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Bureau of Energy Efficiency
Ministry of Power, Government of India

ASPIRE PROGRAMME

Accelerating Smart Power & Renewable Energy in India

SUMMARY REPORT

Domestic Study Tour of

GODAWARI POWER & ISPAT LIMITED

Raipur, Chhattisgarh

20 April 2023

Hosted by:
Godawari Power & Ispat Limited, Raipur

CONTENT

ABBREVIATIONS

Abbreviations	Acronyms
Al2O3	Aluminium Oxide
AFBC	Atmospheric Fluidized Bed Consumption
ASPIRE	Accelerating Smart Power and Renewable Energy in India
BEE	Bureau of Energy Efficiency
CaO	Calcium Oxide
CDM	Clean Development Mechanism
DRI	Direct Reduced Iron
EMS	Environmental Management System
ERW	Electric Resistance Welded
FCDO	Foreign Commonwealth and Development Office
Fe	Iron
GESI	Gender Equality Social Inclusion
GPIL	Godawari Power & Ispat Limited
HR	Hot Rolled
IEED	Industrial Energy Efficiency and Decarbonisation
LM	Liquid Metal
MgO	Magnesium Oxide
MT	Million Tonnes
MW	Mega Watt
OHE	Over Head Equipment
PAT	Perform Achieve and Trade
PV	Photo Voltaic
SiO2	Silicon Dioxide
TLT	Transmission Line Tower
WHRB	Waste Heat Recovery Boiler

BACKGROUND

India has emerged as a significant player in the global steel industry, with second-highest share in production and consumption. The country's crude steel production is expected to grow from approximately **120 million tonnes (MT)** in 2022 to around **200 million tonnes** by 2030 and to an estimated **580 million tonnes** by 2050. Furthermore, per capita steel consumption is expected to increase more than fourfold from **77 Kg** in 2022 to approximately **320 Kg** per person by 2050. The iron and steel sector is a crucial segment of India's economy, contributing ~**2%** to the country's Gross Domestic Product, ~**23%** to Gross Value Additions in 2022, and employing ~**2.5 million** people. However, the sector is also the highest emitter of greenhouse gases in India, accounting for ~**30%** of all industrial emissions. Therefore, it is essential to decarbonise the industry to transition India to a low-carbon economy and to limit global temperature below **1.5°C**. To overscome this challenge, several leading iron and steel companies in India have announced initiatives to reduce Greenhouse Gases (GHG) emissions and decarbonise the sector.

In view of this, a domestic study tour of Godawari Power & Ispat Limited's (GPIL) unit in Raipur, Chhattisgarh was organised on **20th April 2023** under Accelerating Smart Power and Renewable Energy in India (ASPIRE) programme. The study tour was jointly organised by Foreign Commonwealth and Development Office (FCDO) and the BEE with the support of GPIL. The purpose of the study tour was to demonstrate and disseminate the various best practices and innovative Industrial Energy Efficiency and Decarbonisation (IEED) technologies adopted by the GPIL Unit to enhance energy efficiency and decarbonisation of operations.

Objective of the Study Tour

- To demonstrate new and innovative IEED technologies implemented by GPIL.
- To enable other industries in the Iron & Steel sector, to reduce their overall specific energy consumption and adhere to the compliance requirements under BEE's Perform Achieve, and Trade (PAT) scheme.
- To foster an ambitious, mutually beneficial, and outcome-focused relationship between industry stakeholders.

Highlights

- Active participation from **40+ senior officials and executives** from the Central and State government agencies, industrial organisations, research institutions, and national and international technology providers
- Visit to key areas of the plant to understand various IEED measures implemented:
  - Sponge Iron Division
  - Pellets Manufacturing Division
  - Steel Melting Shop

OVERVIEW OF GODAWARI POWER & ISPAT LIMITED

GPIL Plant, Raipur, Chhattisgarh

Godawari Power & Ispat Ltd. (GPIL) is the flagship company of Raipur-based HIRA Group. GPIL. It was incorporated in 1999 with the primary objective of establishing an integrated steel plant, including captive power generation. Commercial operations commenced in 2001 with the successful commissioning of the first Sponge Iron plant. In 2004, GPIL embarked on the initial phase of its expansion plan, encompassing the augmentation of sponge iron capacity to **130,000 tonnes**, steel billets to **100,000 tonnes**, and captive power generation to **10 MW**. Concurrently, the company also established new facilities to manufacture **16,500 tonnes** of ferroalloys and **60,000 tonnes** of Hard Bright (HB) wire, representing a significant advancement towards the value chain. Presently, GPIL in the second phase of its expansion plan, which involves increasing the capacities to **260,000 tonnes** of sponge iron, **200,000 tonnes** of steel billets, and **25 MW** of captive power generation. In recent years, GPIL has experienced a five-fold increase in capacity, positioning itself as India's third-largest producer of coal-based sponge iron.

GPIL's inaugural **Waste Heat Recovery Bed (WHRB)** captive power plant, boasting a capacity of **7 MW**, achieved a significant milestone by becoming the world's first plant registered with the Clean Development Mechanism (CDM) Executive Board for carbon credits under the Kyoto Protocol. The plant efficiently recovers **75%** of waste heat from the flue gas emitted by the sponge iron kiln, employing it to generate steam and produce power. GPIL is an environmentally conscious company that prioritises adherence to all essential environmental compliances as an integral part of its operations. With a robust Environmental Management System (EMS) in place, the company is dedicated to implementing comprehensive eco-friendly programs, serving the best interests of its stakeholders.

On August 6th, 2022, GPIL successfully commissioned and synchronized its state-of-the-art **70 MW captive solar PV power plant** located in Rajnandgaon, Chhattisgarh. This strategic addition enables the company to meet the increased electricity demands of its integrated steel plant while simultaneously mitigating the high costs associated with procuring energy from state power distribution companies (DISCOMs).

RR Ispat, a subsidiary of Godawari Power and Ispat Limited, specializes in forward integration and offers a diverse range of products and services. Comprising two divisions, Consoul and Hira Pipes, RR Ispat strives to establish itself as the most trusted steel brand in Central India. With a strong commitment to growth and collaboration within the industry, the company's extensive portfolio encompasses the manufacturing of Hot Rolled (HR) Coil Electric Resistance Welded (ERW) Steel Pipes, Transmission Line Tower (TLT) Structures, and Railway Overhead Equipment (OHE) Structures. Additionally, RR Ispat excels in designing and constructing Unipole, Octagonal Poles, High Masts, and Street Light Poles, as well as Control Panels, Solar Dual Pump Structures, Mega Structures, and Metal Crash Beam Barriers. Through its comprehensive offerings, RR Ispat strives to foster industry growth while exemplifying the essence of its group tagline, "**GROWING STRONGER TOGETHER**"

STUDY TOUR/ VISIT OF GPIL

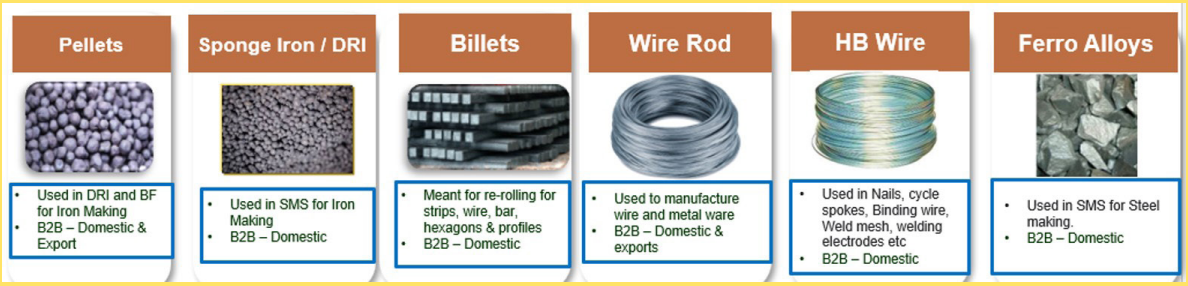
GPIL is the largest manufacturer of iron ore pellets in central India and has production facilities for Sponge Iron, billets, Ferro alloys, wire rods, steel wires, and a Captive power Generating Facility that uses WHRB, Atmospheric Fluidized Bed Consumption (AFBC), Biomass & Solar Power.

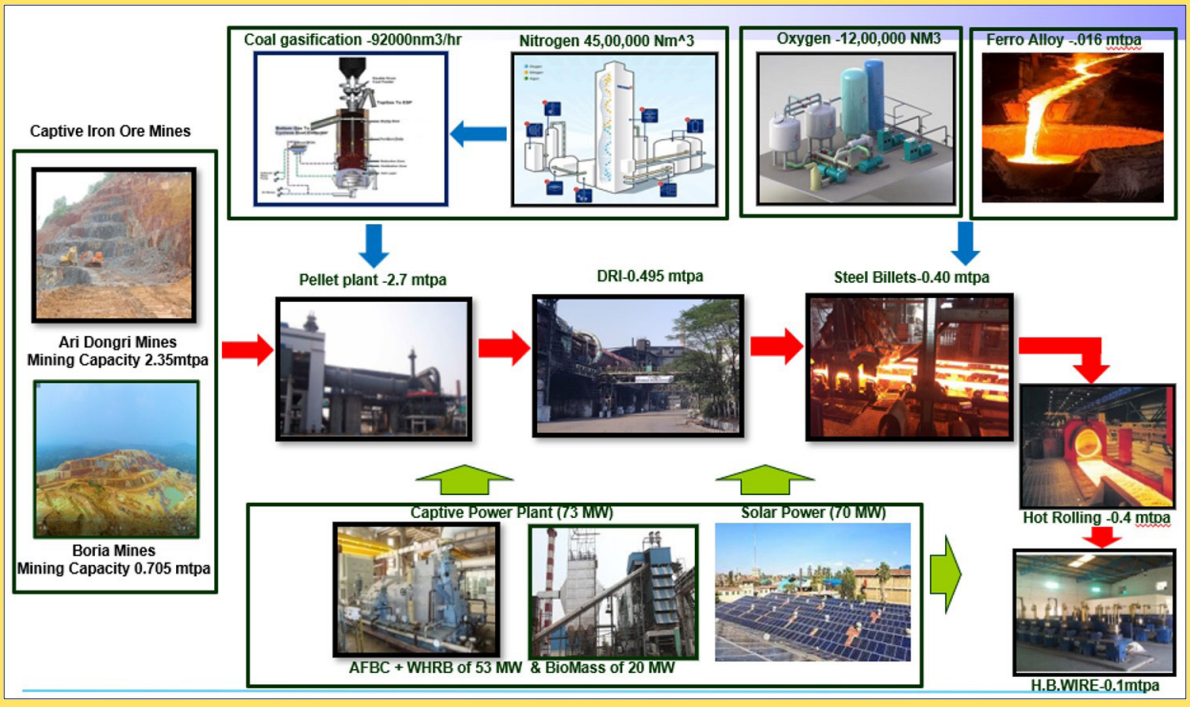
Product Portfolio:

An overview of the process followed at GPIL's unit is presented in the diagram below:

Process Flow Diagram

As part of the study tour, participants visited the Pellet Manufacturing Division and Sponge Iron Division to understand the key areas/department of the plant and detailed process followed as explained below:





- **Process of Pelletisation:**
  - ✓ GPIL utilizes Grate-Kiln technology to transform iron ore fines from its Captive Mines into high-quality pellets.
  - ✓ The process begins with wet grinding the fines, followed by dewatering the resulting slurry through pressure filtration to obtain the Iron Ore Concentrate.
  - ✓ Next, the fine-sized concentrate is mixed with a binder and other additives, and then shaped into green balls using disc pelletisers.
  - ✓ The green pellets undergo a series of steps including preheating, drying, induration, cooling, and are subsequently stored in stockpiles.
  - ✓ This advanced technology enables the production of superior-grade feed material suitable for both Direct Reduced Iron (DRI) and blast furnaces.
  - ✓ The final fired Iron Ore Pellet exhibits excellent techno-commercial and essential physical-metallurgical properties, making it ideal for use in Direct Reduction Iron or Blast Furnace processes for ironmaking.

Qualitative Parameters of High-Grade Iron Ore Pellets:

CHEMICAL PARAMETERS	UNITS	High-Grade Iron ore Pellets
Iron (Fe)	%	64.5 - 65.0
Silicon Dioxide (SiO_2)	%	3.0 - 4.0
Aluminium Oxide ($Al2O_3$)	%	1.0 - 1.5
Calcium Oxide (CaO)	%	0.70 - 0.80
Magnesium Oxide (MgO)	%	0.20 - 0.30
Sulphur	%	0.010
Phosphorus	%	0.025 - 0.03

Participants visiting the GPIL

- **Process of DRI Making:**
  - ✓ The production of Sponge Iron or Direct Reduced Iron involves the reduction of Iron Ore (in the form of lumps/pellets) using non-coking coal within a rotary kiln.
  - ✓ The process of producing Sponge Iron entails the removal of oxygen from Iron Ore Lump/Pellet by utilising coal as both a fuel and a reducing agent. This reduction occurs in the solid phase.
  - ✓ As a consequence of the oxygen removal, the resulting product possesses sponge-like pores, hence earning the name “sponge iron.”
  - ✓ GPIL’s DRI Plant has been meticulously designed to adhere to all necessary safety measures, ensuring the elimination of hazardous working conditions and creating a safe, clean, and risk-free working environment.

Rotary Kiln at Godawari Power & Ispat Limited's (GPIL) unit in Raipur, Chhattisgarh

Qualitative Parameters of Sponge Iron:

Specifications of Sponge Iron	
Fe(m) %	82.52
Fe(T) %	88.87
Fe(O) %	8.16
SiO2 %	4.38
Al2O3 %	2.65
CaO %	1.12
Mgo %	0.5
Carbon %	0.11
Sulphur %	0.017
Phos %	0.035

Participants visiting the Sponge Iron Division

- **Steel Making:**
  - ✓ The DRI and scrap materials are charged directly into the furnace through dedicated hoppers situated at each furnace.
  - ✓ Once the furnace is filled with liquid metal, the chemical composition is adjusted by introducing ferroalloys. The liquid metal is then tapped into a ladle for casting purposes.

- ✓ The ladle containing the liquid metal is directed to the Continuous Casting Machine, where it is cast into billets of the required sizes, lengths, and temperatures. Subsequently, the hot billets are processed into rolled wire products.
- ✓ To ensure proper solidification of the billets during the casting process, water is circulated at a specific pressure and flow rate. This circulation aids in achieving optimal billet solidification.

Key Takeaways

GPIL Plant has implemented a range of energy efficiency and decarbonisation measures to enhance productivity and minimize their carbon footprint. The key takeaways from these initiatives are as follows:

- **Power Division Establishment:** GPIL established their power division in 2002 to achieve higher productivity and improved energy efficiency.
- **AFBC Boiler Addition:** In November 2010, GPIL installed an AFBC (Atmospheric Fluidized Bed Combustion) boiler with a capacity of 100 ton/hr, operating on pure biomass fuel. This expansion increased their generation capacity by 20 MW, reaching a total of 98 MW.
- **Merger with Jagdamba Power & Alloys:** In the current Financial Year, GPIL Plant merged with Jagdamba Power & Alloys, integrating a 25 MW capacity Power Plant into their operations, further boosting their power generation capabilities.
- **Solar Power Plant Operations:** GPIL has been operating a 70 MW solar power plant near Rajnandgaon (Chhattisgarh) since July 2022. This facility significantly contributes to reducing their carbon footprint and harnessing renewable energy resources.
- **Commissioning of a New Solar Power Plant:** GPIL is currently in the commissioning stage of a 30 MW solar power plant near Bemetara (Chhattisgarh). Once operational, it will further enhance their utilisation of renewable energy sources.
- **Commitment to Renewable Energy:** GPIL Plant strongly believes in the utilisation of renewable energy sources. They have successfully commissioned various routes for generating renewable power, including biomass power generation, wind power generation, and solar power generation. These initiatives reflect GPIL Plant's commitment to sustainable practices and reducing their environmental impact.

FEEDBACK FROM THE PARTICIPANTS

- 75% of the participants were more than satisfied with the outcomes of the study tour/ visit (provided a 7+ rating on a scale of 10).
- 75% of the participants were satisfied with the quality and content of the delivery (provided a 7+ rating on a scale of 10).
- Participants also recommended similar study tours/ visits for the Iron & Steel sector.
- The participants suggested the following subjects for future plant visits:
  - ✓ **Energy conservation in the Induction Furnace area:** The participants expressed keen interest in delving into techniques and strategies aimed at minimizing energy consumption and associated costs within the induction furnace area of the plant. .
  - ✓ **Energy efficiency and decarbonisation in Electric Arc Furnaces:** Another subject proposed by the participants focused on acquiring insights into effective measures for reducing carbon emissions and optimizing energy efficiency in electric arc furnaces.
  - ✓ **Energy Management Systems:** The participants also voiced an interest in examining the advantages associated with the implementation of an energy management system within the plant.

> *"I believe that this type of workshop should be held every year, as it provides an excellent opportunity for individuals to learn something new and expand their knowledge"*
>
> **- Mr. Tunak Sil**
>
> DGM (Steel Melt Shop)
> Godawari Power & Ispat Limited

> *"I thoroughly enjoyed the plant visit and would appreciate it if could include other plant visits in the future"*
>
> **Mr. Ashok Pundir**
>
> Vice President
> Shreeyam Power & Steel Ltd.

WAY AHEAD

Group Photograph of Participants

The Study Tour/Visit has received a positive response, attracting significant participation from esteemed individuals such as senior officials from BEE (Bureau of Energy Efficiency), executive leaders representing leading Indian Iron & Steel industries, and technology providers within India. The primary objective of the study tour, which was to provide a platform for national organizations to observe the implementation of innovative Industrial Energy Efficiency and Demand (IEED) measures, as well as the associated challenges, has been successfully accomplished.Furthermore, the study tour demonstrated a commitment to promoting gender equality and social inclusion (GESI) through the active participation of women employees from large energy-intensive Iron & Steel industries. It is anticipated that this study tour will yield tangible and enduring impacts in the field over time.

To sustain the momentum generated by the study tour, the ASPIRE initiative has identified several key activities to facilitate wider adoption of IEED measures and technologies within the Indian Iron & Steel industries, aligning with their net-zero targets. These activities include:

- Provide handholding support including B2B interactions/webinars to large energy-intensive industries (including the Iron & Steel sector) to support in identifying technologies & solutions, and technology suppliers for enhanced adoption of IEED interventions.
- Plan and organise international study tours/visits for Iron & Steel industries in close collaboration with technology suppliers from the UK.
- Create more discussion forums to facilitate the exchange of knowledge and information that will aid in the formulation of policies.
- Organise national-level-policy roundtable on similar lines for hard to abate sectors including the Iron & Steel sector in collaboration with BEE and global technology suppliers including from the UK.

For more information please contact:

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ANNEXURE

Attendance Sheet

S. No	Name	Designation	Organisation
1	Mr. Omprakash Malviya	Chief General Manager - Technical	Jaideep Ispat and Alloys Pvt Ltd.
2	Mr. Kapil Jat	General Manager - OE	Jaideep Ispat and Alloys Pvt Ltd.
3	Mr. Dinesh Bharti	Chief General Manager	Jaideep Ispat and Alloys Pvt Ltd.
4	Mr. Vishal Vashishtha	Asst. General Manager	Nalwa Steel And Power Limited
5	Mr. Srinivasa Rao Boosa	Asst. General Manager	Nalwa Steel and Power Limited
6	Mr. Sarobindu Mohanta	AEA	ESCO Energy Management & Service,
7	Mr. Nukesh Kumar Verma	AGM (Operation/Process)	Hira Power and Steels Ltd. Urla Industrial Complex Raipur
8	Mr. Siddharth Kumar	A.G.M	Jindal Stainless Limited, KNIC, Odisha
9	Mr. Jyoti Ranjan Tripathy	Sr. Manager	Jindal Stainless Limited, KNIC, Odisha
10	Mr. Prashant Kumar Dash	Manager	Jindal Stainless Limited, KNIC, Odisha
11	Mr. Dileep Busigonda	Executive	Jindal Stainless Limited, KNIC, Odisha
12	Ms. Tripti Verma	Asstt. Manager	Energy Management Department, Bhilai Steel Plant
13	Mr. Md. Mustaq	Deputy Mgr.	JSW ISPAT SPL. PROD. LTD
14	Mr. Veer Singh	Sr. Engr.	JSW ISPAT SPL. PROD. LTD
15	Mr. Om Prakash Khard	Sr. Manager	JSW ISPAT SPL. PROD. LTD
16	Mr. Bharat Mahajan	Manager	JSW ISPAT SPL. PROD. LTD
17	Dr. Raghuraj K Rao	MD	AKXA Tech Pvt. Ltd. Works
18	Mr. Nihar Ranjan Sahu	Project Coordinator, CREDA	Chhattisgarh State Renewable Energy Development Agency (CREDA)
19	Mr. Ravindra Kumar Singh	Sr. GM	Super Smelters Ltd.
20	Mr. Rajesh Kumar	Manager - Electrical	Godawari Power & Ispat, Aaridongri Mines
21	Mr. PD Mishra	Manager – Electrical	Godawari Power & Ispat, Aaridongri Mines
22	Mr. Tunak Sil	DGM – SMS/Electrical	Godawari Power & Ispat Ltd., Ph-1, Siltara, Raipur
23	Mr. Dilip Bhattalwar	Gen Manager (Project)	SAIL, Mul Road Chandrapur, Maharashtra
24	Mr. Ashok Pundir	Vice President	Shreeyam Power & Steel Industries Ltd.
25	Mr. Ravi Yadav	AGM	Shreeyam Power & Steel Industries Ltd.
26	Mr. Ramnaresh Choubey	Asst Manager (Energy audit)	Vandana Global Limited Works:
27	Mr. Sumit Singh	Sr. Engineer (Energy audit)	Vandana Global Limited Works
28	Ms. Neena Raicha	Sr. Consultant Architect – Building Cell	CREDA

S. No	Name	Designation	Organisation
29	Ms. Preeti Gupta	Sr. Consultant Engineer – Building Cell	CREDA
30	Mr. Sreekanth P K	Lead Energy Assessor	Industry Energy Assessment Cell (IEAC), IIT Bombay
31	Mr. Nilabh Thakur	Assistant Manager	Godawari Power & Ispat Ltd., Ph-1, Siltara, Raiour
32	Mr. H. S. Singh	Associate Head MBF	Sunflag Iron & Steel Co. Ltd.
33	Mr. M. S. Chawla	Section Head A&E and Energy Manager	Sunflag Iron & Steel Co. Ltd.
34	Mr. S.K. Khandare	Director, BEE	Bureau of Energy Efficiency
35	Mr. K.K. Chakarvarti	Sr. Advisor	Knowledge Exchange Platform
36	Mr. Rajiv Shukla	Executive Director	Idam Infra
37	Ms. Dhaarna Rawat	Analyst	Idam Infra
38	Mr. Anurag Singh Sirola	Manager	KPMG
39	Mr. Himanshu Choudhary	Sector Expert	BEE
40	Mr. Sandeep Nanda	Energy Manager	Nava Limited, Dhenkanal, Odisha
41	Mr. Rajat Kanti Sahoo	Manager-Ele (FAP)	Nava Limited, Dhenkanal, Odisha
42	Mr. Deepti Ranjan Pradhan	Engr-MM (FAP)	Nava Limited, Dhenkanal, Odisha
43	Mr. Aashish Kumar Gupta	Asst. Mgr- Solar & E.A.	Vandana Global Ltd.
44	Mr. Mahveer Jain	Founder & Director	E- Efficiency Management Consultancy Private Limited
45	Mr. Alok Thakur		Steel Mint
46	Mr. A. G. Sharma	Director	Stelex Industries
47	Mr. Indrajit	Director	SAIL