Cutting Costs with Captive Power

Benefits derived by Jaiprakash Associates' cement division

Cement is a major consumer of power among industrial units. By setting up a captive power plant (CPP), such units can save substantially on costs and derive other benefits as well.

This has bee the case with Jaiprakash Associates' cement division. While for most cement manufacturers, the cost of production has gone up in the last two three years, Jaiprakash Associates has managed to bring down costs by meeting more than 50 per cent of its power needs from its captive plant. It has also derived synergistic benefits from the plant by utilising fly ash to make cement. Such a practice is also environment friendly.

In the case study that follows, we take a look at how the cement division of Jaiprakash Associates has benefited by setting up a captive generation facility.

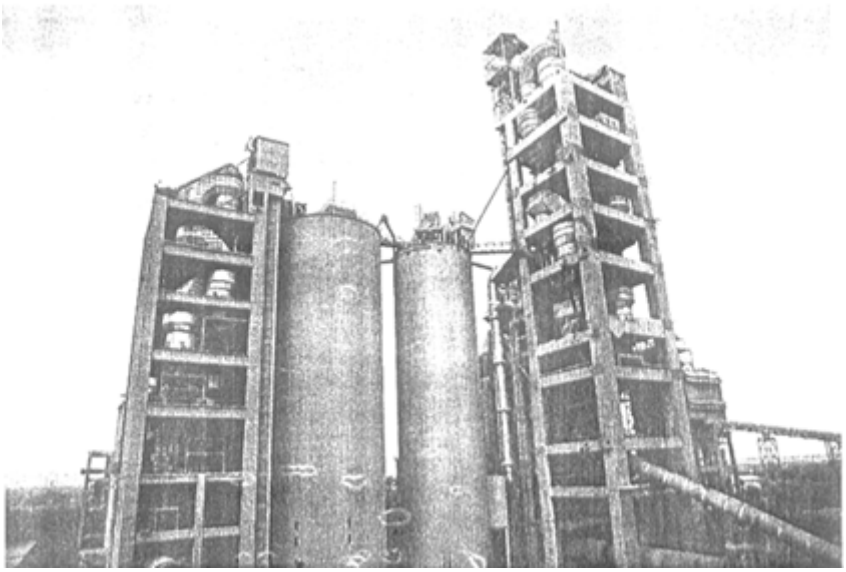
Case study

The cement division has three production lines for clinker production: JRP-I and JRP-II at Rewa, which produce 4,500 tonnes per day (tpd) and 5,700 tpd respectively; and JBP at Bela, which produces 6,700 tpd. The combined cement production capacity of the Rewa cement complex is 5.4 million tonnes per annum. The cement division has two more grinding/ blending units at Tanda and Sadwa Khurd. The combined capacity of the cement division stands at 7 million tonnes per annum from all these plants.

The total power requirement at the Rewa complex is 86 MW and power accounts for more than 30 per cent of the cost of production. Earlier, the power required for the division was sourced from the Madhya Pradesh State Electricity Board (MPSEB) and from captive DG sets.

Captive power plant –I

The company set up its first CPP of 25 MW with a conventional steam cycle operating in Rankine cycle, consisting of two atmospheric bubbling fluidised bed combustion (AFBC) boilers and one steam turbine with an air-cooled condenser. The plant was commissioned in October 2003 and served the power requirements of the Jaypee Rewa plant for JRP-I and JRP-II. Water was made available through water harvesting and creation of an artificial lake at Rewa. Air-cooled condensers were used in order to minimise the use of water.



Benefits: The cost of power from the captive plant was Rs 1.70 per unit as against MPSEB's power cost of Rs 5 per unit and the DG cost of Rs. 4.60 per unit. As a result, the cost of power has come down from Rs 367 per tonne to Rs 327 per tonne.

Captive power plant – II

An identical 25 MW captive plant was set up for the JBP plant. It has a single boiler of 125 tph and was commissioned in November 2004.

Benefits: With this installation, the over all cost of power of the cement division was reduced further, from Rs 327 per tonne to Rs 229 per tonne.

Additional benefits and features

At present, 58 per cent of the total power requirement is being met by the two CPPs. The company has started sale of 5 MW power per day to MPSEB during peak hours (6 p.m. to 10 p.m.), which is surplus after drawal of minimum power from MPSEB, according to the contract load demand.

A tie-line has been made between JRP and JBP to use the excess power available at either of these locations by hooking up the power available from CPP-I, CPP-II and the DG power of both places. This has been done to ensure optimum utilisation of power from all available sources as per the situation and availability at the lowest possible cost.

There is a 90 per cent saving in water through use of air-cooled condensers, which require only 350 m^3 per day as compared to water-cooled condensers, which have a water consumption requirement of about 3,500 m^3 per day.

Key features of Jaiprakash Associates' captive power plants

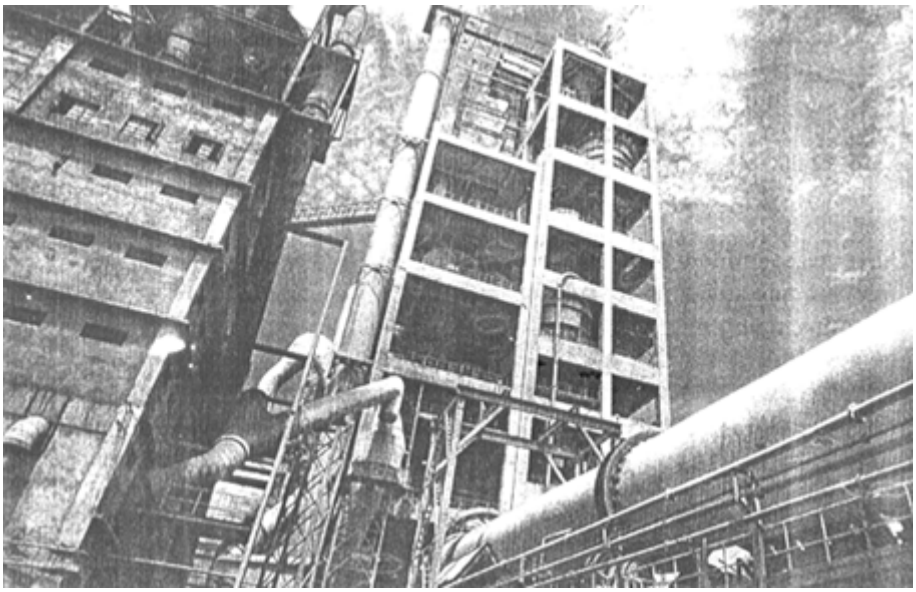
Details	CPP-I	CPP-II	CPP-III
FBC boiler	Two AFBC type 60 TPH,	One AFBC type 125 TPH,	One CFBC type 170 TPH,
	87ata, 510+/-50 C	87 ata, 515+/-50 C	86ata, 515+/-30 C
Feed water pump	Three multi-stage centrifugal	Three multi-stage centrifugal	Three multi-stage centrifugal
Steam turbine	One 27 MW straight condensing type	One 27 MW straight condensing type	One 38.5 MW straight condensing type
Air-cooled condensers	One 85.4 TPH, 0.22 ata, forced draft type	One 84.27 TPH, 0.22 ata, forced draft type	One 86 TPH, 0.22 ata, forced draft type along with one set of water cooled condenser

Generation and PLF

	CPP-I	CPP-II	CPP-III
Installed capacity (MW)	25.0	25.0	38.5
Actual generation (2004-05) (MUs)	184.3	61.3	270.0*
Plant load factor (%)	84.0	92.0	NA
* Expected generation on commissioning			

Another important feature is that the unit uses fly as in an extremely constructive and environment-friendly manner. The fly ash generation from the CPP-I and CPP-II plants is 172 tonnes per day (tpd) and 175 tpd respectively. Of this, 15 per cent ash is bed ash and the remaining 85 per cent is fly ash. This is collected and used in the manufacture of PPC, cement. Bed ash is also collected safety and disposed of through trucks to the mines area.

Coal is used as the fuel for these captive plants. The annual requirement for coal for the three plants is approximately 640,000 tonnes. The coal received is of a calorific value of about 4,000 with 40 per cent ash content and 5 to 15 per cent moisture content.



There are a number of other features that make the plant extremely environment-friendly. The emission level of dust in exhaust air is limited to less than 50 mg per nM3. There are no effluents in the water being disposed of as they are suitably neutralised.

Noise pollution from equipment such as turbines, fans, centrifugal pumps and electric motors is kept below the permissible limit of 85 dB at 1 metre away from the source.

Captive power plant –III

The company is now in the process of setting up its third captive power plant of 38.5 MW at the Jaypee Rewa plant.

The CPP-III is also a conventional steam cycle operating in Rankine cycle, consisting of one circulating fluidised bed combustion (CFBC) boiler of 170 tph capacity and one steam turbine. The plant is based on CFBC technology for boiler as against the AFBC technology used in CPP-I and CPP-II. The main advantage of a CFBC system is that solid and gaseous products leaving the combustion zone circulate in the CFBC resulting in higher efficiency, unlike in AFBC technology. The CPP-III is designed to use low-grade coal/ washery coal with ash content as high as 60 per cent.

Procurement of equipment for the third plant has already begun and the plant is slated to be commissioned by March 2006. With this, the total captive thermal power generation capacity of the cement division will increase to 88.5 MW as against the requirement of 86 MW. This captive facility, of an aggregate 88.5 MW, will also be one of the largest captive units in the cement industry and will help the company reduce its costs further.

Reference book:

Power Line,
May 2005