23rd National Award for Excellence in Energy Management 2022

23 - 26 August 2022

Bhilai Steel Plant
Steel Authority of India Ltd.

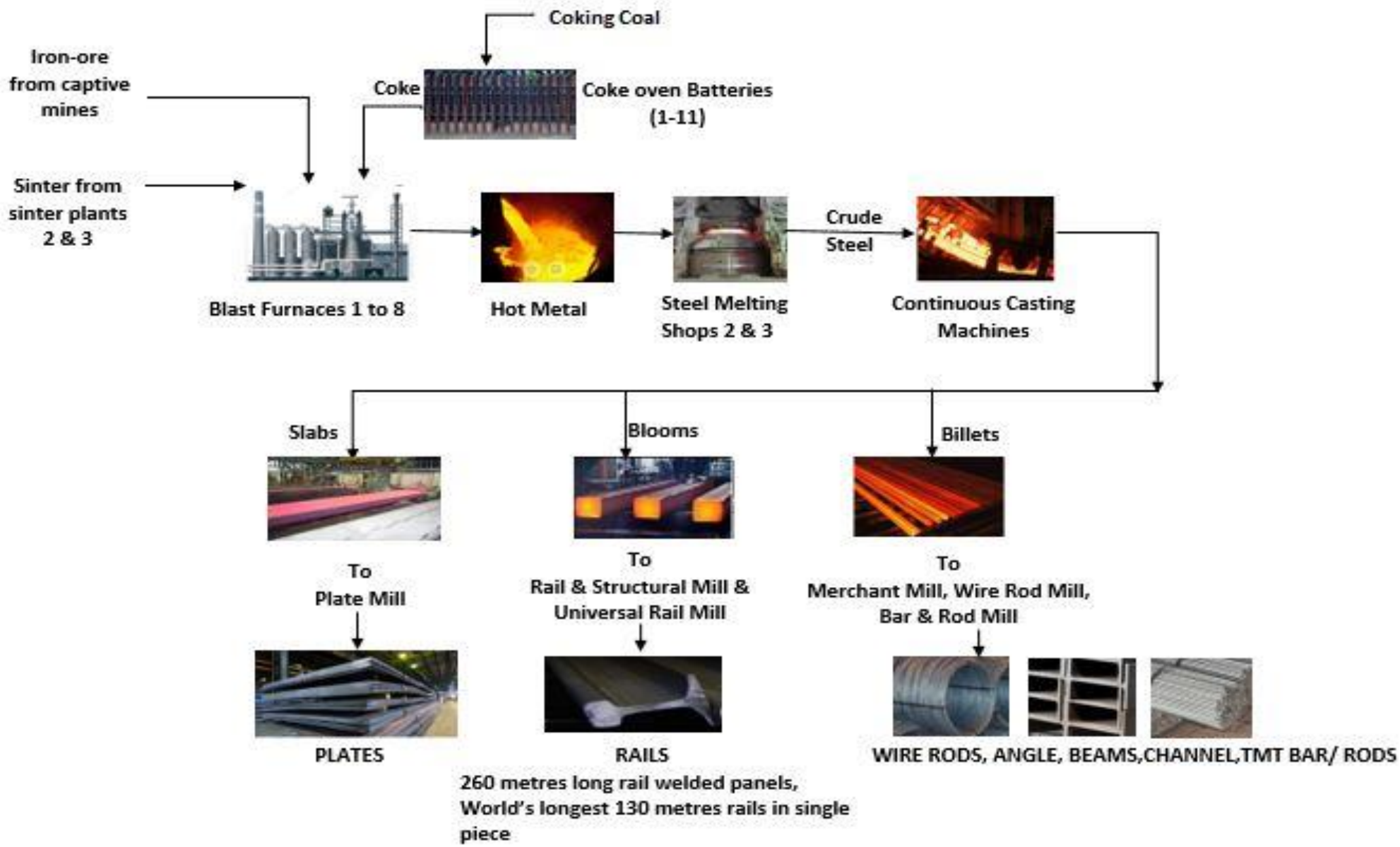
Presented By

1. Ms. Bonya Mukherjee, GM(EMD)
2. Shri K Praveen, GM(Env.MD)
3. Shri Aakash Kaushal, Mgr.(TP&IE)

Company Profile

- Set up in 1959 with 1 MT crude steel production capacity, Bhilai Steel Plant is the flagship unit of SAIL
- Presently, 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



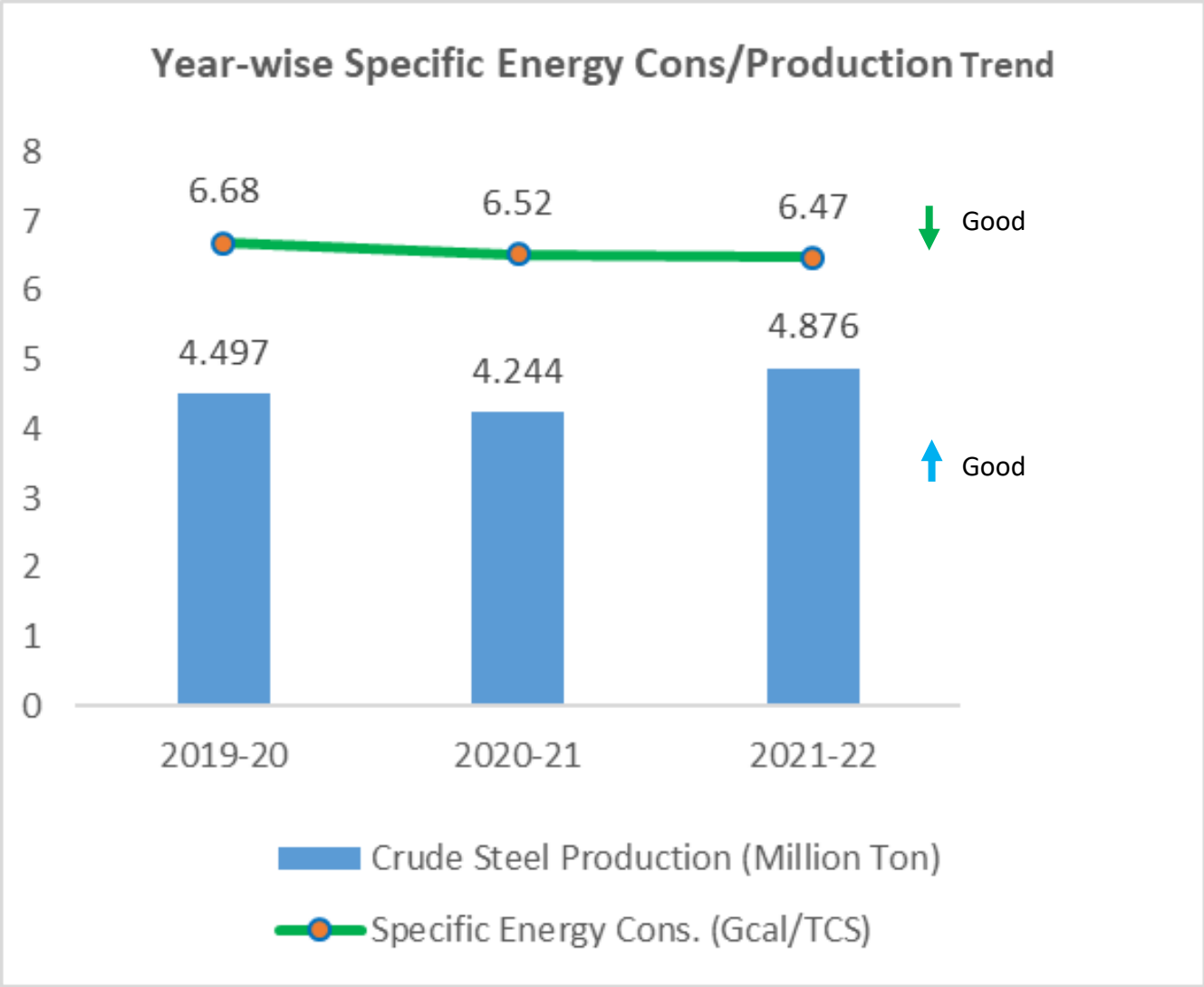
Company Profile

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

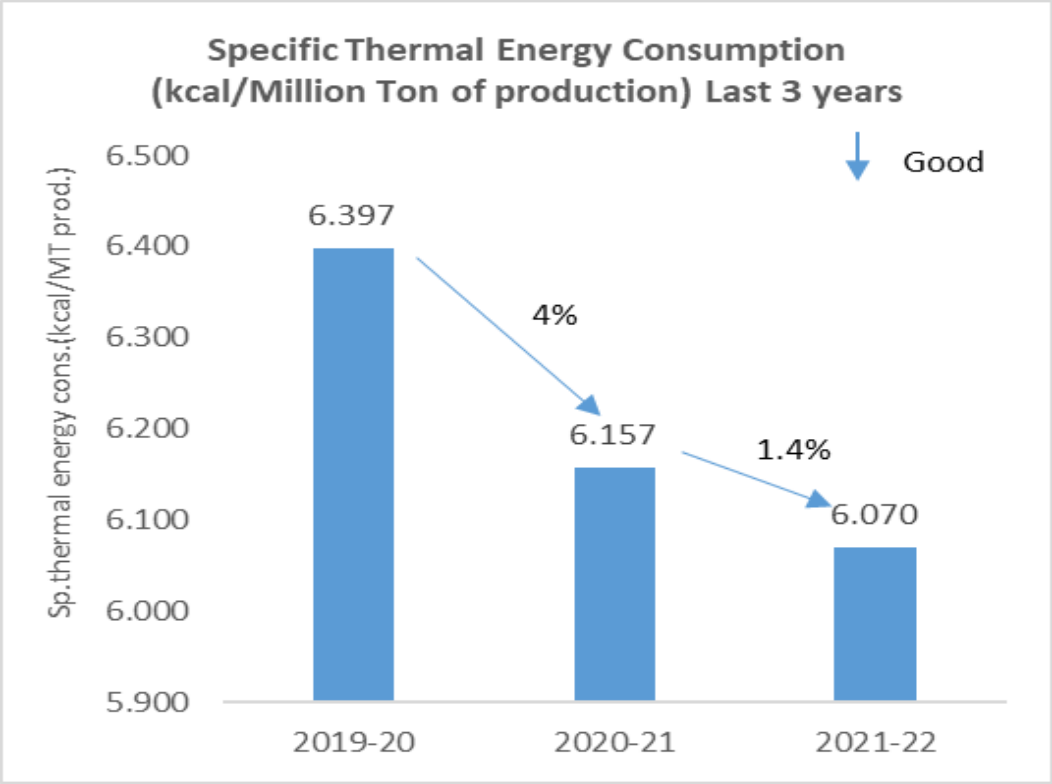
Energy performance – Past 3 Years

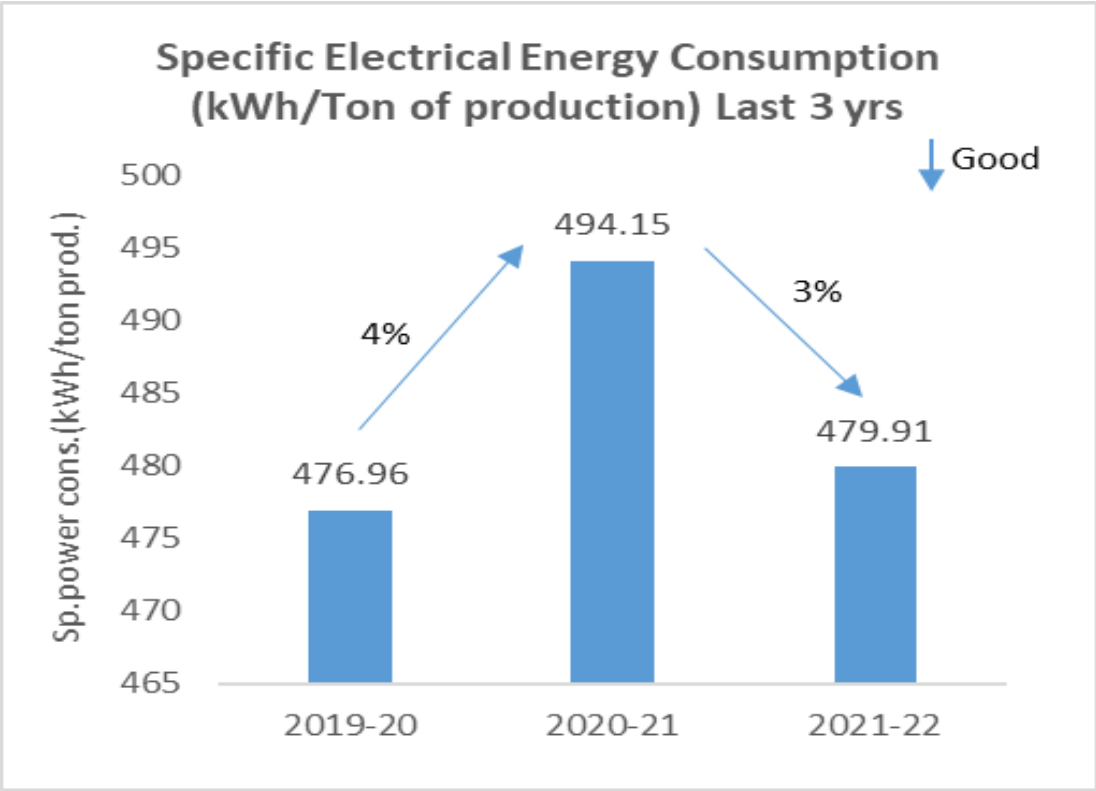


Reasons for variation

- **Energy Rate decreased by 0.8 % in FY:21-22 YOY while crude steel production increased by 15 %**
- **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 – Past 3 Years

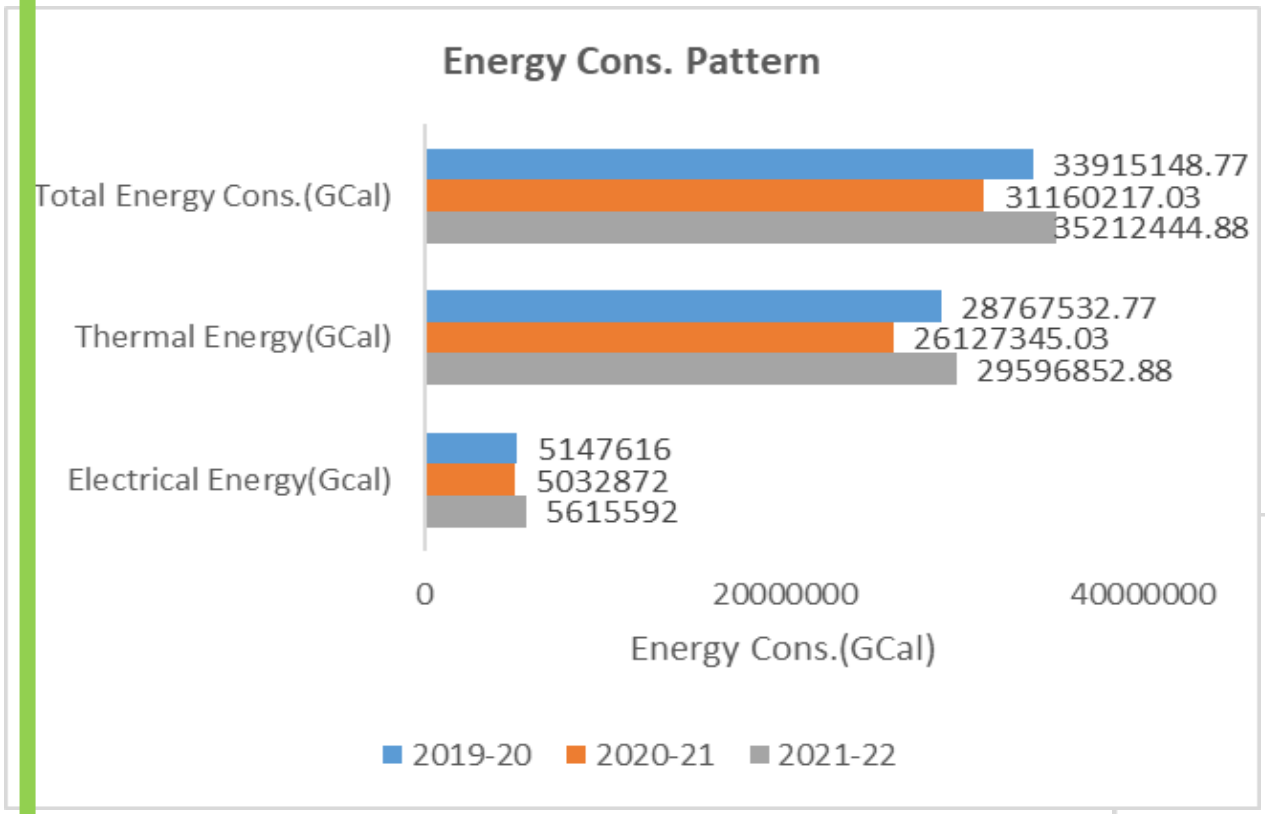


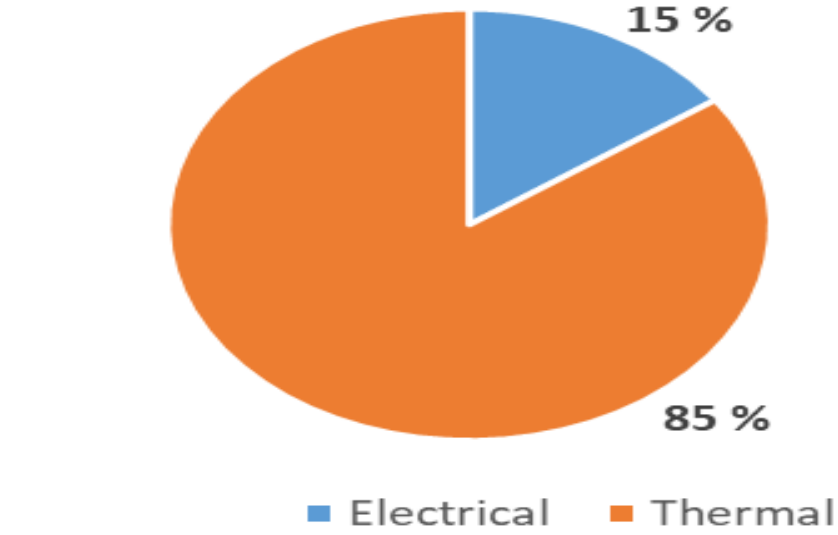


The specific power consumption in FY:2020-21 was higher due to :

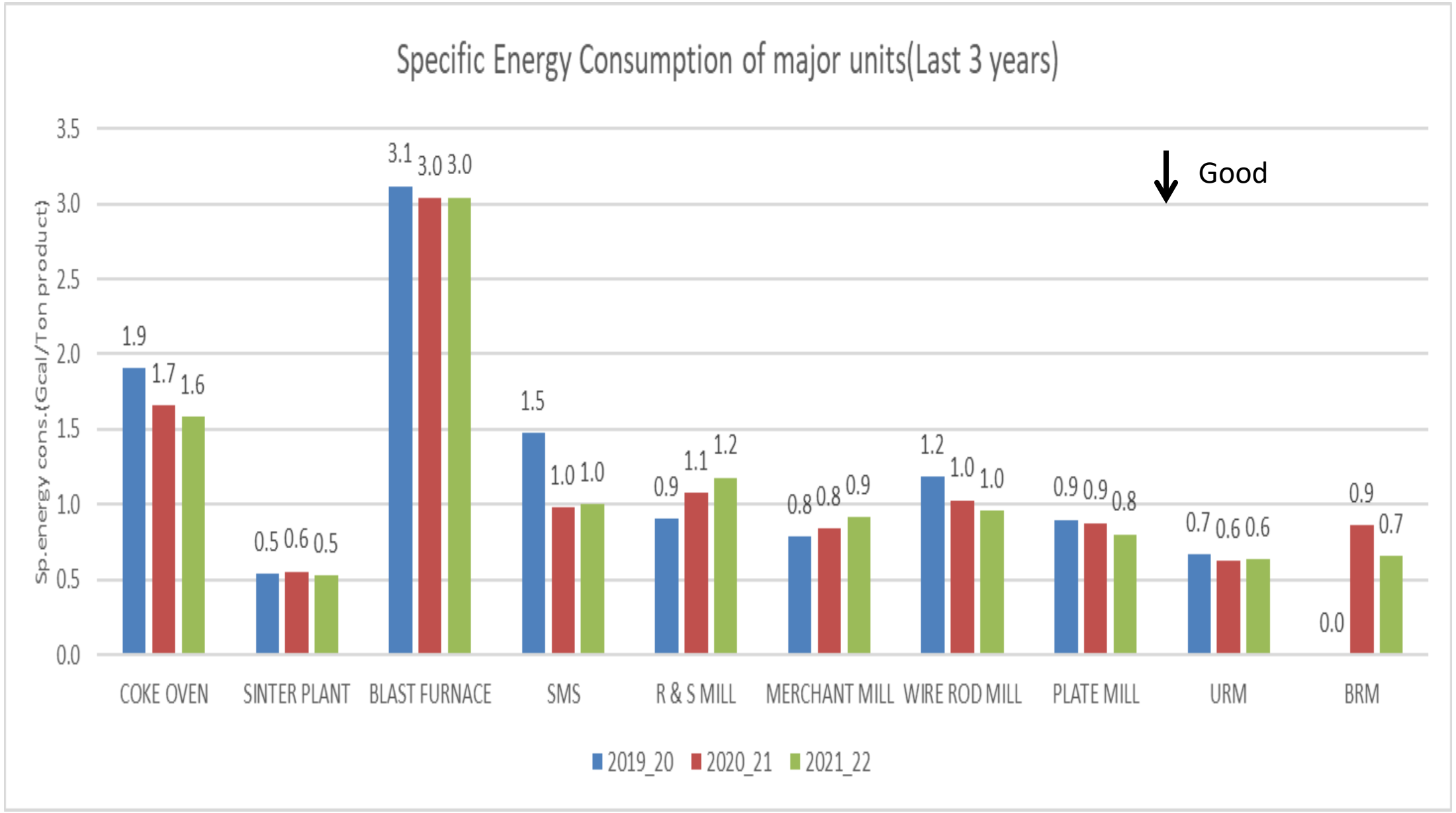
- ✓ COVID – 19 disruptions
- ✓ Commissioning activities in new units of URM,BRM & SMS-3

Energy performance – Past 3 Years





Energy performance – Past 3 Years



Our Competitors, National & Global benchmark, Targets

BSP

National

TATA STEEL

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

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- 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 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 a new and modern higher capacity Blast Furnace in place of older Blast Furnaces 1, 2 & 3
- Installation of a 15 MW floating solar power plant in collaboration with NTPC
- Installation of a new pellet plant using iron ore fines to increase sinter + pellet burden in Blast Furnaces and reduce lump ore consumption
- Replacement of Furnace Oil firing with by-product gas firing in existing old twin shaft calcining kilns

Major ENCON projects planned for FY:2022-23

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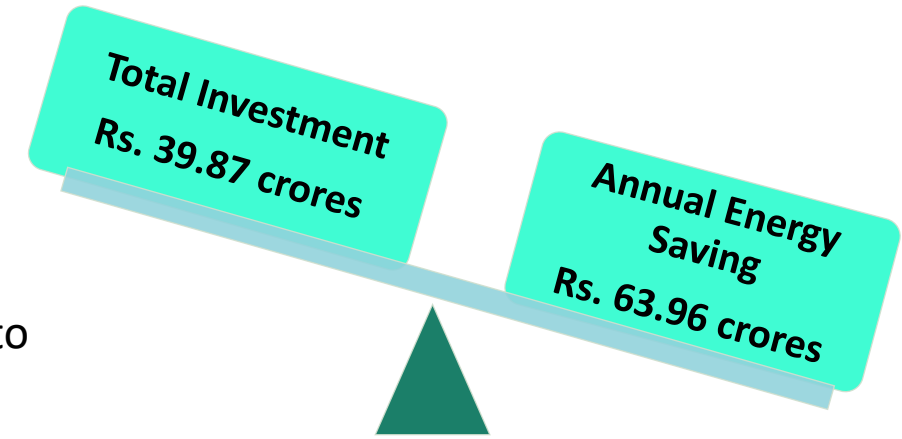
- Improvement in Insulation in PBS-1 & PBS-2 (Power and Blowing Station-1&2) area to minimize heat loss
- Installation of VVF drives in SMS-2, Cooling Water Pump motors of Convertor 2(in 6/12 pump motors), URM/BRM Booster Station (1 no.), Rolling Mill Gas Booster Station(1 no.) and Plant De-dusting Fan Motors (2 nos.) in SP-3
- Installation of MV drives in Combustion air fan of 200KW in BF-6
- Replacement of one 55 TPH capacity pump with 25 TPH capacity pump in Power & Blowing Station-2.
- Periodic Cleaning of the STG & Turbo Blower - 1 & 3 Cooling Tower Fan to achieve desire effectiveness & temperature
- A Separate New Compressor of 5000 Cubic meters / hr. to be installed to fulfil the requirement of BRM at 6.5 kg/cm^2 and thereafter one compressor out of five compressors running in central compressed air house can be stopped to save the significant energy in compressed air section
- Replacement of Conventional Lighting Fixtures with LED Light Fixtures
- Installation of 3 MW Roof Top Solar Power Generation System



Energy Saving Projects implemented in last 3 years

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Year	No. of energy saving projects	Investment (INR Million)	Electrical Savings (Million kWh)	Thermal savings (Million Kcal)	Savings (INR Million)	Impact on SEC (Electrical, thermal)
2019-20	7	1247.17	7.612	47500	248.07	Implementation of ENCON measures has resulted in drop in overall SEC. However, impact of individual measure on SEC has not been ascertained
2020-21	10	44.82	7.691	89961	151.69	
2021-22	10	41.02	50.2	193391	515.81	

INNOVATIVE PROJECTS IMPLEMENTED - 1

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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:

- ❑ 2019-20 – 51.236 MU (Year of commissioning)
- ❑ 2020-21 – 78.955 MU
- ❑ 2021-22 - 89.533 MU

Benefits :

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

- ✓ Reduction in power bill as well as the specific power consumption per ton of crude steel produced

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

INNOVATIVE PROJECTS IMPLEMENTED - 2

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IN HOUSE WATER CONSERVATION INITIATIVES

Units/Areas	Details of the Effluent Treatment Facility Installed
Project 1: **Universal Rail Mill (URM)**	• Scale pits – 3 nos. (2 nos. for URM and 1 no. for BRM) • Secondary Settling Tanks • Oil catchers with scale collection system • **Scale Removal Filters – 22 nos. (8 nos. for URM & 14 nos. for BRM)** • Cooling Tower • Diversion of backwash water of SRF & HYDAC filters to Secondary Settling Tanks, storage in Overhead Tank • Recovered waste water is reused after filtering for cleaning of SRFs and backwash of HYDAC filters • Elimination of 2 nos. PSFs • **90% requirement of Make-up water is reduced in URM** • **Zero discharge of water from BRM**
Project 2: **Bar & Rod Mill (BRM)**	

INNOVATIVE PROJECTS IMPLEMENTED

BSP

IN HOUSE WATER CONSERVATION INITIATIVES

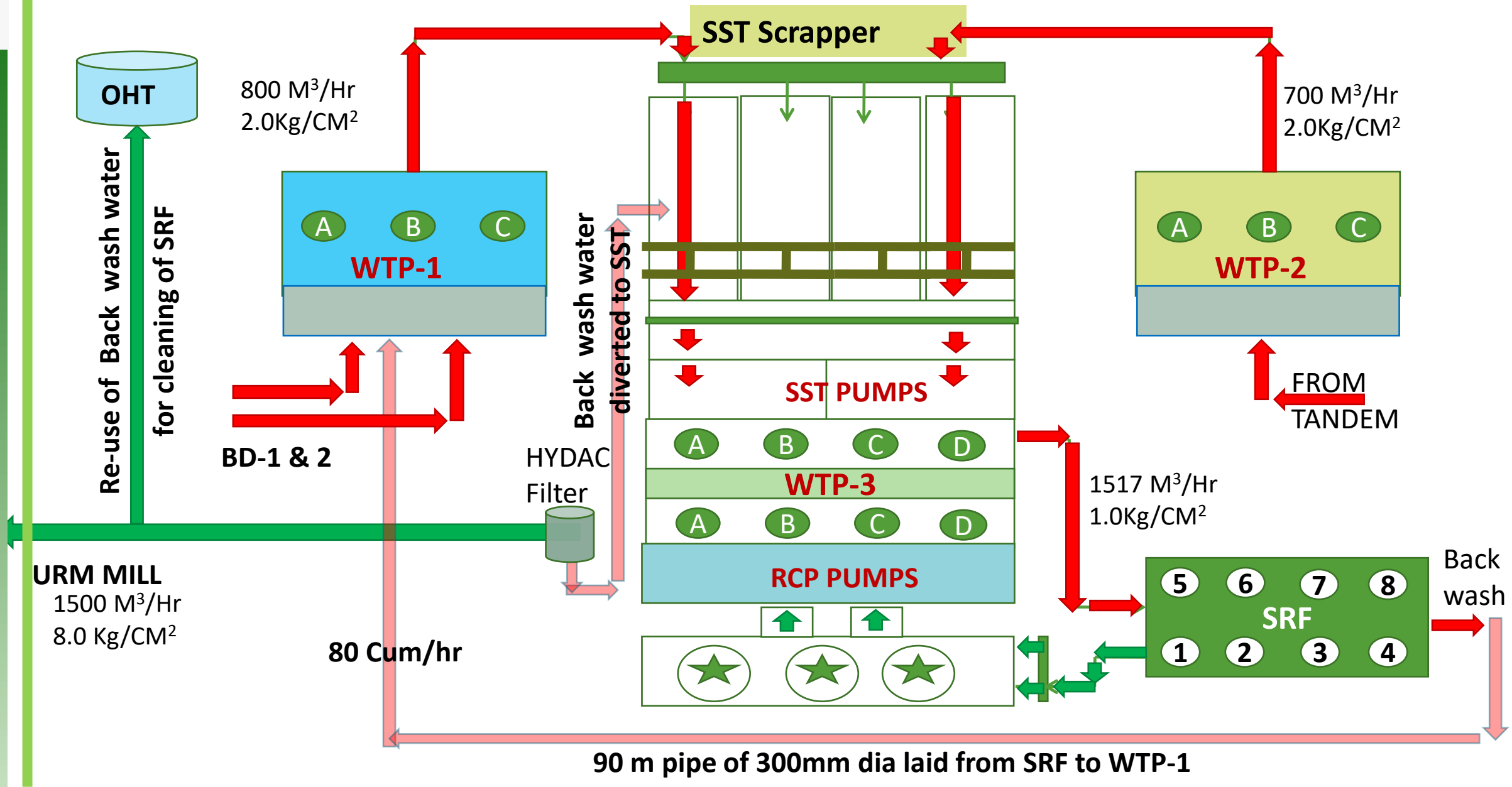
Benefits achieved in URM

- Elimination of discharge of effluent water
- **Savings of electricity required in running of 35 kw vertical pumps in waste water tank and 18.5 kw OHT filling pumps**
- Elimination of Operation & Maintenance of 2 nos. of PSF
- **Elimination of operation & maintenance of 6 nos. of pumps**
- Saving of **80cum/hr.** of makeup water ~ 7 lakhs cu.m./year
- Electricity saving – 469 MWH/Year
- Total savings – Rs. 1.5 Crores per annum

Benefits achieved in BRM

- Elimination of discharge of 2016 cu.m./day of backwash water from 14 nos. SRFs
- Backwash water is routed to a Waste Water Tank and a high capacity Slurry Pump recyclespolluted water back into the Secondary Settling Tank, thereby making it a closed loop system
- **BRM has become a zero Discharge Unit**
- Saving in wastage of 2000 Cu.m./day of water

Diversion of Back-wash water of SRF & HYDAC



Schematics of Modified BRM WTPs

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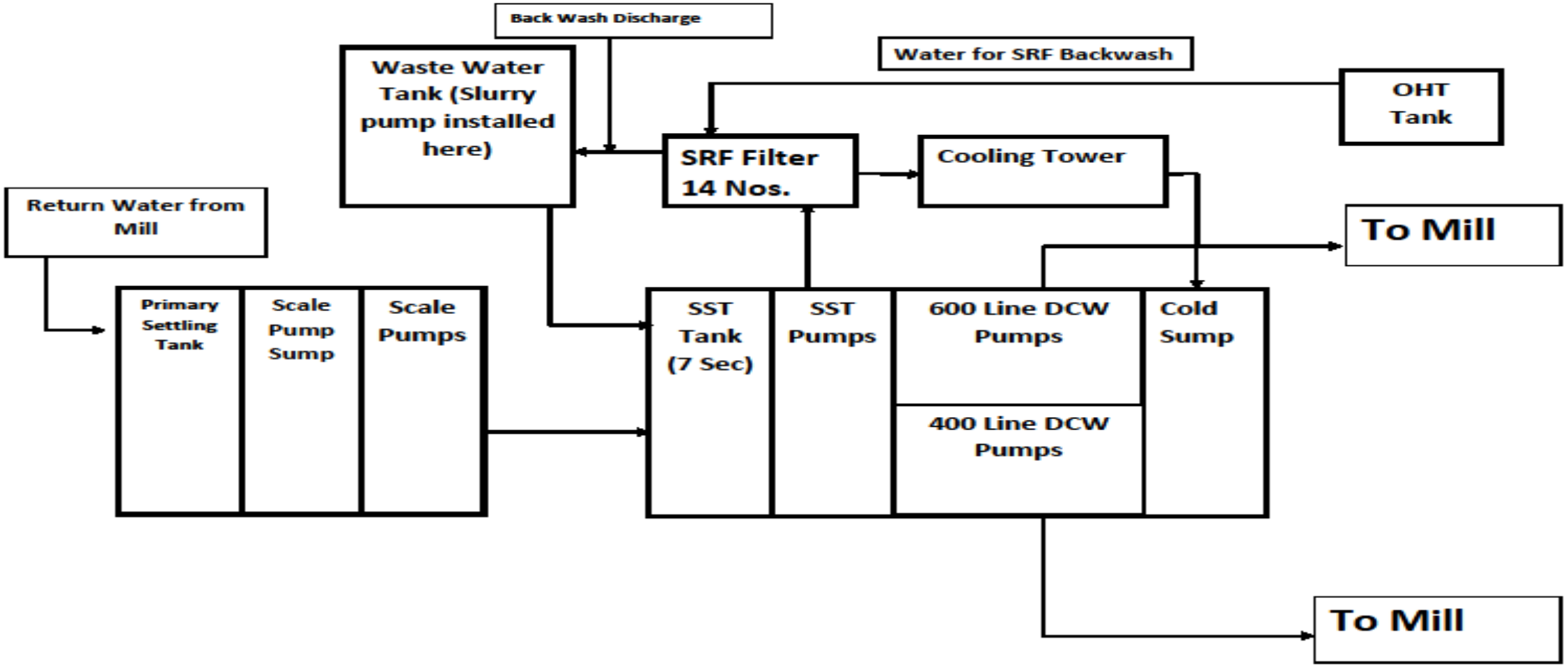

Utilization of Renewable Energy Sources & Waste Energy Sources

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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
				2019-20		2020-21		2021-22	
Electrical	Solar	On site	2 X 100	0.002187		0.04660	0.001	0.216785	0.008
TRT	Potential energy in BF gas	On site	14000	51.236	2.4%	78.955	3.8%	89.533	3.8%
BPTG	Waste heat from CDCP	On site	4000	5.146	0.24%	17.84	0.85%	11.28	0.5%

Utilization of Renewable Energy Sources

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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	

Waste utilization and management as fuel

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Name of the waste used as fuel	Type of waste	2019-20		2020-21		2021-22		Waste as % of fuel (in terms of heat value)
		Quantity (MT/Year)	GCV (Kcal/Kg)	Quantity (MT/Year)	GCV (Kcal/Kg)	Quantity (MT/Year)	GCV (Kcal/Kg)	
Coke Oven Gas	By-product gas	572976	1945	559006	1948	604749.58	1948.5	42%
Blast Furnace Gas	By-product gas	10750772	1069	9806763	1084	11818398	1075	50%
BOF Gas	By-product gas	171097.5	2125	101372.5	2125	124430	2125	1%
Pitch Creosote Oil Mixture (PCM)	Liquid waste from fractional distillation of crude tar removed while cleaning Coke Oven gas	63822	10000	44054	10000	42591	10000	3%

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		

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	

Strategies to reach 100% utilization by 2027-28

Type of waste	Strategy	Status
BF-Slag (75% of total waste)	Phase-out old units which do not have slag granulation facilities	• BF-2, 3 phased-out in 2019-20 • BF-1 to be phased-out in 2022-23
LD-Slag (15% of total waste)	Processing of waste to improve its characteristics for utilization in Road making , construction industry & use in agriculture. LD slag utilization as soil conditioner	• R&D studies by RDCIS-SAIL • Studies by NIT-Raipur regarding the utilization as Road making material completed in 21-22 • Partnership with IARI to explore potential of slag as soil stabilizer
Dusts & Sludges (10% of total wastes)	Agglomeration and recycling to process	• Micro pelletization of sludges & dusts and recycling in Sinter Plant

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***
- ***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

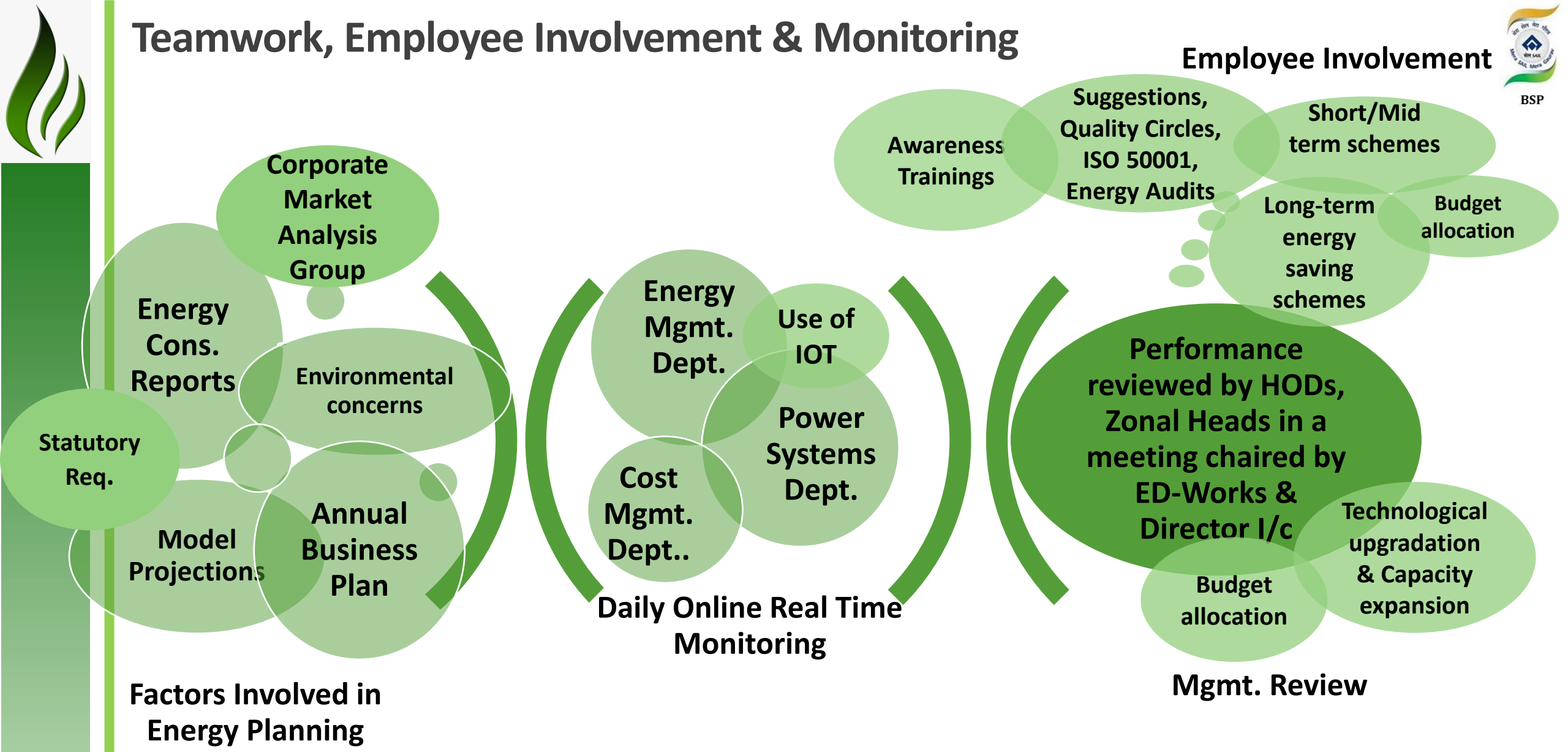
Absolute Emissions and Emissions intensity of last three years

Year	Absolute emissions (Tons)	Emission intensity (Ton/Ton of crude steel)
2019-20	12,068,715	2.6838
2020-21	11,357,667	2.6764
2021-22	12,850,339	2.64

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 2.3 T/TCS (**Already reduced 34 Lac tons of CO_2 emissions over 2018-19**)
  - **Focus areas : Improvement in Raw material quality, BF-burden, Renewables, solid waste utilization/circular economy**
- Phase-2 de-carbonization by 2034-35 to achieve CO_2 emissions rate of 2.0 T/TCS
  - **CCUT technologies in next phase of expansion**
- Phase-3 de-carbonization by 2070 to achieve Net Zero Emissions
  - **Use of Green Hydrogen as fuel**

Teamwork, Employee Involvement & Monitoring



Use of IOT in Energy Monitoring

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- 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
- 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
- MIS section of Energy Mgmt. Dept. prepares energy performance report of the plant on daily, weekly , monthly and annual basis
- 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
- Awareness Training programs are conducted regularly at organizational and department level

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

Learning from CII Energy Award & Awards Won by in Last 3 Years

Learnings from CII Energy Award

- Opportunity for self assessment in terms of energy efficiency measures undertaken
- Benchmarking with the energy performance of similar industries
- Knowledge acquisition regarding new, innovative and replicable energy efficiency measures undertaken by other industries

Awards Won by BSP in Last 3 years

- **Prime Minister's Shram Awards.** 16 BSP employees, including 4 women employees have bagged the prestigious Shram Shree/ Shram Devi awards announced by Prime Minister's Shram Awards (PMSA) in 2021
- **VISHWAKARMA RASTRIYA PURASKAR**. 18 employees of SAIL-Bhilai Steel Plant from 3 groups have been selected for the Vishwakarma Rastriya Puraskar
- **ISPAT SURASHA PURASKAR 2021 -** In the Integrated steel Plant category under Group 'A', BSP's Coke Ovens and Coal Chemical department (CO & CCD) and Rolling Mills zone were felicitated for 'No fatal accident' for the year 2019 and 2020
- **Greentech Safety Culture award 2021** SAIL-BSP has bagged the Greentech Effective Safety Culture award 2021 in the Metal and Mining category in heavy industries.
- **3rd National Water Awards - SAIL has bagged 3rd prize under best industry category at the 3rd National Water Awards. Bhilai Steel Plant's Universal Rail Mill Zero Liquid Discharge (URM- ZLD) had been taken as a model case for the award**
- **Shram Yashasvi awards 2020-21 -** Four BSP employees received the Shram Yashasvi awards for year 2020-21.

BSP

Thank You

Name	Email id	Contact
Ms. Bonya Mukherjee	bonyamukherjee@sail.in	9407982583
Shri K Praveen	kpraveen@sail.in	9407981622
Shri Aakash Kaushal	aakash.kaushal@sail.in	9407980337

LD slag utilization as soil conditioner

- **R&D to ascertain use of BOF slag as liming agent for amelioration of acidic soil and fertilizer being done through ICAR-IARI by MoS and industry partners SAIL, JSW & Tata steel.**
- **Out of the total cultivable land of 157 Mha, 49 Mha is acidic (8% of total geographical area in India), which limits crop production.**
- **With an application of BOF slag @1 ton/ha – Annual potential of gainful use of BOF slag – 49 MTt**
- **Surplus BOF slag in SAIL 1 MT annually - CO_2 emission saving 0.42 Mt/t of slag, if used as liming agent in agriculture.**
- **BOF slag from BSP, DSP, BSL & ISP is being supplied for road making as an attempt to enhance steel slag utilisation**

Technologies implemented which has created potential for CO2 reduction

Major technologies Implemented	GHG Emission Reduction potential (Tonnes per year)
7m tall Coke Oven Battery with Coke Plant Automation and Process Control System and CDCP with 4 MW Power generation)	3,54,000
14 MW Top Pressure Recovery Turbine at BF-8	3,42,345
BF Stove Waste heat recovery	81,019
Increase in Coal Dust Injection in Blast Furnaces	12,12,527
Sinter cooler Waste heat recovery	87,050
BOF gas Recovery with gas holder	6,04,800
100% Gas use in new PBS-II	3,54,000
Energy efficient twin-shaft kiln at RMP-III	50000
Walking beam furnaces in New Rolling Mills (BRM & URM)	50,000
Estimated Energy & CO_2 Emission Reduction Potential	**34,35,741**

BSP

Phase-1 Decarbonisation till 2030: Enablers for Reducing CO_2 Emissions

1 Coke Rate & CDI

0.5 tonne CO_2 reductions for 1:1 substitution of coke with CDI Coal

2 Energy Efficient Lighting & Renewable Energy

1 KWh energy savings reduces **~0.89 kg of CO_2**.

3 Improvement in Prepared Burden

3.25 MT CO_2 savings through 25% pellet & 60% sinter in BF feed

4 Promotion of Circular Economy

0.3/0.42 t CO2 savings by BOF slag use in cement making/ liming agent in agriculture

5 Enhancing Scrap Use & BOF Gas Recovery

- 1% increase of scrap use saves **0.76 MT CO_2**.
- 100 Nm^3/tcs gas recovery.saves **80 kg/tcs CO_2 savings**

6 Internal Carbon Pricing

- Influence future climate change costs.
- SAIL ICP – **18 USD/t of CO_2**

Phase-I de-carbonization to achieve 2.3 T T/TCS emissions by 2030

S.no	BSP's Strategy	Projects implemented/under implementation	Time period	Expected CO2 emission reduction /Ton of Crude steel
1	Gradual phasing-out of the old technologies in steel making & adoption of state of the art technologies during expansion/modernization of the plant.	• BSP has recently completed its ambitious Modernization & Expansion plan from 4.0 MTPA to 7.0 MT PA Crude steel where-in state of the art technologies have been implemented resulting increase in energy efficiency & reduction in CO2 emissions • SMS-1, BBM, BF-2,3 phased-out and BF-1 to be phased-out in 2022-23	Completed	Achieved a CO2 emission of 2.64 T/TCS in 2021-22 from 2.68 In 2020-21 and 2.81 in 2018-19
2	Improve Raw material quality & optimization to improve techno economics	• Achieve Coke rate of 380 Kg/THM. • Installation of new ore beneficiation units in Mines area • Installation of Pelletization plant of 1 MTPA at Dalli-Rajhara • Increasing the sinter in BF & pellet burden in BFs.	2024-25	0.21-0.25 T/TCS

S.no	BSP's Strategy	Projects implemented/under implementation	Time period	Expected CO2 emission reduction /Ton of Crude steel
3	Recovery & optimal use of By-product gases	• Maximum Recovery of BOF gas through installation of Gas holders • Use of excess by-product gases for making alternative fuels like bio-ethanol • Use of excess by-product gases in making power & steam through installation of high efficiency CCGT • Installation of energy efficient walking beam furnaces in RSM & Plate Mill • TRT in BF-7	Completed Under study -do- By 2024-25	0.15 T/TCS
4	Electrical energy conservation & use of renewable sources of energy	• Replacement of 6,300 Motors through VVVF drives &Use of LEDs for all lighting purposes in Plant & Township • Installation of 15 MW floating type Solar plant & 3 MW roof top solar plant	2025-26	0.1-0.15 T/TCS

BSP

Phase- II Decarbonisation till 2035: Enablers for Reducing CO_2 Emissions

1

Next phase of expansion

Phasing-out old batteries & Blast Furnaces.

2

Carbon capture & use technologies

3

Improvement in Prepared Burden

3.25 MT CO_2 savings through 25% pellet & 60% sinter in BF feed

4

Promotion of Circular Economy

0.3/0.42 t CO2 savings by BOF slag use in cement making/ liming agent in agriculture

Phase-II De-carbonization to achieve 2.0 T/TCS by 2035

BSP

S.no	Strategy	• Projects	CO2 reduction
1	Adoption of carbon capture in all the future expansion schemes wherever possible	• Capture of CO2 from BF flue gases • Capture of CO2 from Power Plant flue gases	Will reduce Co2 emissions by 0 3 T/TCS
2	Technology Landscaping in future expansion	• Coke Dry Cooling Plants for stamp charge Coke Ovens of 1 MTPA capacity • Higher volume Blast Furnaces with TRT of 5580 m3 with WHR from stoves and Torpedo ladles for hot metal transport • WHR from Sinter Coolers • BOF Gas recovery from all converters. • Alternative routes of Iron making like Midrex/Finex Introduction of Thin Slab Casting & Direct Rolling • Energy efficient reheating furnaces, burner systems	
3	Installation of efficient Boilers in place of existing Boilers at PBS-1 & PP-2	• replacement of boilers in PP-1 and PP-2 with CCGT (Combined Cycle Gas Turbine) process	

Phase-III De-carbonization to achieve Net Zero emissions by 2070

- **Gradual Implementation of Zero emission Hydrogen fuel based advanced technologies & technologies for Sequestration or capture of carbon , high capacity compact renewable energy technologies which are under development stage, post 2035 to achieve the target of Net Zero Emissions**

Way forward for Deep Decarbonisation – Plausible Initiatives from SAIL

- Phased Replacement of CDI with Hydrogen.
- Top-gas recycling
- Low Temperature heat conservation.
- H2-DRI followed by EAF powered by Green Energy.
- CCUS in coal bed methane. Talks initiated with NEERI and National Geophysical Research Institute.

Phase-III de-carbonization to achieve Net Zero emissions by 2070

BSP

Technologies under development:

Developer	Technology	Remarks
JV of Swedish companies SSAB, Luossavaara-Kiirunavaara Aktiebolag (LKAB), and Vattenfall	Hydrogen Breakthrough Ironmaking Technology (HYBRIT) for 100 per cent fossil-free steelmaking	Commercially available by 2035
Voestalpine, in partnership with Siemens and VERBUND	H_2-DRI with 6 MW of electrolyser capacity	Reduce emissions by 30% by 2035 and over 80% by 2050.
Celsa, Norway in association with Nel Hydrogen Electrolyser and Statkraft	Hydrogen production through 40-50 MW of alkaline electrolysers	Electrolyser project expected to be operational by 2023.
HBIS Group (China) in association with Tenova	600,000 Tpa H_2-DRI plant using ENERGIRON technology	Carbon footprint= 250 kg of CO_2/T of DRI
ArcelorMittal (Sestao plant, Spain)	1.6 MTPA H_2-DRI plant	To be operational by 2025.

Year: 2019-20

Type of Waste	Generation	Utilisation					Utilisation (%)
		Recycled/ Reused	Purpose	Sold	Purpose	Total	
BF Slag (Unprocessed)	177479	0		53348	Slag wool Manufacturers	53348	30.1
BF Slag (Processed)	1825480	0		1825480	Cement manufacturers	1825480	100.0
BF Slag, Total	2002959	0		1878828		1878828	93.8
BF Flue Dust	47697	0		62775	Cement manufacturers	62775	131.6
LD Slag	376068.23	246397.81	Internal recycling	0		246397.81	65.5
LD Sludge	17989	0		11017		11017	61.2
Other sludges (SP, BF & THF)	73097	0		0	Cement manufacturers	0	0.0
Sinter dust	73884	73884		0		73884.32	100.0
Lime/ Dolo Fines/RMP arisings	218130	218130	In sinter making	0		218130	100.0
Mill Scale	112179	112179	In sinter making	0	RSM mill scale used by Railway to use in welding purpose	112179	100.0
Cinder & Cinder Sludge	3185	3185		0	Pallet manufacturers	3185	100.0
Used/Rejected Refractory Bricks	13674	10231	Used in different shops	1533	Refractory manufacturers	11764	86.0
THF Slag	51067	7757.59	Land fill in low lying area	0		7757.59	15.2
Fly Ash	27672	27672		0		27672	100.0
Total	3017602.19	699436.72	0	1954153	0	2653589.72	87.9

Year: 2020-21

Type of Waste	Generation	Utilisation					Utilisation (%)
		Recycled/ Reused	Purpose	Sold	Purpose	Total	
BF Slag (Unprocessed)	224968	0		97774.02	Slag wool Manufacturers	97774.02	43.5
BF Slag (Processed)	1749019	0		1749019	Cement manufacturers	1749019	100.0
BF Slag, Total	1973987	0		1846793.02		1846793.02	93.6
BF Flue Dust	57826.46	0		54401.27	Cement manufacturers	54401.27	94.1
LD Slag	476171.6565	235280.31	Internal recycling	0		235280.31	49.4
LD Sludge	21219	0		37635.17		37635.17	177.4
Other sludges (SP, BF & THF)	62849	0		0	Cement manufacturers	0	0.0
Sinter dust	68684	68684		0		68683.94	100.0
Lime/ Dolo Fines/RMP arisings	295028	295028	In sinter making	0		295028	100.0
Mill Scale	85445	85445	In sinter making	0	RSM mill scale used by Railway to use in welding purpose	85445	100.0
Cinder & Cinder Sludge	4436.59	4436.59		0	Pallet manufacturers	4436.59	100.0
Used/Rejected Refractory Bricks	8131.06	6267	Used in different shops	399.6	Refractory manufacturers	6666.6	82.0
THF Slag	0	18497.13	Land fill in low lying area	0		18497.13	
Fly Ash	17257	17257		0		17257	100.0
Total	3071034.356	730894.97	0	1939229.06	0	2670124.03	86.9

Year: 2021-22

Type of Waste	Generation	Utilisation					Utilisation (%)
		Recycled/ Reused	Purpose	Sold	Purpose	Total	
BF Slag (Unprocessed)	253278	0		60103.17	Slag wool Manufacturers	60103.17	23.7
BF Slag (Processed)	2177539	0		2177539	Cement manufacturers	2177539	100.0
BF Slag, Total	2430817	0		2237642.17		2237642.17	92.1
BF Flue Dust	47671.25	0		96703.32	Cement manufacturers	96703.32	202.9
LD Slag	522167.95	222294.2	Internal recycling	38441.3		260735.5	49.9
LD Sludge	24377	0		59402.66		59402.66	243.7
Other sludges (SP, BF & THF)	73853	0		0	Cement manufacturers	0	0.0
Sinter dust	78937	78937		0		78936.69	100.0
Lime/ Dolo Fines/RMP arisings	372323	372323	In sinter making	0		372323	100.0
Mill Scale	108601	108601	In sinter making	0	RSM mill scale used by Railway to use in welding purpose	108601	100.0
Cinder & Cinder Sludge	1243.59	1243.59		0	Pallet manufacturers	1243.59	100.0
Used/Rejected Refractory Bricks	18878.72	7764.5	Used in different shops	7484.22	Refractory manufacturers	15248.72	80.8
THF Slag	0	25980.39	Land fill in low lying area	0		25980.39	#DIV/0!
Fly Ash	5175	5175		0		5175	100.0
Total	3684044.125	822318.37	0	2439673.67	0	3261992.04	88.5