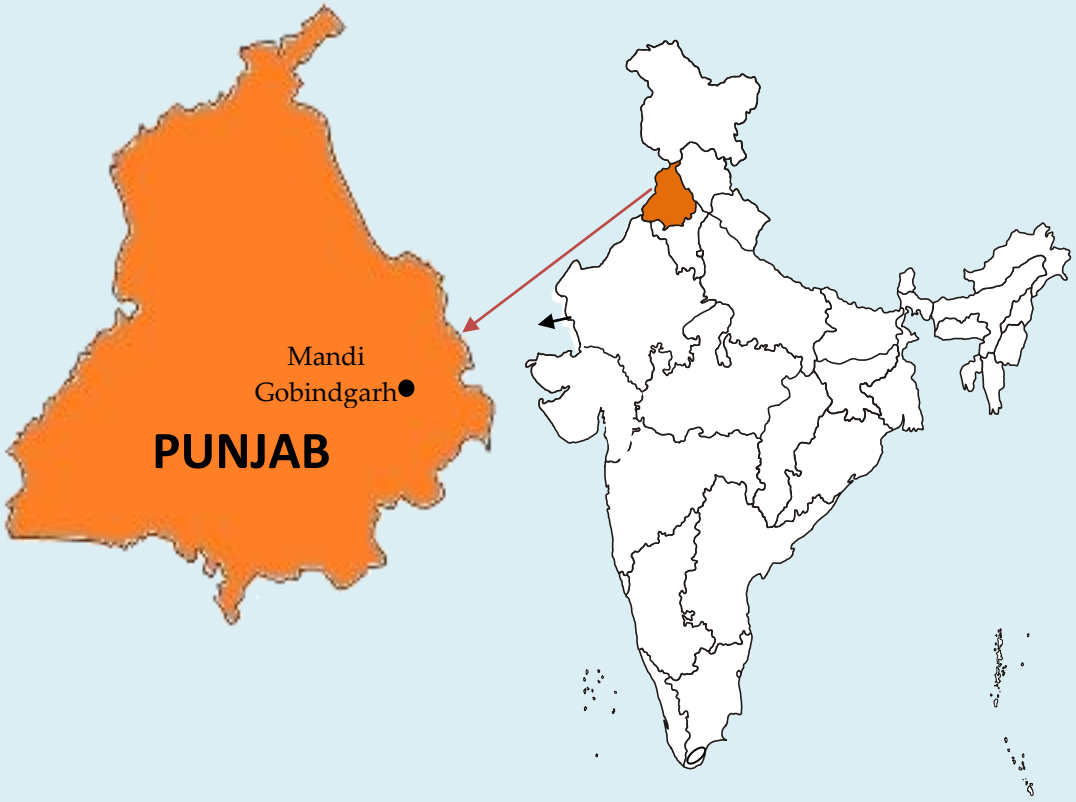
Cluster Profile
Mandi Gobindgarh steel rerolling mills



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Promoting Energy Efficiency in SMEs
SAMEEEKSHA

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TERI team is indebted to local industry association, All India Rollers Association for providing support and information related to steel re-rolling units in Mandi Gobindgarh cluster. TERI extends its sincere thanks to Mr Vinod Vashisht, President, All India Rollers Association for extending support and interactions during the study for the preparation of this cluster profile report.

Last but not least, our sincere thanks to MSME entrepreneurs and other key stakeholders in the cluster for providing valuable data and inputs that helped in cluster analysis.

Mandi Gobindghar steel rerolling mills

Overview of cluster

Mandi Gobindgarh is known as "Steel Town" for its largest cluster of rolling mills in the country. The cluster comprises about 404 MSME units out of which about 341 small and medium scale steel re-rolling units. There are some 160 functional rolling mill units. Apart from rolling, there are about 27 functional melting facilities having induction and cupola furnaces. Only few units have both melting and rolling facilities. The steel rerolling industry is supported by around 500 traders and allied industries like induction furnaces, foundries, pipe plants, etc. Due to dominance of non-mechanized pusher type furnaces, the industry is labour intensive providing direct and indirect employment to over 25,000 people.

Product types and production capacities

Different raw materials used in steel re-rolling mills include waste of large steel process industries in form of bars and section, raw billets, ingots and blooms. These raw materials are generally procured from local market. There are about 27 steel industries that are exclusively involved in supplying raw materials for steel rerolling mills. These melting units use induction and cupola furnaces for melting scrap.

Raw material

The major products manufactured in Mandi Gobindgarh cluster include rounds, Squares, TMT Bars, Press Patti etc. The cluster shows huge variations in terms of production capacity, which varies between 300 tonne per year (tpy) to 10,500 tpd, with an average production capacity of 3500 tpd.

Energy scenario in the cluster

Coke and electricity are the major sources of energy in steel rerolling mills in Mandi Gobindgarh. Coal is sourced from Assam. Grid based electricity is used by rerolling units, supplied by the Punjab State Power Corporation Limited.

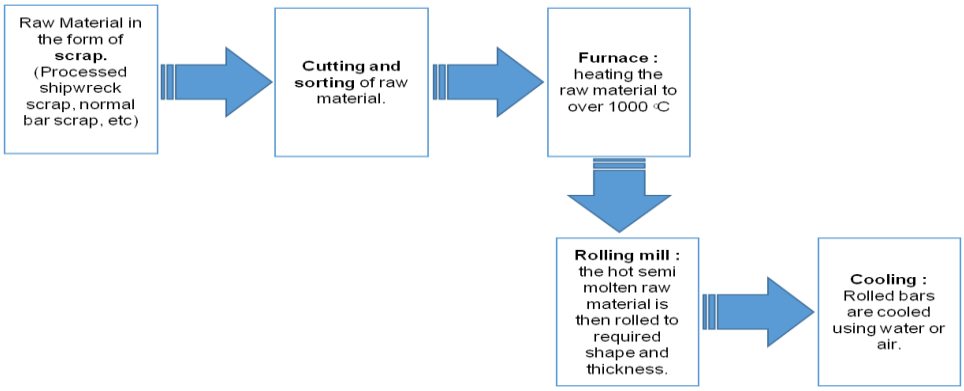
Prices of major energy sources

Type	Price
Coal	Rs 14,000 per tonne
Electricity	Average Energy charge : Rs 6.10 per kWh

Production process

Steel re-rolling mills are used to roll different kinds of metal objects to give them desired shape, thickness, density and curves. The production process in a typical unit begins with charging of raw billets, ingots or blooms in a reheating furnace which generally uses coal as the fuel in the cluster. Once desired temperature of raw material achieved, it is manually or automatically racked to push into the rolling floor, where iron rollers (also called drums) are

used to squeeze and stretch the hot raw material into finished steel products. The process flow in a steel rerolling mill is shown in the figure.



Process flow in a steel rerolling mill

Technologies employed

Reheating and rolling are two important sections of a steel rerolling unit, which are described below.

i) Reheating furnace

Reheating furnaces are used in hot rolling mills to heat the steel feedstock to temperatures of around 1200-1250 ^{0}C, which is suitable for plastic deformation of steel and hence for rolling in the mill. Most of rerolling mill has installed pusher hearth type of furnaces. The furnaces employed in Mandi Gobindgarh cluster are essentially pulverised coal fired systems with very low level of automation. Since the units in the cluster are quite small, raw materials are procured from the market and hot charging is not possible in these kinds of systems.

Reheating furnace

Recently the rerolling units have started retrofitting of 'waste heat recovery' (WHR) systems in reheating furnaces. These locally designed and fabricated 'recuperators' have been installed in reheating furnaces for preheating of combustion air fed into the furnace. However, the performance of these WHRs needs to be ascertained. The refractory provided and surface insulation of reheating furnaces is also found to be poor. There is lack of monitoring and control mechanism to monitor the furnace and product temperature profiles.

Recuperator

ii) Rolling mill

The primary function of the hot rolling mill is to reheat slabs/ingots/ billets/blooms of steel close to soaking temperature point, then rolls to thinner and longer through successive rolling mill stands driven by electric motors. The steel slabs/billets are heated up to about

1,250 C in reheating furnaces. The rolling mills in Mandi Gobindgarh uses mainly coal. The heated slab is rolled in a roughing stand, in which the thickness is reduced in various passes, back and forth. The length of the slab would have increased from 3 to 6 meters to an intermediate slab which is up to 40 meters long. The material is then rolled down to between 32 mm to 1.8 mm in only one pass through stands.

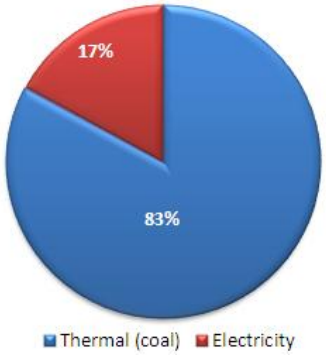
Rerolling section

Energy consumption

The major energy forms used by rerolling mills in Mandi Gobindgarh cluster include coal and electricity. Coal accounts for major energy consumption in steel rolling mills. Coal is used for heating of steel to the required temperature. In the entire process, the re-heating furnace is central towards efficient production of rolled products. The energy required for heating and soaking has a direct bearing on production efficiency. GAIL (India) Limited is laying a 'Compressed Natural Gas' (CNG) pipeline from Dadri to Nangal which will pass close to Mandi Gobindgarh. GAIL has indicated its willingness to "All India Steel Rerollers Association" to supply natural gas to steel rerolling mills in the cluster.

i) Unit level consumption

An analysis of unit level energy consumption of a typical steel rolling mill indicates thermal energy accounts for a major share of energy consumption in the form of coal (about 83% of total energy consumption). Electricity accounts for about 17% of total energy consumption of the unit.



Energy share in a steel rerolling mill

The total energy consumption of a typical steel rolling mill in Mandi Gobindgarh cluster is estimated to be 345 toe per year. The average 'specific energy consumption' (SEC) of the mill is estimated to be 1.48 MJ per kg of product (equivalent to 0.035 toe per tonne). With temperature of reheating furnaces not being monitored across the cluster, there can be wide variations in specific energy consumption levels of the furnace for same type of products.

ii) Cluster level consumption

The overall energy consumption of steel rolling mills in the cluster is estimated to be 55,218 toe per year. This does not include energy consumption of induction furnaces which are exclusively used for production of raw materials used in steel rerolling mills. Coal represents about 60% of total energy costs in steel rolling mills in the cluster. This is observed to be lower as part of steel rolling mills is not in operation. The break-up of energy consumption and annual energy bill are shown in the table.

Energy consumption of Mandi Gobindgarh steel rerolling cluster (2014-15)

Energy type	Annual consumption	Equivalent energy (toe)	Annual energy bill (million INR)
Coal	70,909 tonne	45,765	993
Electricity	110 million kWh	9,453	671
Total		55,218	1,664

Energy saving opportunities and potential

Steel rerolling mills in Mandi Gobindhgarh offer significant scope for energy efficiency improvements both in thermal and electrical areas.

i) Energy efficient reheating furnace

Reheating furnace accounts for about 80% of energy consumption in steel rerolling mills. The existing design of the furnace indicates that there is huge potential to improve the existing design in terms of fuel feeding, firing, monitoring & control of various furnace parameters including furnace temperatures in different zones, insulation of the furnace, etc. This would require designing a new energy efficient furnace encompassing various parameters for different capacities of the furnaces. The potential for energy saving is about 15-20%.

ii) Waste heat recovery system

A number of units in the cluster are using recuperator, a 'waste heat recovery' (WHR) system to recover waste heat available in hot flue gases, which is designed and fabricated locally and of sub-standard design. Efficient WHR system can be designed to extract maximum possible waste heat available in flue gases. Thus, there is substantial scope to improve the performance of waste heat recovery system. As a thumb rule, about 20 ^{o}C raise in preheat air temperature would result in 1% fuel saving.

iii) Improved refractory and surface insulation

The existing status of refractory used and surface insulation of reheating furnaces is quite poor. Replacement of worn-out insulation and lagging the furnace with better insulation material such as ceramic fibre blankets would help in reducing surface heat losses in the furnace.

iv) Use of CNG as fuel in reheating furnaces

All steel rolling facilities in the cluster use coal as main fuel in reheating furnaces. The fuel handling system includes electrical operated coal pulveriser. The performance of the coal fired reheating furnace is always dependent on high accuracy control and monitoring system. The use of CNG as fuel in reheating furnaces will not only improve the efficiency levels, but also help to maintain specific energy consumption within the standard limits.

v) Other measures

Other options that would help in improving energy performance of the unit includes replacement of inefficient motors with energy efficient motors, adoption of 'best operating practices' (BOP) in reheating furnaces and rolling mills, etc.

Major stakeholders

The major stakeholders in the cluster are as follows

- All India Rollers Association
- Punjab Small Industries & Export Corporation
- Punjab State Industrial Development Corporation

Cluster development activities

United Nations Development Program (UNDP) has implemented a project on "Removal of Barriers to Energy Efficiency Improvement in the Steel Re-Rolling Mill Sector in India" which promotes energy efficiency in the cluster.

About TERI

A dynamic and flexible not-for-profit organization with a global vision and a local focus, TERI (The Energy and Resources Institute) is deeply committed to every aspect of sustainable development. From providing environment-friendly solutions to rural energy problems to tackling issues of global climate change across many continents and advancing solutions to growing urban transport and air pollution problems, TERI's activities range from formulating local and national level strategies to suggesting global solutions to critical energy and environmental issues. The Industrial Energy Efficiency Division of TERI works closely with both large industries and energy intensive Micro Small and Medium Enterprises (MSMEs) to improve their energy and environmental performance.

About SDC

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Swiss Agency for Development and Cooperation SDC

SDC (Swiss Agency for Development and Cooperation) has been working in India since 1961. In 1991, SDC established a Global Environment Programme to support developing countries in implementing measures aimed at protecting the global environment. In pursuance of this goal, SDC India, in collaboration with Indian institutions such as TERI, conducted a study of the small-scale industry sector in India to identify areas in which to introduce technologies that would yield greater energy savings and reduce greenhouse gas emissions. SDC strives to find ways by which the MSME sector can meet the challenges of the new era by means of improved technology, increased productivity and competitiveness, and measures aimed at improving the socio-economic conditions of the workforce.

About SAMEEEKSHA

SAMEEEKSHA (Small and Medium Enterprises: Energy Efficiency Knowledge Sharing) is a collaborative platform set up with the aim of pooling knowledge and synergizing the efforts of various organizations and institutions - Indian and international, public and private - that are working towards the development of the MSME sector in India through the promotion and adoption of clean, energy-efficient technologies and practices. The key partners are of SAMEEEKSHA platform are (1) SDC (2) Bureau of Energy Efficiency (BEE) (3) Ministry of MSME, Government of India and (4) TERI.

As part of its activities, SAMEEEKSHA collates energy consumption and related information from various energy intensive MSME sub-sectors in India. For further details about SAMEEEKSHA, visit http://www.sameeeksha.org