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MICRO, SMALL & MEDIUM ENTERPRISES

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

GLOBAL ENVIRONMENT FACILITY
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ENERGY IS LIFE
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Bureau of Energy Efficiency

सत्यमेव जयते
Ministry of New and Renewable Energy

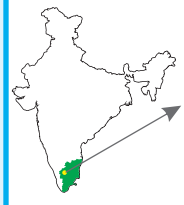
"Promoting Energy Efficiency and Renewable Energy in selected MSME clusters in India"

With an aim to develop and promote a market environment for introducing energy efficiency and enhanced use of renewable energy technologies in process applications in the selected energy-intensive MSME clusters, United Nations Industrial Development Organization (UNIDO), in collaboration with Bureau of Energy Efficiency (BEE), is implementing a project titled "Promoting Energy Efficiency and Renewable Energy in selected MSME clusters in India" funded by Global Environment Facility (GEF) and co-financed by Ministry of Micro, Small and Medium Enterprises (MoMSME) and Ministry of New and Renewable Energy (MNRE). The project supports MSME units in implementing various energy conservation measures and thus result in reduced energy consumption and Green House Gas (GHG).

A GEF-UNIDO-BEE Project

Furnace Crucible Refractory Lining Optimization and De-slagger Addition

Company Profile



Mahendra Pumps Private Limited is a medium scale foundry unit located at Kalapatti Road, **Coimbatore, Tamil Nadu**. Today Mahendra Pumps caters its services to 4 modern operating divisions that include motors and pumps division, foundry division, submersible pumps division and engineering services division.

Objective

To mitigate slag generation, increase refractory lining life, increased melting capacity and reduce specific energy consumption for the molten metal.

Intervention

Induction Furnace (500kW) refractory lining optimization to increase yield and life of the furnace. De-slagger is added to the molten metals to reduce slag formation.

Outcomes

- Reduced specific energy consumption for liquid metals up to 10%
- Increased melting efficiency
- Increased lining life by 50%
- Reduced labor costs
- Increased production

Activity conceived and implemented with technical help from project

Principle

- Furnace performance is directly related to the lining performance. Well-stabilized lining results in the smooth working of the furnace, optimum output and better metallurgical control. The purpose of the lining is to contain the metal during melting, and to electrically and thermally insulate the furnace from the remainder of the furnace, particularly the water-cooled induction coil.
- Controlling slag formation results in the reduction of the specific energy consumption required for the liquid metals, maintaining the lining thickness. The overall energy efficiency of the furnace increases, melting efficiency is enhanced, and the same lining can be used for 50% additional melting. The expected energy reduction is approximately 8% from the actual consumption.

Implementation

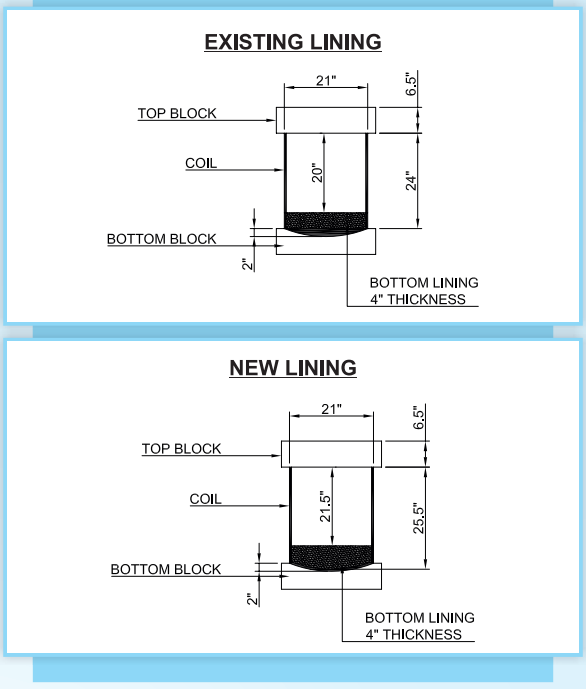
- The quality of metallic scrap and other iron-unit feed stocks had steadily deteriorated because of which slag generation and slag related melting problems had increased. As a solution, the furnace lining method has changed and ladle flux (de-slagger-Redux EF40L) was added in the liquid metals to control the slag formation.
- The intervention involves reduction of lining insulation bottom thickness by 35 mm. This increase the volume of the crucible and led to increase in the molten metal output. Addition of ladle flux (Redux-EF40L) reduce the slag build-up and eliminate the lengthy superheating to remove the upper slag ring.

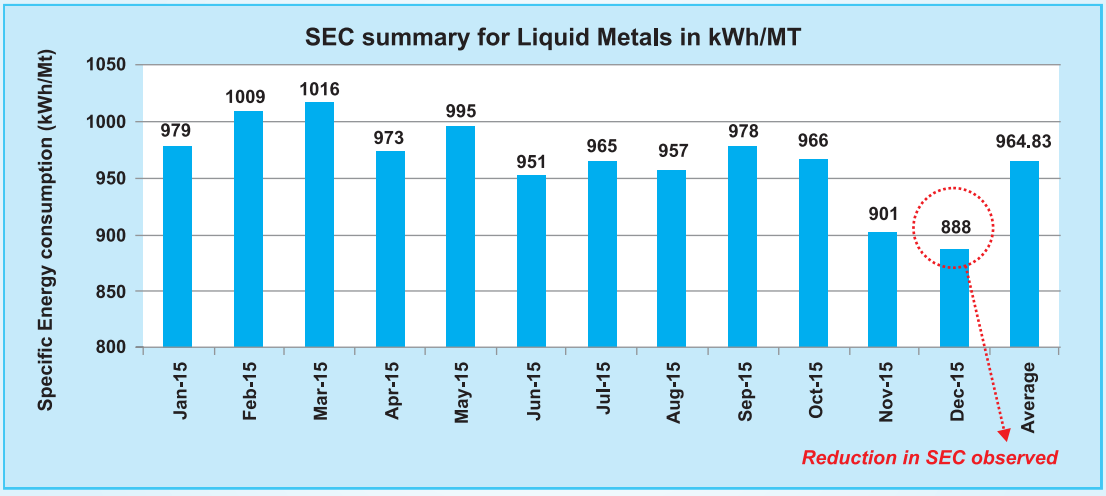
Cost-Economics

Furnace throughput increased per heat	40 kg
Energy savings per heat	35 kWh
Melt time reduction per heat	8 min
Additional heats per day	2 heats
Energy savings per day	700 kWh
Energy savings per month*	17500 kWh
Extra liquid metals per day	1800 kg
Increase in the melting capacity per month	20000 kg
Yield improvement per month	20%
Total energy cost savings per month (@ ₹ 7.5/kWh)	₹ 131250/-
Total investment required	₹ 150000/-
Payback period	~ 2 Months

* 25 operating days per month.

Existing and Proposed Refractory Lining





RESULTS

By altering the existing furnace crucible lining procedure with new method, the refractory lining life was **increased from 350 heats to 600 heats** and the slag formation in the side walls was reduced.

- Melting capacity increased up to **40 kg/heat**
- Specific energy consumption required for the molten metals reduced up to **80 kWh/MT**

Melting time reduced by proper raw material mixing patterns and adding the **de-slagger** (Redux EF40L) to molten metals.

The reduction in melting time enabled additional heats, **increasing productivity to 1400 kg/day.**

Annual energy savings is around 210 MWh and a consequence reduction of **175 tonnes of CO_2** emission per annum

Replication Potential

This method can be implemented in all induction furnace based foundries. However, periodic monitoring and measurement of crucible lining dimensions is essential. It is also suggested to check the slag content relative to raw material feeding and liquid metal output on daily basis

CONTACT DETAILS :

Unit:
Mahendra Pumps Pvt. Ltd.
(Foundry Division)
Kalapatti Road, Coimbatore -14, Tamil Nadu
Contact Person : Mr. Jayakumar Ramdass
E-mail: jramdass@mahendrapumps.in
Mobile: +91 9894043045

Cluster Leader:
Mr. R. Sivakumar
Cluster Leader,
Coimbatore Foundry Cluster,
GEF-UNIDO-BEE Project
E-mail: siva.raja076@gmail.com
Mobile: +91 9965250504

Bureau of Energy Efficiency
GEF-UNIDO-BEE PMU
Project Management Unit
4th Floor, Sewa Bhawan, Sector-1,
R. K. Puram , New Delhi 110066.
T: 011-26179699;
E-mail: gubpmu@beenet.in

United Nations Industrial Development Organization
Mr. Sanjaya Shrestha
Industrial Development Officer
UNIDO
E-mail: s.shrestha@unido.org