

Replacement of inefficient coke-fired cupola by energy efficient induction furnace in cast iron castings production

Tags

Type: Unit case study

Sub-sector: Foundry

Location: Kolhapur

Partners: GEF, World Bank, SIDBI, BEE, TERI, IIF–Kolhapur chapter, Kolhapur Engineering Association

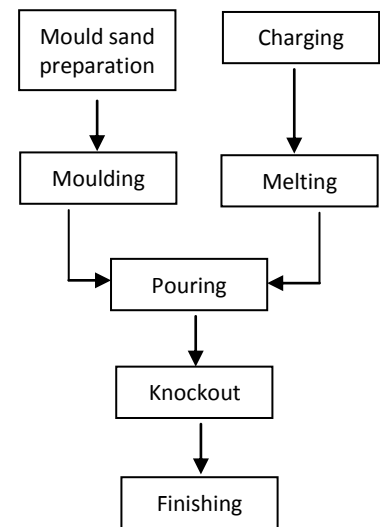
Year: 2012–14

Cluster background

Kolhapur (Maharashtra) is one of the important foundry clusters in India. The cluster has around 300 MSME foundries producing about 600,000 tonne of castings annually, primarily ferrous (iron) castings for the automotive sector, and accounting for about 7–8% of India's total castings production. The production capacity of these units varies from less than 1000 tonnes to over 10,000 tonnes per annum (tpa).

Unit profile

The MSME foundry unit **K5** manufactures graded cast iron (CI) castings. The production is about 1976 tonnes per annum (tpa). The annual energy bill of the unit was Rs 174 lakhs. The major process steps involved in the production of castings include mould preparation, melting, pouring, knockout and finishing. Green sand is prepared using sand mixer and the moulding is done manually. The charge material is melted in a coke-based cupola melting furnace. The molten metal is poured into moulds, which are cooled down and knocked out manually to remove the castings. The castings are subjected to finishing operations such as shotblasting and machining. The sand from the moulds is sent for reuse in moulding process.



Production process in a foundry

Energy consumption

The major energy consuming equipment included the coke-fired cupola melting furnace and electrical motors associated with process equipment such as air compressor, fan, pump, etc. The annual energy consumption was around 313 tonnes of oil equivalent (toe), comprising coke 98% (309 toe) and grid electricity 2% (4 toe).

Intervention

The unit was operating an old coke-fired cupola melting furnace. The energy audit found that the coke-to-metal ratio of this cupola furnace was 1:5.88, which was far lower than the design ratio of 1:10 and an indicator of very low energy efficiency. Further, the capacity of the cupola furnace was insufficient in meeting the unit's plans for product diversification.



Energy efficient induction furnace

The unit replaced its inefficient coke-fired cupola melting furnace with an energy efficient induction furnace

As per the recommendations of the energy audit, the unit replaced the inefficient, small capacity cupola furnace with a 1250 kW induction furnace having crucible capacity of 500 kg, 1500 kg and 2500 kg, and capable of supplying power to all three crucibles at the same time. The specific energy consumption of the induction furnace was 550 kWh/tonne. The electricity consumption of the induction furnace was 1.672 million KWh/year, replacing 515 tonnes of coke consumed by the unit. This investment of Rs 99.6 lakhs for the induction furnace is saving Rs 47.2 lakhs annually. The simple payback period is 2.1 years. The GHG reductions with switch over from coke firing to electrical furnace are about 265 tonnes CO₂ per year.

