Energy efficiency improvements – A path for Decarbonisation of Bhilai Steel Plant

Bhilai Steel Plant
Steel Authority of India Ltd.

Presented By

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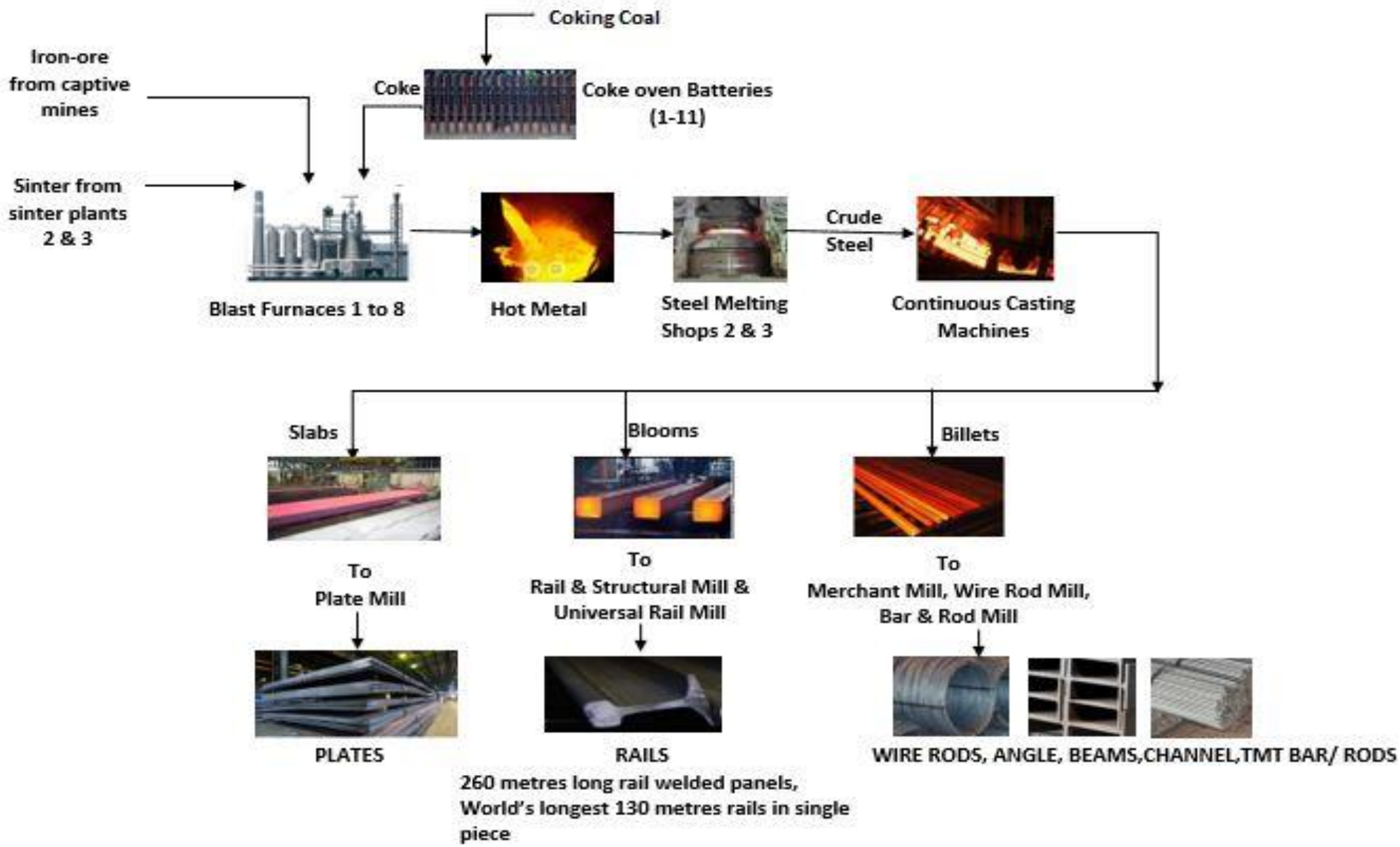
Company Profile

- Set up in 1959 with 1 MT crude steel production capacity, Bhilai Steel Plant is the flagship unit of SAIL
- Recently, BSP has completed 7 MT Expansion and Modernization and is ramping up production in its newly commissioned units
- All the new 7 MT capacity units are equipped with state of the art energy efficient and environment friendly technologies
- BSP operates on BF-BOF route for producing crude steel
- BSP is India's largest producer and supplier of world class rails for the Indian Railways, including
  - ✓ World's longest 130 metres rails in single piece
  - ✓ 260 metres long rail welded panels
- BSP is also a major producer of a wide variety of large and heavy steel plates
- BSP also specialises in wire rods, merchant products and heavy structurals
- The TMT Bars & Rods produced by BSP are of earthquake resistant grade and superior quality

Company Profile – Process Flow Chart



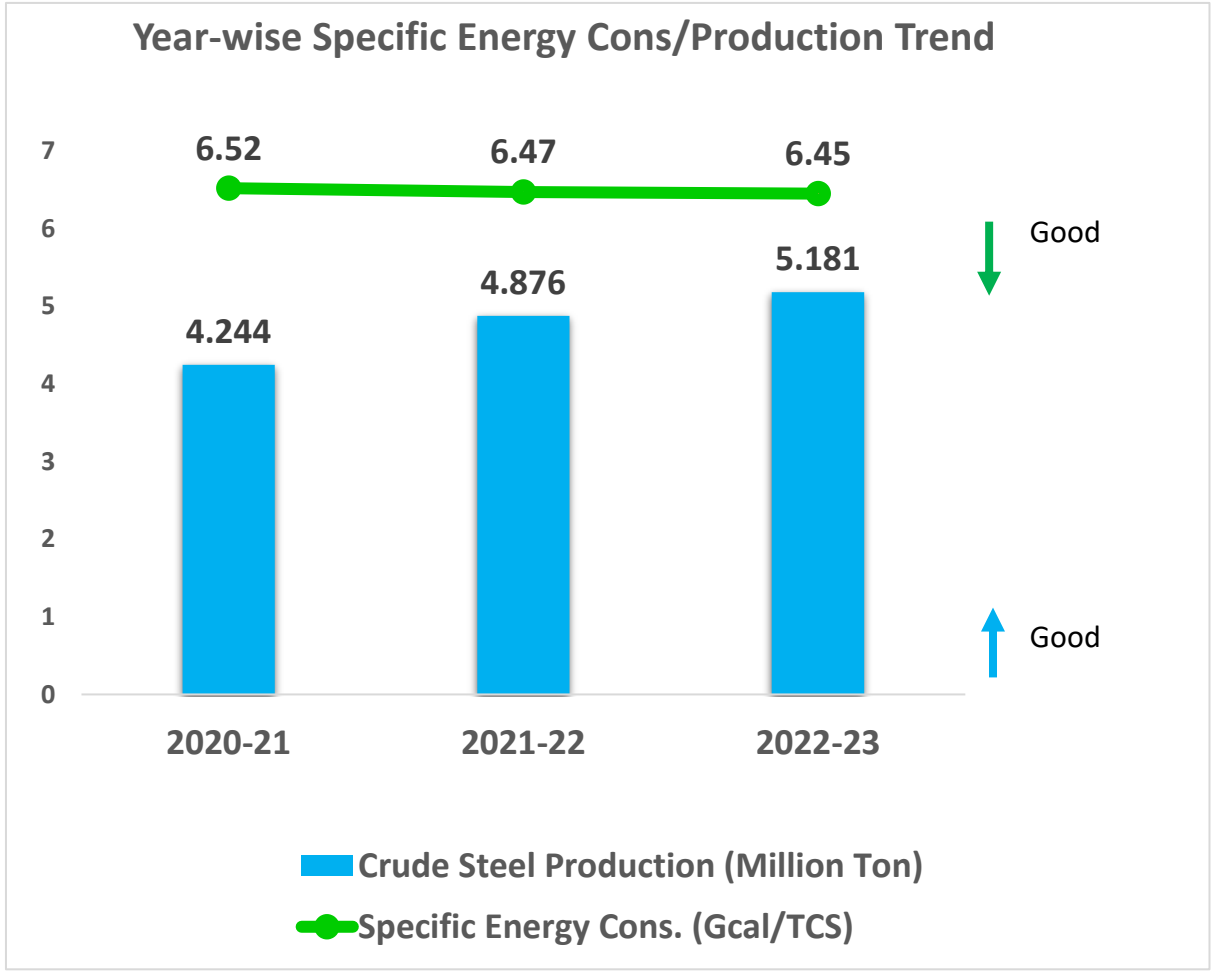
Company Profile

BSP

- Some of the major energy efficient technologies installed in BSP are

  - Coke Dry Cooling Plant with Back Pressure Turbo Generator for waste heat and power recovery
  - Coal Chemical Dept. with Claus process for desulphurization of Coke Oven gas
  - Top Pressure Recovery Turbine of 14 MW capacity in one of India's biggest BFs of 8000 TPD capacity (BF-8) with torpedo ladle facility for hot metal transfer
  - Waste heat recovery system in BF stoves of new BF-8
  - Sinter cooler heat recovery system and curtain flame burners in sinter machines
  - 3 x 120 T BOFs equipped with 24000 NM^3 storage capacity wet type LD gas holder
  - 3 x 180 T BOFs equipped with 80000 NM^3 storage capacity dry type LD gas holder
  - Continuous bloom, billet and slab casters with hot charging facility
  - Walking Beam Furnaces and fully automated efficient mills in URM and BRM
  - By-product gas fired twin shaft regenerative kilns in calcination plants
  - By-product gas fired efficient boilers and 25 MW capacity Turbo-generator in captive Power & Blowing Station

Energy performance – Past 3 Years



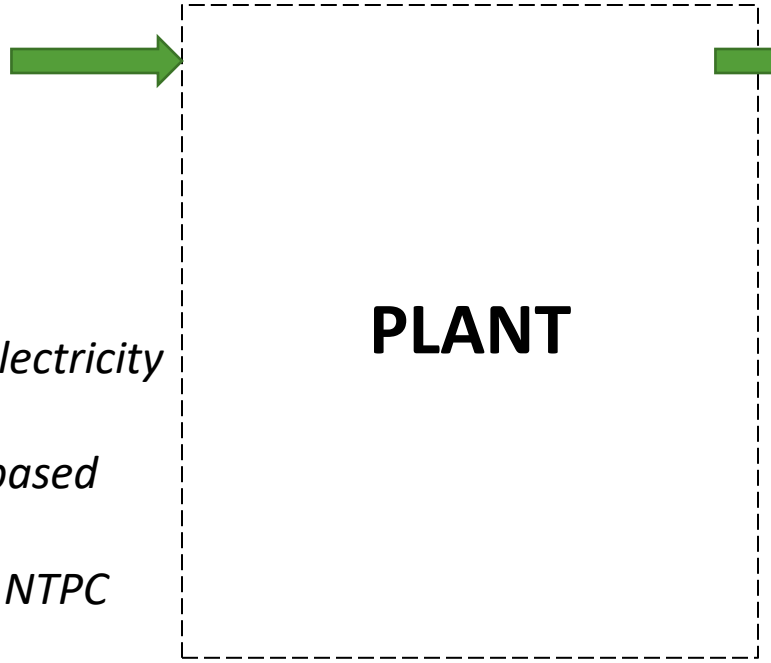
Reasons for variation

- **Energy Rate decreased by 0.31% in FY:22-23 YOY while crude steel production increased by 6 %**
- **Also, old highly energy intensive units - old BFs 2 & 3, SMS-1, BBM and RMP-1 were phased out**
- **Lower production and higher energy rate in FY:2020-21 and FY:2021-22 is attributable to COVID-19 disruptions**

Energy Performance

Input:

- *Boiler coal*
- *Coking coal*
- *Coal dust for Blast Furnaces*
- *Furnace oil*
- *HSD for loco transport*
- *Imported power from state electricity board and JV with NTPC*
- *Imported oxygen from BOO based plant*
- *Imported steam from JV with NTPC*



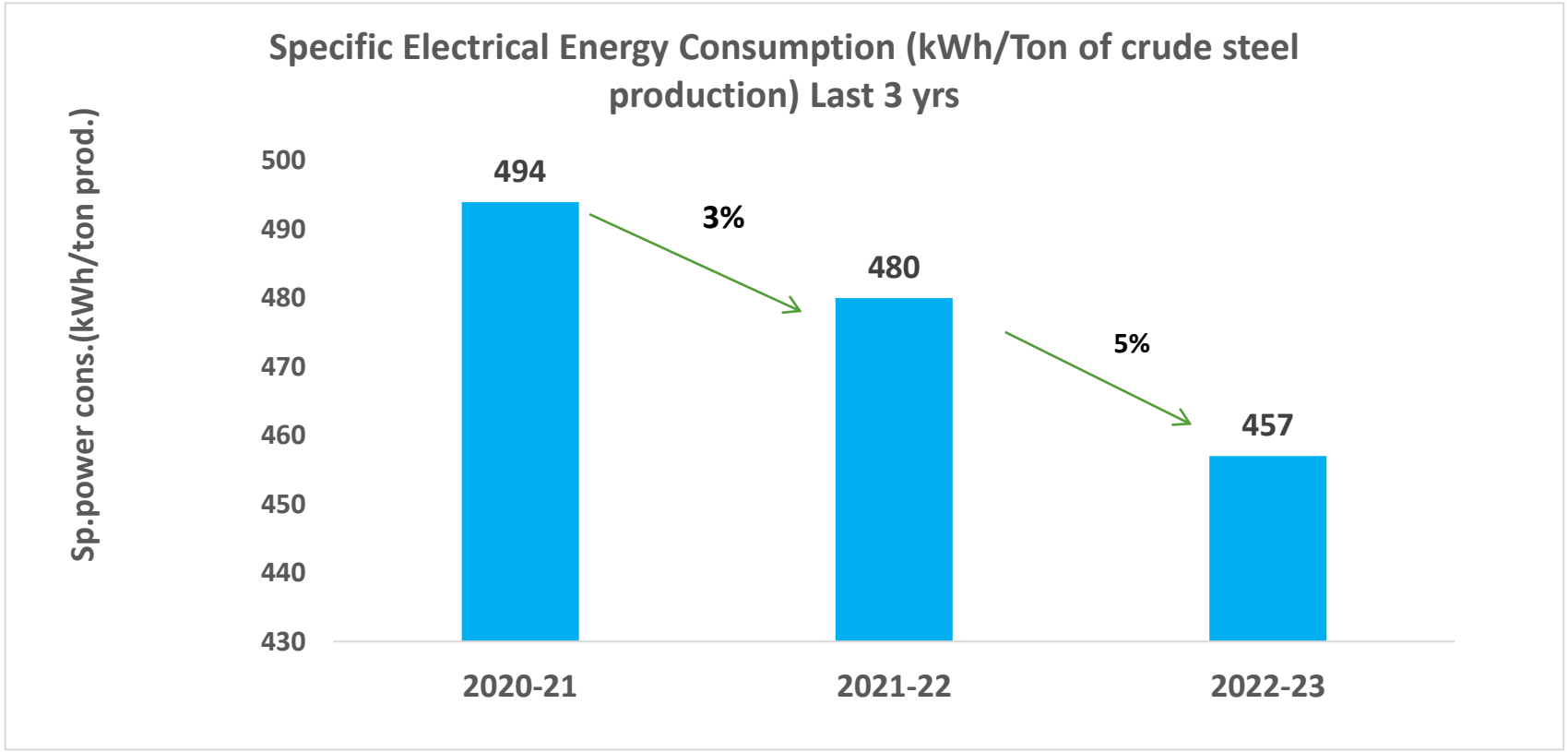
Output:

- *Products/By-products like Benzene, toluene, xylene, tar products,*
- *Granulated Blast Furnace slag sold to cement plants*
- *Power export outside plant boundary*
- *Coke transferred to sister plants,*
- *Coke Oven gas supplied to JV power plant*

ENERGY STATISTICS

- *Annual Energy Cost: Rs 4706/Gcal or Rs 30352 /TCS*
- *Annual Sales Volume = 4823375 Tons of saleable steel*
- *Energy Cost : 39 % of Manufacturing Cost*
- Plant Maximum Demand: 150 MVA

Energy performance – Past 3 Years

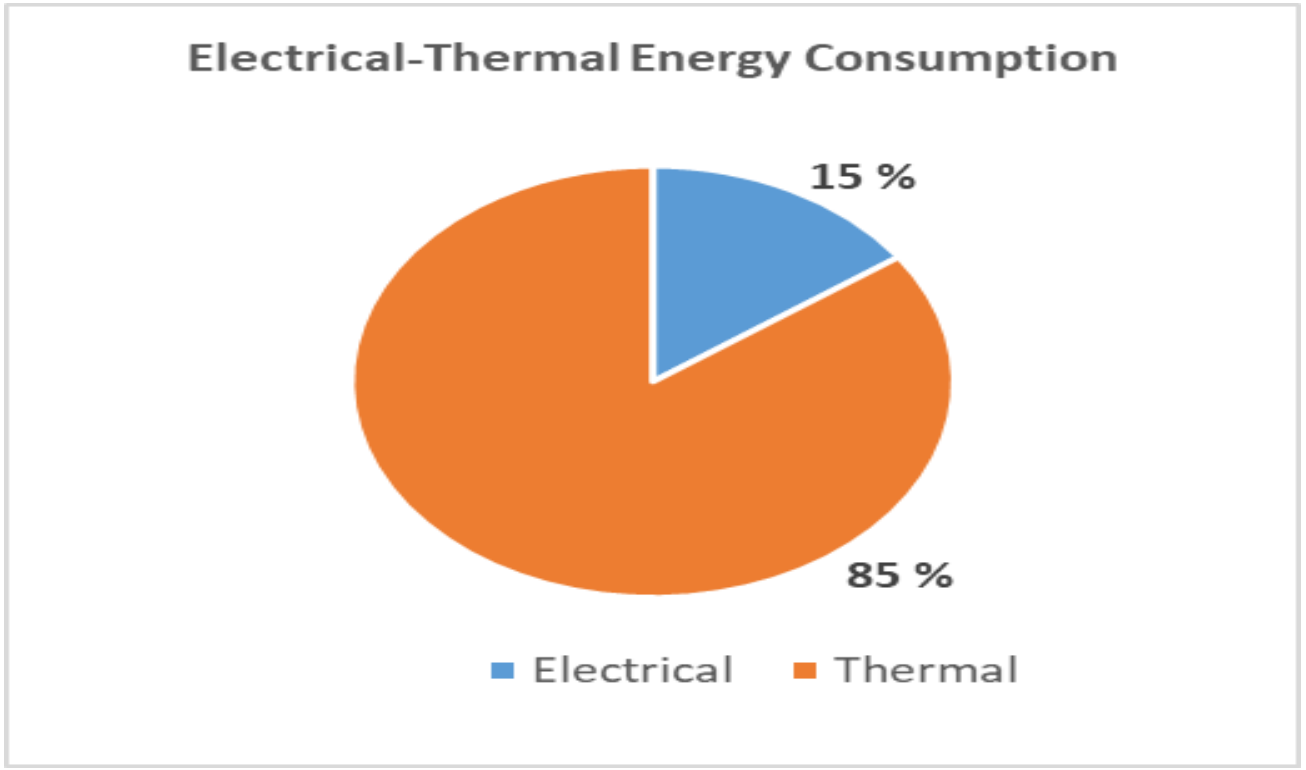


The specific power consumption in FY:2020-21 was higher due to :

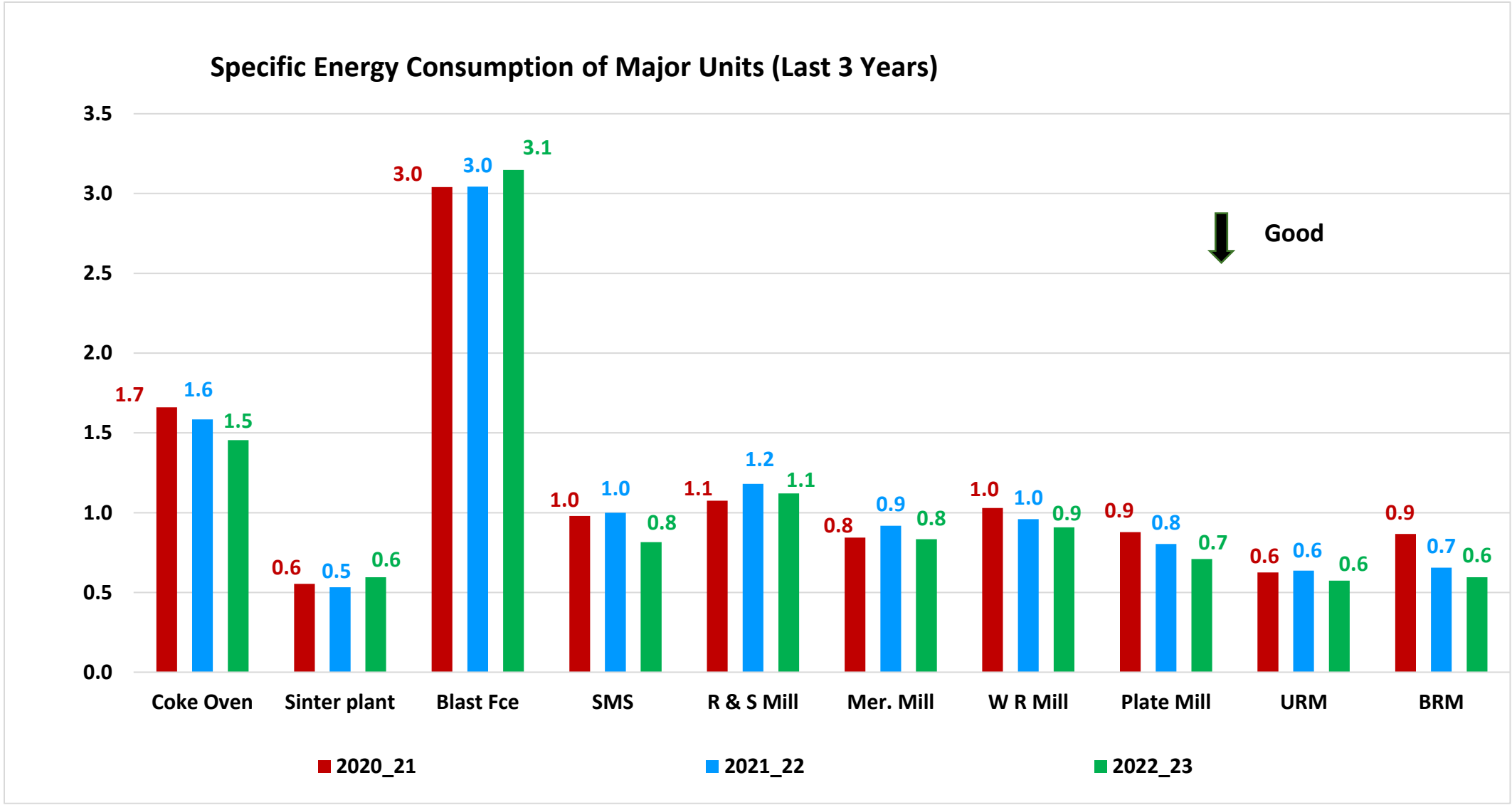
- ✓ COVID – 19 disruptions
- ✓ Commissioning activities in new units of URM,BRM & SMS-3

Electrical –Thermal Energy Consumption

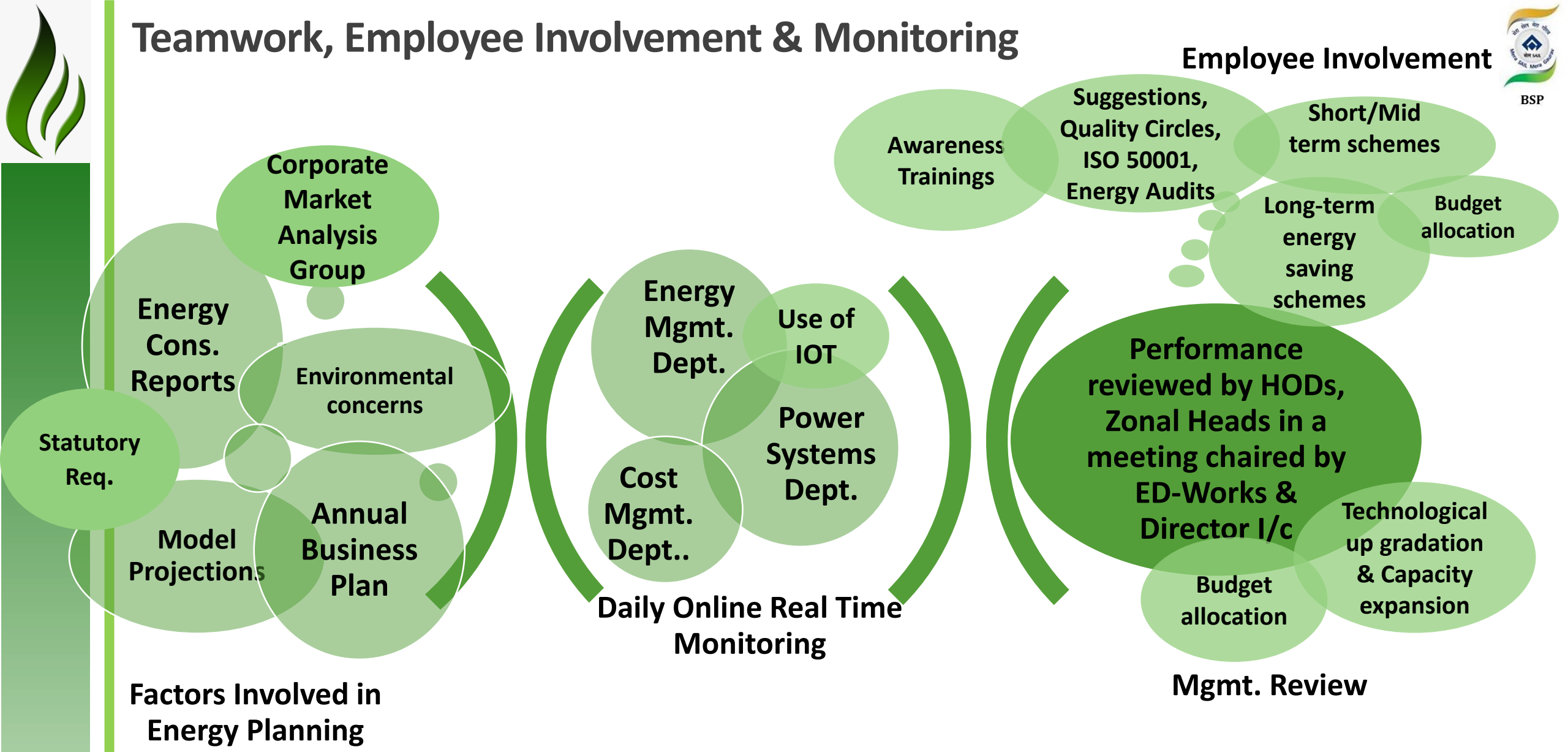
BSP



Energy performance – Past 3 Years



Teamwork, Employee Involvement & Monitoring



Use of IOT in Energy Monitoring

BSP

- Energy Mgmt. Dept. has a centralized online energy monitoring system for real time overview of all energy parameters
- More than 1000 signals of energy parameters like by-product gases, oxygen, nitrogen, argon, steam and compressed air are monitored online 24 x 7
- Reports and trends are also generated and stored for data mining
- MIS section of Energy Mgmt. Dept. prepares energy performance report of the plant on daily, weekly , monthly and annual basis

Use of IOT in Energy Monitoring

BSP

- Power Systems Department monitors electrical energy consumption patterns across the plant through a Plant wide Power Monitoring System
- Enertics sensors are installed in 100 critical motors in BSP for continuous real time monitoring
- Cost Control department carries out cost analysis on a monthly basis to translate the deviation in energy performance indices in terms of cost and spell out its impact on the profitability of the plant

Waste utilization and management as fuel

BSP

Name of the waste used as fuel	Type of waste	2020-21		2021-22		2022-23		Waste as % of fuel (in terms of heat value)
		Quantity (Th.NM^3/KL)	CV (Kcal/NM^3)/ (Kcal/L)	Quantity (Th.NM^3/KL)	CV (Kcal/NM^3)/ (Kcal/L)	Quantity (Th.NM^3/KL)	CV (Kcal/NM^3)/ (Kcal/L)	
Coke Oven Gas	By-product gas	1134785	4329	1314673	4323	1342513	4331	41.7%
Blast Furnace Gas	By-product gas	7327525	803	8819700	796	9153062	808	53.0%
BOF Gas	By-product gas	81098	1700	99544	1700	233365	1700	2.8%
Pitch Creosote Oil Mixture (PCM)	Liquid waste from fractional distillation of crude tar removed while cleaning Coke Oven gas	37334	10200	36094	10200	25322	10200	1.9%

99.4% of the energy needs are met by waste/by-product gases & only 0.6% is met through purchased fuels.

Waste utilization and management

BSP

Solid Waste Management:

Year	Total waste generated (Tons)	Total waste utilized (Tons)	% utilization	Remarks	Type of Waste
2019-20	3017602	2653589	87.9	Managed by selling (about 75%) or recycled (about 25%)	BF slag, LD slag, mill scale, flue dust, fly ash, etc.
2020-21	3071034	2670124	86.9		
2021-22	3684044	3261992	88.5		

Target : 100 % by 2027-28

Bench Mark : 99.9 % (Tata Steel Europe)

Waste utilization and management

BSP

Hazardous Waste Management:

Year	Total waste generated (Tons)	Total waste utilized	% utilization*	Remarks
2019-20	4452	3981	89.4	Managed by selling (about 60%) or recycled (about 40 %) .
2020-21	3981	3548	89.1	
2021-22	3415	2939	87	

Hazardous Waste Management

BSP

- The remaining wastes are stored in Bhilai Steel Plant. No waste is being sent for landfill. However, we have recently commissioned a secured landfill of 36000 M3 capacity for occasional disposal of asbestos and tar sludge from coke ovens.

- Bhilai Steel Plant has setup a National level Facility to decontaminate the PCBs in transformer oils at least 3400 Tones which is mainly from Bhilai Steel Plant and to recycle the oil further in order to reduce and eliminate PCBs in India, prioritizing in the power sector.

- BSP add additional facility for destruction of Pure PCBs and also decontamination of transformer core parts.

Strategies to reach 100% utilization by 2027-28

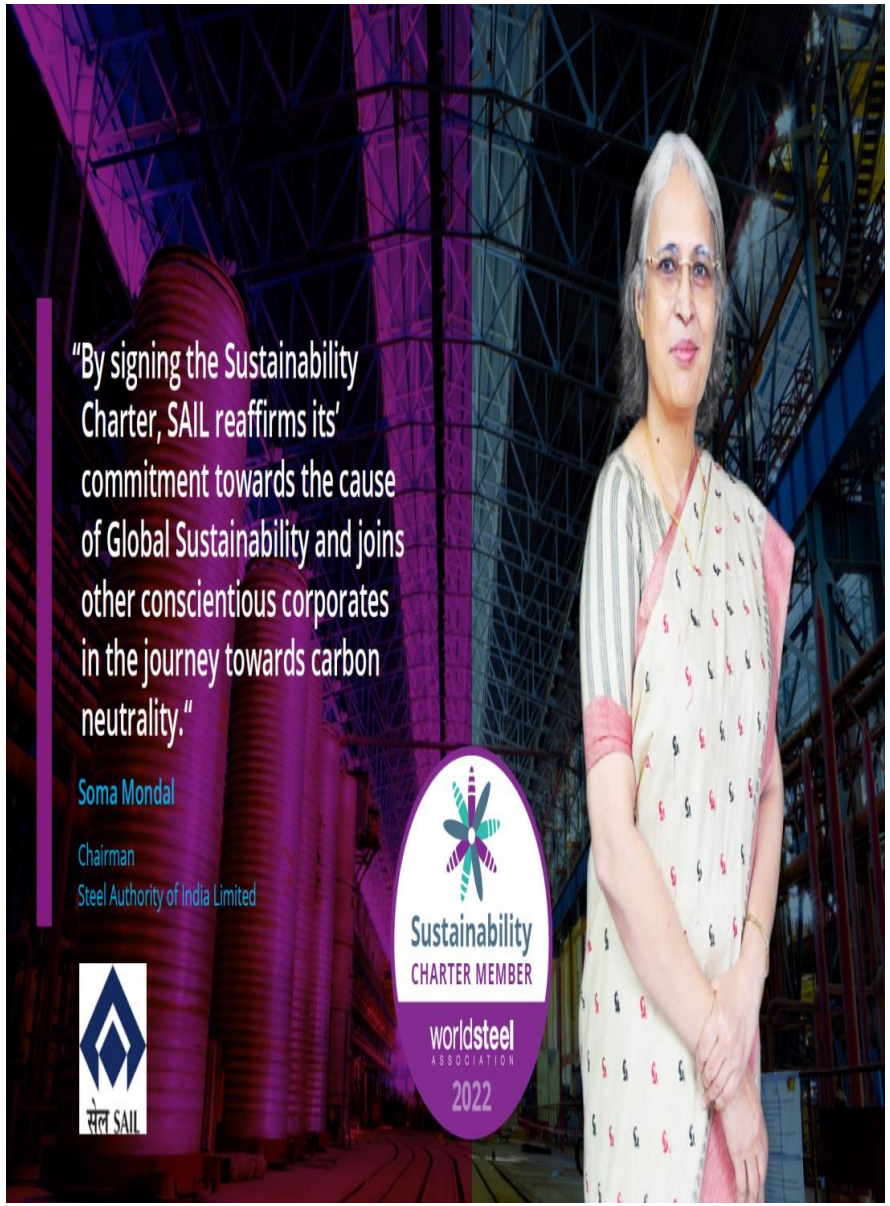
Type of waste	Strategy	Status
BF-Slag (75% of total waste)	Phase-out old BFs which do not have slag granulation facilities	• BF-2, 3 phased-out in 2019-20 • BF-1 to be phased-out in 2023-24
LD-Slag (15% of total waste)	Processing of waste to improve its characteristics for utilization in Road making , construction industry & use in agriculture. LD utilization as soil conditioner has a highest potential.	• R&D studies by RDCIS-SAIL • Studies by NIT-Raipur regarding the utilization as Road making material completed in 21-22 (Supply of 2 lac Tons of LD slag to R&B dept CG govt being finalized) Partnership with IARI to explore potential of slag as soil stabilizer (Potential for supply of 40 MT)
Dusts & Sludges (10% of total wastes)	Agglomeration and recycling to process	• Scheme for 1 lac Ton /Annum, Micro pelletization plant finalized – expected to be completed in 2023-24.

GHG Inventorisation

BSP

Information on GHG Inventorisation and public disclosure :

- ***SAIL is a member of World Steel association (WSA) and participating in the GHG disclosure project since 2010-11***
- ***SAIL publishes its sustainability reports every year where-in GHG emissions are disclosed***
- ***SAIL has also signed the sustainability charter of WSA in 2022***
- **BSP was the first public sector unit to publish sustainability report in the year 2006-07 as per GRI guidelines**



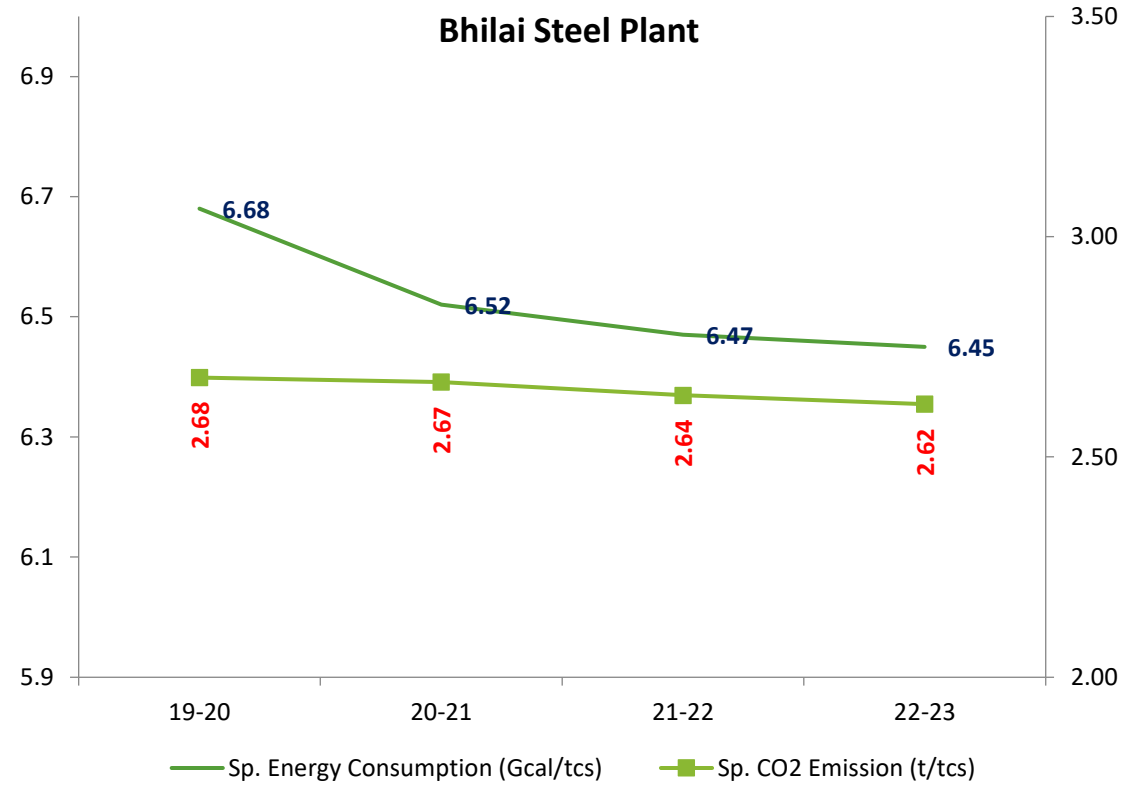
Scope of emissions (I,II,III) Considered:

- ***Direct emissions (Scope-1 emissions) i.e*** emissions from site chimneys determined by the carbon balance methodology
- ***Energy related emissions (Scope-2 emissions) :***Upstream emissions or credits related to procurement/delivery of electricity and steam from site. Upstream
- ***Credits (Scope-3 emissions) :***Other upstream emissions or credits related to procurement/delivery of pre-processed materials/co-products from site.

Methodology for calculation: WSA GHG emission calculation tool

Absolute Emissions and Emissions intensity of last three years

Year	Absolute emissions (Tons)	Emission intensity (Ton/Ton of crude steel)
2020-21	11,357,667	2.676
2021-22	12,850,339	2.64
2022-23	13,554,637	2.616



Target : 1.96 T/TCS by 2027-28

Bench Mark : 1.8 % (Rautraukki Steel, Finland)

Target (short term/ long term) for CO_2 emission reduction and action plan

- Phase-1 de-carbonization by 2029-30 to achieve CO_2 emissions rate of 1.96 T/TCS (**Already reduced 34 Lac tons of CO_2 emissions over 2018-19**)
  - **Focus areas : Improvement in Raw material quality, BF-burden, BF hot blast temperature/ presume, Use of Renewables, solid waste utilization for a circular economy**

  (Schemes for 1 MTPA pellet plant & 5.2 MTPA slime beneficiation /silica reduction plants in mines, Sourcing of good quality ore from Raughat)

- Phase-2 de-carbonization by 2034-35 to achieve CO_2 emissions rate of 1.8 T/TCS
  - **CCUT technologies in next phase of expansion**

INNOVATIVE PROJECTS IMPLEMENTED - 1

BSP

Top Pressure Recovery Turbine (TRT) of 14 MW power generation capacity in Blast Furnace no. 8

- ✓ Daily hot metal production of BF-8 = 8000 Ton/day
- ✓ Top gas pressure = > 2.5 Kg/cm2
- ✓ This pressure energy is being utilized to run a turbine and generate power
- ✓ **TRT has been installed at BF-8 for recovery of 14 MW power from the BF gas released from BF-8** before the cleaned BF gas is fed into the plant wide network to be used as fuel.

- ✓ The power generation achieved from TRT of Blast Furnace – 8 in the last three years is as follows:

- ❑ 2020-21 – 78.955 MU
- ❑ 2021-22 – 89.533 MU
- ❑ 2022-23 - 91.525 MU

Benefits :

- ✓ **Reduction in import of an equivalent quantity of power** from the State power grid

- ✓ Reduction in power bill

- ✓ *With further stabilization of the TRT, the power generation from TRT is going to increase in the coming years*

Utilization of Renewable Energy Sources & Waste Energy Sources

BSP

Technology (Electrical)	Type of Energy	Onsite/ Offsite	Installed Capacity (KW)	Generation (million kWh)	% of overall electrical energy	Generation (million kWh)	% of overall electrical energy	Generation (million kWh)	% of overall electrical energy
				2020-21		2021-22		2022-23	
Electrical	Solar	On site	2 X 100	0.04660	0.001	0.216785	0.008		
TRT	Potential energy in BF gas	On site	14000	78.955	3.8%	89.533	3.8%	91.525	3.6%
BPTG	Waste heat from CDCP	On site	4000	17.84	0.85%	11.28	0.5%	29.23	1.2%

Utilization of Renewable Energy Sources

BSP

RENEWABLE PURCHASE OBLIGATION

Sl. No.	FINANCIAL YEAR	CATEGORY	MUs	RPO, MUs
1	2021-22	Captive Consumption	2271	182
		Cogen CPP -1, Cogen CPP - 2	282.874	

Energy Saving Projects implemented in last 3 years

BSP

Year	No. of energy saving projects	Investment (INR Million)	Electrical Savings (Million kWh)	Thermal savings (Million Kcal)	Savings (INR Million)
2019-20	7	1247.17	7.612	47500	248.07
2020-21	10	44.82	7.691	89961	151.69
2021-22	10	41.02	50.2	193391	515.81

Major ENCON projects implemented for FY:2022-23

BSP

- Installation of VVF drives in SMS-2, Cooling Water Pump motors of Convertor 2(in 6/12 pump motors), Plate Mill Gas Booster Station (2 nos.)
- Installation of VVVF drives in Combustion air fan of BF-7
- Replacement of Conventional Lighting Fixtures with LED Light Fixtures
- Installation of 3 MW Roof Top Solar Power Generation System

Our Competitors, National & Global benchmark, Targets

National

TATA STEEL

RASHTRIYA ISPAT NIGAM LIMITED
VIZAG STEEL
Pride of Steel

Global

posco

	TATA STEEL (Jamshedpur)	RINL	POSCO	BSP	BSP's TARGET
Specific Energy Cons. For FY:21-22	5.41 Gcal/Ton of crude steel prod.	6.02 Gcal/Ton of crude steel prod.	5.04 Gcal/Ton of crude steel prod.	6.47 Gcal/Ton of crude steel prod.	5.95 Gcal/Ton of crude steel prod.

Long Term Road Map for improving energy efficiency

- Installation of a new and modern higher capacity Blast Furnace in place of older Blast Furnaces
- Installation of a new pellet plant using iron ore fines to increase sinter + pellet burden in Blast Furnaces and reduce lump ore consumption
- Installation of by-product gas fired GTCC and phasing out of old, obsolete captive coal fired power plant boilers
- Installation of TRT of 4 MW capacity in existing Blast Furnace – 7
- Installation of new Walking Beam Furnaces in Rail & Structural Mill and Plate Mill with State of the Art Mill equipment and Capacity Enhancement
- Installation of a 15 MW floating solar power plant in collaboration with NSPCL
- Replacement of Furnace Oil firing with by-product gas firing in existing old twin shaft calcining kilns

Implementation of ISO 50001

- ISO 50001:2011-Energy Management System(EnMS) was implemented in Bhilai Steel Plant in 2017
- In July 2020, the EnMS was upgraded to ISO 50001:2018
- **Bhilai Steel Plant is the only Integrated Steel Plant in India to have ISO 50001:2018 certification for entire integrated steel making process covering production of coke, sinter, iron and steel making and rolling of finished steel products**
- In total, 15 depts. of BSP are in the scope and boundary of ISO 50001
- The current ISO 50001:2018 certification is valid till July 2023

% investment of energy saving projects (including new highly energy efficient commissioned units during modernization) on total turnover of the company (FY 21-22) = 4 %

TÜV NORD

CERTIFICATE

Management system as per
ISO 50001: 2018

In accordance with TÜV INDIA procedures, it is hereby certified that

BHILAI STEEL PLANT
(A UNIT OF STEEL AUTHORITY OF INDIA LIMITED)
Bhilai Steel Plant, Bhilai - 490 001,
Chhattisgarh,
India

applies a management system in line with the above standard for the following scope

Integrated Steel Making Covering Production of Coke, Sinter, Iron and Steel Making and Rolling of Finished Steel Products

Certificate Registration No. ENMS 04 00006
Audit Report No. Q 10388/2020

Valid until 12.07.2023
Valid from 14.12.2020
Initial Certification 12.07.2017

Certification Body
at TÜV INDIA PVT. LTD.

Issue 14.12.2020
Place : Mumbai

This certification was conducted in accordance with the TÜV INDIA auditing, and certification procedures & shall be valid subject to regular Surveillance Audits.

TÜV India Pvt. Ltd., 801, Raheja Plaza – 1, L.B.S. Marg, Ghatkopar (W), Mumbai - 400 086, India cert.helpdesk@tuvindia.co.in

Thank You