Replacing traditionally designed reheating furnace with EE furnace system in glass bangle industry

Tags

Type: Unit case study

Sub-sector: Glass

Location: Firozabad

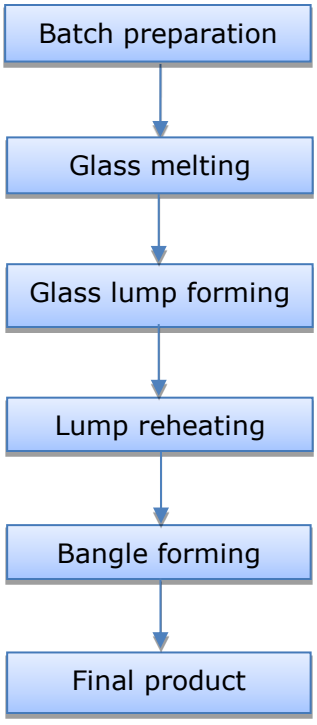
Partners: SDC, TERI

Cluster background

The Firozabad glass industry cluster accounts for about 70% of total glass production in small scale sector. The glass bangle units are located mainly in and around Firozabad town. These units use open pot furnaces to produce glass for shapinginto bangles. There are more than 100 pot furnace units with average production capacity of 7 tonnes per day engaged in bangle production in the cluster. Apart from pot furnaces, a few tank furnaces, which are of larger capacity than pot furnaces, are also being used to produce glass bangles.

Unit profile

The bangle unit manufactures glass bangles of various sizes and colours. The average production of the unit is about 1.02 million bangles per day (melt glass processed around 7.2 tonnes per day) with annual energy bill more than 15 million rupees (Rs 150 lakhs). The first step in the manufacturing process involves raw material batch preparation. The batch material, comprising mainly soda lime and silica, is heated in refractory pots placed inside the pot furnace. A lumpof glass melt is formed by drawing molten glass from a pot; the lump of glass is heated again in a reheating furnace to enhance plasticity of the lump; bangles are formed from the lump in spiral shape, which are cut using a diamond cutter to produce individual bangles. These cut bangles undergo a number of downstream operations, generally undertaken outside the factory premises, to produce the bangles in their final market-ready form.



Glass bangle production process

Intervention

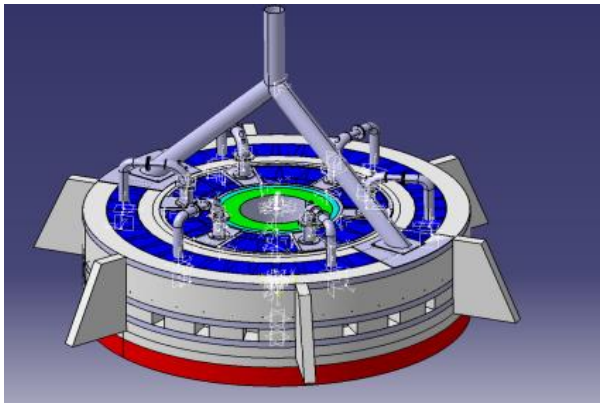
The reheating furnace (*sekai bhatti*) is an auxiliary furnace used in the bangle making chain to improve plasticity of the glass lump before it is taken for drawing into a bangle spiral. It uses natural gas (NG) as fuel. A typical glass bangle making open pot furnace unit operates only one reheating furnace for about 8–10 hours that include production duration and preheating time from cold start.

The unit replaced traditional reheating furnace with an energy efficient reheating furnace

In the base case, the reheating furnace design was traditional to meet the process requirement; flue gases were vented off at very high temperatures (800–1000°C). There was no waste heat recovery (WHR) system to recover waste heat from flue gases. Also, the furnace lacked proper insulation to reduce surface heat losses. The average gas consumption of the baseline unit was observed to be 697 Sm^3/day with 14% efficiency.

Traditional reheating furnace

The reheating furnace was modified using compatible refractory and necessary insulation, employment of WHR system, and better control on air–fuel ratio to improve the performance of the furnace. With the inclusion of WHR system, the combustion air is preheated to 200°C. Improved insulation on crown surfaces and side walls of the furnace using ceramic fibre insulation helped in bringing down the surface temperatures from 250°C to less than 100°C.



Modified reheating furnace

The efficiency of the furnace improved from 14% to 22%. The average gas consumption was reduced from 697 Sm^3/day to 432 Sm^3/day, indicating 38% saving of NG. The investment required towards construction and commissioning of the reheating furnace was Rs 12 lakhs. The annual monetary saving is Rs 14 lakhs, with simple payback period less than one year. The estimated reduction in GHG reductions is 162 tonnes CO_2 per year.