SMALL AND MEDIUM ENTERPRISES: ENERGY EFFICIENCY KNOWLEDGE SHARING

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SAMEEEKSHA NEWSLETTER

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Inside...

Promoting Energy Efficiency in SMEs

SAMEEEKSHA

VISION

SAMEEEKSHA envisages a robust and competitive SME sector built on strong foundations of knowledge and capabilities in the development, application, and promotion of energy-efficient and environment-friendly technologies.

Bureau of Energy Efficiency

SHAKTI SUSTAINABLE ENERGY FOUNDATION

The Energy and Resources Institute

A PLATFORM FOR PROMOTING ENERGY EFFICIENCY IN SMEs

IN THIS ISSUE...

The theme of this issue is a project being undertaken by TERI to accelerate industrial decarbonization in India through relevant frameworks including policies, low carbon technology roadmaps, finance, corporate commitments, and generating demand for green products. The project also has a focus on MSMEs, which form a significant and integral part of the Indian industry sector. The project plans to develop national-level strategies/ roadmaps to identify and implement energy-efficient, low-carbon pathways by which India can meet its future demands of materials like steel, cement and bricks while averting the alarming prospect of increased resources consumption and CO_2 emissions.

The theme article underlines the vital need to decarbonize the industrial sector—particularly, the 'hard-to-abate' sectors like cement, iron & steel, etc., which account for a significant share of overall carbon emissions—in order to enable India to meet its goal of becoming a 'net zero' economy by 2070. It focuses on key activities that are being undertaken in MSMEs in steel and allied industries during the course of the three-year project. These include situation analyses and energy assessment studies in four selected energy intensive clusters, which will be followed through by deep dive interventions to identify energy-efficient technological options and support their adoption by providing technical assistance. Through these strategies, the project will help prepare industries in the MSME segment for progressive energy efficiency improvements and decarbonization measures, thus providing a huge boost to India's efforts to achieve its net-zero target by 2070.

The second article in this issue delves deeper into the energy assessment study undertaken in the Raipur steel industry cluster, which is one of the largest clusters of MSMEs and one of the biggest markets of iron and secondary steel products in the country.

SAMEEEKSHA Secretariat

TOWARDS NET-ZERO: DECARBONIZING MSMEs IN STEEL AND ALLIED INDUSTRIES

Context

India declared its aim to become a net-zero economy by 2070 at the climate change summit (COP-26) held in Glasgow, 2021. Towards achieving this target, India is taking major strides to decarbonize electricity supply by increasing renewable energy (RE) generation capacities and by progressive integration of RE into the grid to reduce the grid emissions factor. However, on the energy consumption side, the major challenge—and the key to achieve India's net-zero target—is to decarbonize the vast and diverse industrial sector, which on the one hand remains the prime driver of India's economic growth, but on the other, consumes huge amounts of fossil fuels and accounts for about 50% of total commercial energy consumption and over 45% of the total energy-related emissions.

Actions to decarbonize Indian industry must be taken urgently and achieve quick and tangible results if India is to meet its net-zero target. In particular, the actions must focus on the so-called 'hard-to-abate' industrial sectors, in which the challenge to transition from fossil fuels to low/zero-carbon energy sources is especially formidable[1]. A number of large-scale industries have committed themselves to achieve 'near-zero' emissions by 2050 and are making significant progress in this direction.[2]

The challenge is to widen and scale up efforts in this direction to cover all industries across India. In particular, it is imperative to bring about successful transitions among MSMEs, which cumulatively account for a significant proportion of the total fossil fuel consumption and emissions in Indian industry, including the hard-to-abate sectors.

It is in this context that TERI, is working towards developing an evidence base that will help chart a roadmap for decarbonization of Indian industry—particularly, hard-to-abate sectors like iron & steel, cement, etc. — through enabling policies, low carbon technologies, finance, and corporate commitments.[3]

TERI has already initiated the process of preparing decarbonization roadmaps for steel and cement sectors. This article outlines the studies and other activities being conducted by TERI under this project in a large number of MSMEs, which form a significant and integral part of the Indian iron & steel sector. The next article delves deeper into the Raipur secondary steel cluster, which is one of the largest clusters of MSMEs and one of the biggest markets of iron and secondary steel products in the country.

Secondary steel sector

'Secondary steel' is a broad term used for steels and steel products that are made using either only steel scrap or a mix of scrap and other solid ferrous materials such as sponge iron and pig iron as the primary raw materials. The secondary steel sector encompasses industrial units making semi-finished steels as well as finished steel products through processes such as melting, casting, reheating, rolling, forging, wire drawing, etc.

Corporate commitment for near-zero emissions

On 24th September 2020, six leading Indian industry houses voluntarily came together to pledge for achieving near- zero emissions by 2050, as a significant and vital step towards helping India achieve net-zero by 2070. The group together signed an ***'Industry Charter for Near Zero Emission Ambition by 2050'***, undertaking to pursue a set of decarbonization measures, both at the company level and collectively. The founding signatories of the Charter are: Dalmia Cement (Bharat) Ltd; Hindalco Industries; Shell Group of Companies, India; Siemens Energy India; Tata Consulting Engineers Ltd; and Thermax. The Secretariat of this industry coalition is located at TERI, which has been at the forefront of assessing future pathways for India's energy and industry transition.

[For more details please visit https://www.teriin.org/industry-charter-near-zero-emission-ambitio-2050]

1 TERI: https://www.teriin.org/energy-transitions/industry-transition. Also see SAMEEEKSHA 11(3), 2020.

2 TERI. Industry charter for near zero emission by 2050. https://www.teriin.org.

3 TERI. Ibid

Decarbonizing hard-to-abate sectors

Decarbonizing is in principle straightforward: it means switching (or 'transitioning') from burning fossil fuels for energy, to using low-carbon/zero-carbon energy sources like green electricity. However, issues related to process, technology as well as costs make such transitions very difficult to achieve in certain industrial sectors like aluminium, cement, industrial chemicals, iron & steel, etc. Hence, these are known as 'hard-to -abate' industrial sectors.

A characteristic of hard-to-abate industries is that they require process heat at very high temperatures for extended periods. In theory, electricity can meet such prolonged, high-temperature heating requirements; but for many processes there are no proven and commercially viable electricity- based technological options yet available at global level. The industries therefore meet their process heat requirements by burning coal and other fossil fuels.

To further compound the transition challenges, some of these industries generate significant carbon emissions from non-energy sources (e.g., calcination reaction in cement manufacture; producing hydrogen from natural gas in ammonia manufacture). Also, the existing systems and processes in these industries are complex and highly integrated—making it difficult as well as prohibitively expensive to develop and implement any new low/zero-carbon technological options.

The project

The project focuses not only on large-scale industries but also MSMEs, which account for a sizeable share of overall production as well as energy and resources consumption and carbon emissions in hard-to-abate sectors like chemicals, iron & steel, etc. These MSMEs are beset by the same interlocking challenges that characterize the Indian MSME sector as a whole and make it difficult to introduce and scale up clean, energy-efficient technologies and practices. Some of the major challenges are technological obsolescence; low awareness levels regarding improved technologies and practices; difficulty in accessing clean fuels at affordable costs; lack of skilled workforce; inability to access adequate, affordable and timely finance for upgrading technology; and inability to explore and expand into new markets.

The project has structured its approach and activities to overcome these challenges among MSMEs. The primary activities include the following:

- Situation analyses of selected energy intensive clusters, to provide the foundations for undertaking deep dive interventions to bring about energy efficiency (EE) improvement
- In-depth analyses and identification of EE improvement potential and options
- Support to interested units for adoption of EE options
- Development of technology and sector intervention plans for pilot plants for decarbonization of existing fossil-fuel industrial processes through direct electrification route in MSMEs

Situation analyses are being conducted in a number of secondary steel MSME clusters to collate baseline data and related information on the existing technologies, energy consumption and GHG emissions, as well as to obtain a clearer understanding of relevant cluster-level issues on demand and supply sides. The studies cover four large heterogeneous clusters – Ahmedabad, Howrah, Raipur and Rajkot.

Energy assessment studies have been initiated in industries in these clusters, to identify EE technology options as well as potential decarbonization areas through performance assessment of key equipment in representative industries.

Deep-dive interventions will be carried out in the four selected clusters to support implementation and demonstration of various cleaner options and pave the ground for their adoption through knowledge-sharing and awareness initiatives. Technical assistance will be provided to industries for the adoption of EE options, mainly in the short-term.

Also, TERI will prepare sample **'energy management manuals'** which will be useful for secondary steel industries, under the initiative undertaken by the Bureau of Energy Efficiency (BEE) to improve energy efficiency in the MSME sector.

Through these strategies and activities, the project will help prepare the industries in the secondary steel sector for progressive EE improvements and decarbonization measures in the short to medium term (up to, say, 2030 and then 2030–50). This will provide a huge boost to India's efforts to achieve its net-zero target by 2070. By the time India enters the final phase of its decarbonization efforts (2050–70), hopefully we will have readily available and proven new/improved low carbon technologies for steelmaking and other processes in the secondary steel industry, that will support the final run to achieving the net-zero target.

SITUATION ANALYSIS OF RAIPUR SECONDARY STEEL CLUSTER

TERI has undertaken situation analysis in the Raipur secondary steel cluster. This article presents a brief profile of the Raipur cluster including the types of secondary steel industries; the technologies being deployed and patterns of energy usage; some potential energy- efficient (EE) technology options identified based on an energy assessment study of a few representative MSMEs; and the next steps that are proposed to be undertaken to improve energy efficiency and reduce carbon emissions in the cluster and in other secondary steel clusters across India.

Overview

Raipur, the capital city of Chhattisgarh state, is a major hub for trade and commerce in eastern India. Raipur and its neighbouring districts of Bilaspur, Bastar, Raigarh and Durg are rich in deposits of coal, iron ore, limestone and other minerals. Hence, Raipur has one of the largest clusters of mineral- and metal-based industries and one of the biggest markets of iron and secondary steel products in the country. There are an estimated 379 MSME secondary steel industries in the Raipur cluster. Most of these industries are located in the well-established industrial estates of Urla and Siltara, including the surrounding localities of Rawabhatha, Tatibandh, Sarola, Bagoli, Bhanpuri, Gaugaon and Tendua.

The main types of secondary steel industries in the Raipur cluster are summarized in table 1. They include:

- Direct reduced iron (DRI) industries, which produce sponge iron from iron ore by the direct reduction of iron process using rotary kilns.
- Steel melting industries, which melt sponge iron and steel scrap to produce steel ingots and billets for further downstream processing.
- Steel re-rolling mills (SRRM), which produce rolled steel products from steel ingots and billets using: (1) reheating furnaces to preheat the ingots and billets; (2) rolling mills to make the rolled steel products from the heated billets/ingots.
- Wire industries (WI), which produce annealed wire and galvanized wire from coiled steel wire using machinery/equipment such as wire drawing machines, annealing furnaces and galvanizing baths.
- Ferro alloy industries, which produce alloying elements such as ferro manganese, silicon manganese, ferro silicon, chrome alloys, etc. that are used in the production of steel and cast iron.
- Other allied industries such as foundries and forging units, which produce casted products and spare parts as required by the secondary steel units.

Table 1. Types of secondary steel industries in Raipur cluster

Industry type	No. of units
DRI	69
Steel melting	75
SRRM	73
WI	21
Ferro alloy	105
Others	36
Total	**379**

The products manufactured in the cluster include angles, channels, cold twisted deformed (CTD) bars, pipes, rails, thermo-mechanically treated (TMT) bars, tubes, strips, wires, and so on in different grades and compositions of steel such as mild steel (MS), stainless steel (SS), etc. These steel products are used in a wide range of sectors including building & construction, domestic, education, industry, infrastructure, medical, municipality, railways, etc. Figures 1–4 depict snapshots of some of the technologies used in the secondary steel industries in Raipur.

Technology status

Table 2 summarizes the primary technologies used by different types of secondary steel industries. Figure 5 depicts the complexity of the material flow chain in the secondary steel industries.

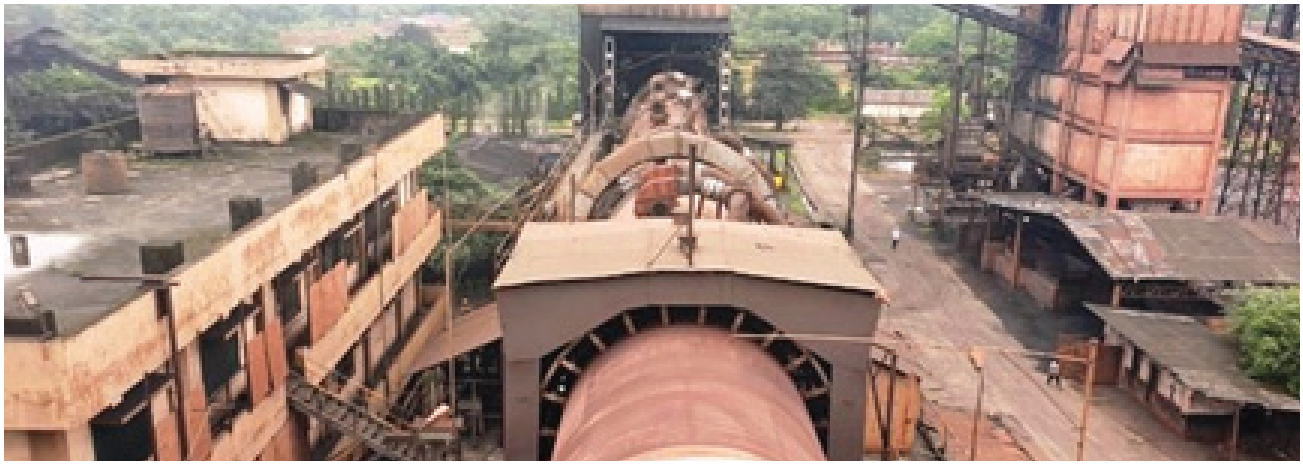

Figure 1. Rotary kiln in DRI industry

Figure 2. Reheating furnace in steel re-rolling mill

Figure 3. Scrap charging into electric induction furnace

Figure 4. Rolling in progress

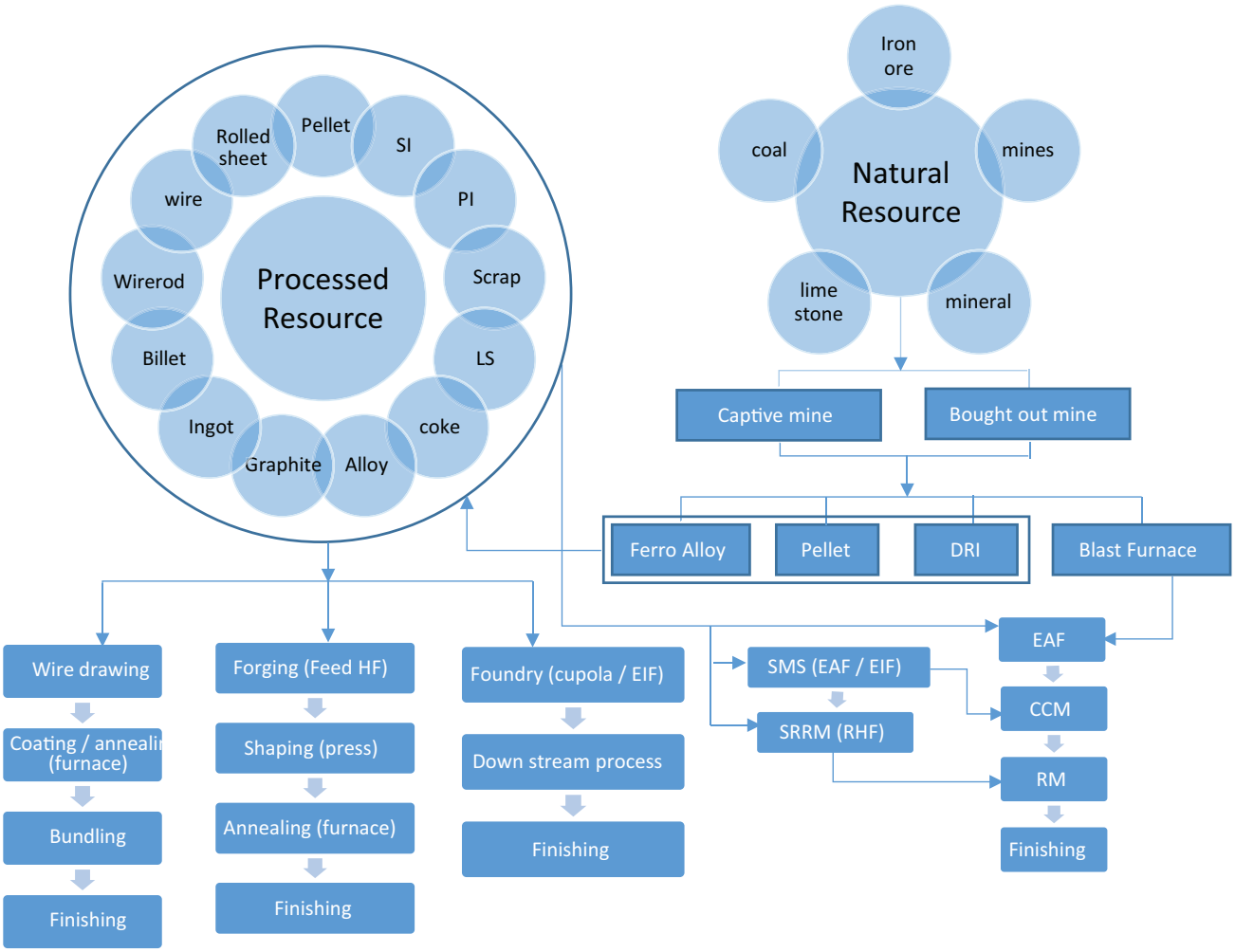

Figure 5: Material flow chain in Raipur steel industries

Table 2. Primary technologies, raw materials and energy sources by industry type

Industry type	Primary technology	Raw materials	Energy source(s)
DRI	Rotary kiln	Iron ore	Coal, electricity
Steel melting industries	Electric induction furnace	Sponge iron, scrap	Electricity
	Continuous casting machine	Liquid metal	Electricity
SRRM	Re-heating furnace	Ingots, billets	Coal
	Rolling mill	Hot ingots and billets	Electricity
Ferro alloy	Submerged arc furnace	Mineral ores	Coal, electricity
Wire Industry	Wire drawing machine	Coiled wire	Electricity
	Annealing furnace	Drawn wire	Furnace oil, electricity
	Galvanizing bath	Drawn wire	Furnace oil, electricity

Key stakeholders

The Raipur secondary steel cluster has a number of active industry associations that address pertinent issues related to their respective members, including facilitating technical support by organizing training programs, workshops, and so on. Other important stakeholders include government agencies that focus on promoting renewable energy, finance, infrastructure, etc. for industrial development. The industry associations and other important stakeholders in the cluster are listed below.

- Chhattisgarh Sponge Iron Manufacturers Association (CGSIMA)
- Chhattisgarh Mini Steel Plant Association (CGMSPA)
- Chhattisgarh Ferro Alloy Plant Association (CFAPA)
- Chhattisgarh Steel Re-rollers Association (CGSRA)
- Chhattisgarh Wire Industries Association (CWIA)
- Urla industries association (UIA)
- Raipur Iron and Steel Trade Association (RISTA)
- Chhattisgarh Chamber of Commerce and Industry (CCCI)
- Chhattisgarh State Renewable Energy Development Agency (CREDA-SDA)
- MSME-Development Institute, Raipur
- Chhattisgarh State Industrial Development Corporation (CSIDC)
- District Investment Promotion Committees (DIPC)
- District Trade and Industries Centre
- Directorate of Industries, Raipur

Energy use

The total annual energy consumption by secondary steel industries in the Raipur cluster is estimated at 3.91 million tonnes of oil equivalent (Mtoe), of which thermal energy accounts for 3.18 Mtoe (81%) and electricity, 0.73 Mtoe (19%). The DRI industries alone account for over 87% of the total annual energy consumption, while steel melting, SRRM and ferro alloy industries account for almost the entire remaining 13% (figure 6, table 3).

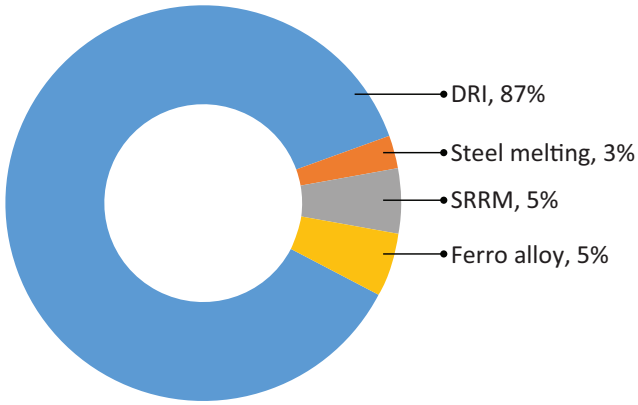

Figure 6. Energy consumption shares by industry type

Table 3. Energy use in Raipur secondary steel cluster

Industry type	Annual energy consumption (Mtoe)			Annual emissions (Mt-CO_2)
	Thermal	Electrical	Total	
DRI	2.94	0.46	3.40	16.01
Steel melting	–	0.10	0.10	0.97
SRRM	0.16	0.03	0.19	0.97
Ferro alloy	0.06	0.13	0.19	1.44
WI	0.01	0.01	0.02	0.11
Others	0.01	–*	0.01	0.06
Total	**3.18**	**0.73**	**3.91**	**19.56**

Options for energy saving

TERI conducted plant-level energy assessment studies in five representative secondary steel industries in Raipur focusing on induction furnace based steel melting and re-rolling mills, in order to identify technological options for improving energy efficiency and reducing emissions. The studies helped identify a large number of energy conservation measures (ECMs) that could be adopted in these industries in the short/medium term to bring about energy and monetary savings as well as emission reductions, with attractive payback periods on investments (table 4).

Table 4. Potential benefits of the key ECMs identified for the five secondary steel industries studied

Industry	Annual energy saving		Cost saving	Investment	SPP (years)*	CO2 reductions (t/year)
	Electricity (million kWh)	Coal (t)	(Rs million/year)	(Rs million)		
1	0.2	99.4	4.3	6.7	1.6	297
2	0.1	203.0	4.8	5.5	1.1	507
3	0.6	173.0	6.8	16.2	2.4	830
4	3.8	–	19.7	25.3	1.3	3000
5	7.7	–	43.2	148.0	3.4	6000
Total	**12.40**	**475.4**	**78.8**	**201.7**	**–**	**10634**

*marginal

Way forward

The studies on the technology use and energy consumption levels of different secondary steel industries in Raipur cluster indicate significant scope for energy saving and CO2 reductions. A programmatic approach can be initiated at the cluster level to provide technical assistance to identify EE options and support their adoption on a large scale across the Raipur cluster as well as in other secondary steel industry clusters. This will require close involvement at project level to extend technical support to industrial units and strengthen local capacities with close cooperation of key stakeholders at both cluster and national level.

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