in action to expand the further utilization of LMB/LMTG for domestic and international customers.

3.2 Efforts to achieve globally acceptable quality

In order to achieve global quality for MHPS projects, 5S, improvement-oriented small groups and TPM activities has been introduced with the assistance of Technology & Innovation Headquarters of Mitsubishi Heavy Industries, Ltd and continuous "KAIZEN" activities are being organized at LMB/LMTG.

In addition, periodical audit by MHPS is carried out to support the quality improvement activities in LMB/LMTG.