PRESENTATION
on

ROAD MAP TO ACHIEVE BENCHMARKING IN SPECIFIC ENERGY CONSUMPTION AT RINL

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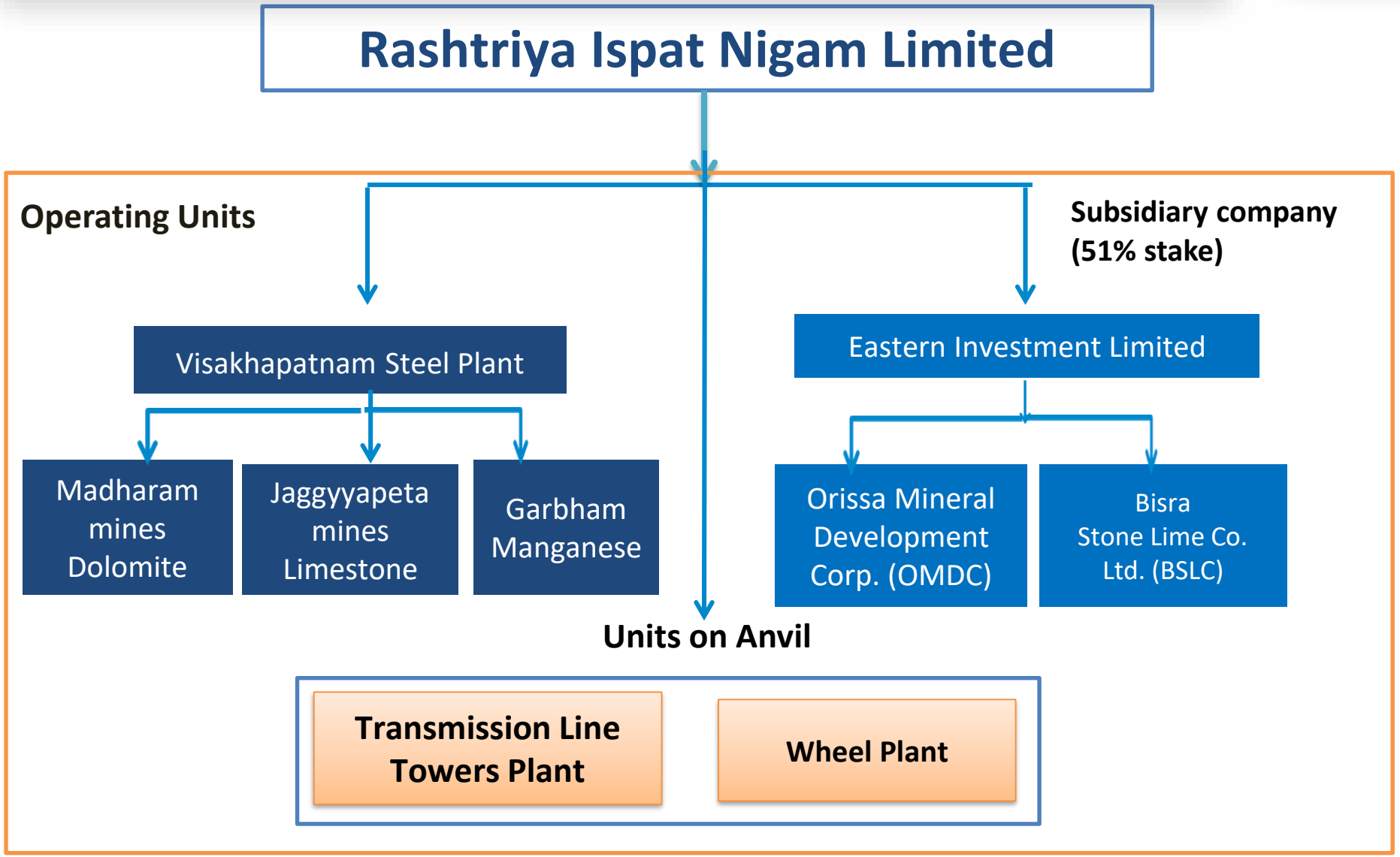
Rashtriya Ispat Nigam Limited
VISAKHAPATNAM STEEL PLANT

CONTENTS

RINL Corporate Structure



RINL – Snapshot

Unit: Rs. Crs

Turnover (2016-17)	12,707
Net worth as on 31/03/16	9873

* 100% owned by Govt. of India

RINL - Snapshot

The 1st ISP to be certified for Quality, Health & Safety and Environment

1st steel Plant to get ISO 50001 certification for Energy Management

CMMI Level 3 certification for IT Systems

1st ISP to be 5S Certified for the whole plant

ISO 9001:2008 CERTIFIED

OCCUPATIONAL HEALTH & SAFETY OHSAS 18001

ENVIRONMENTAL MANAGEMENT SYSTEM ISO 14001

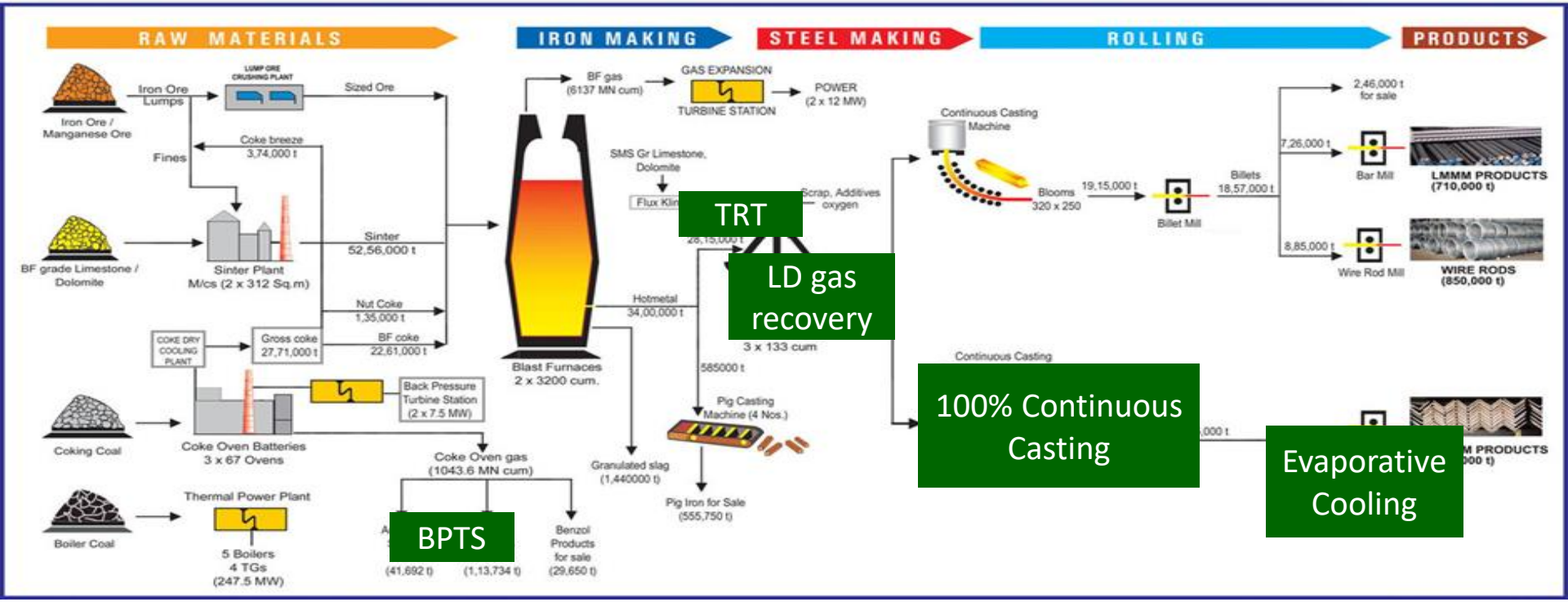
ISO 50001 ENERGY MANAGEMENT

TRANSPARENCY INTERNATIONAL

CMMI LEVEL 3

5S

Production Process flow at RINL



CO Battery with Coke Dry Quenching and Back Pressure Turbine Station

3200 cum BF with Top Recovery Turbine and BF gas recovery

Rolling Mills with Stelmor & Tempcore (TMT) processes equipped with evaporative cooling for waste heat utilization

RINL's Growth Plan

RINL's growth strategy for enhancement of capacity through a combination of brown field expansion and modernization in phases:

- **6.3 Mtpa expansion**
  - ✓ **Completed in 2015 and under stabilization**
  - ✓ **Invested Rs. 12,291 Cr (80% met through internal accruals)**
- **Upgradation & Modernization**
  - ✓ **Underway to enhance capacity to 7.3 Mt by 17-18**
  - ✓ **With an investment of Rs. 4,000 Crs.**
- **Vision envisages growth to 20 Mtpa by 2032-33 in phases**

Energy Consumption Variables

- Process route (BF-BOF Vs EAF),
- State of Technology
- Quality of Raw materials(Ash content of Coal and Coke, Coke Strength after Reaction(CSR), Alumina in Iron ore and Sinter, Silicon in Hot Metal
- Level of Energy conservation Technology(Waste heat recovery(Coke Dry Quenching, Sinter Heat recovery,BF Stoves WHR, Reheating Furnaces Heat recovery)
- Process management(Coke rate at BF, Coke Breeze at SP, Hot Metal Rate at SMS)
- Energy mix(Less power import)
- Scale of operation
- Energy Efficiency in the generation of utilities(Power Generation efficiency)

Specific Energy Consumption of Indian Steel Industry

Parameter	Unit(GCal/tCS)
Indian Steel Industry	5.70-7.0
Japanese/Korean Steel Industry	4.5-5.5
IISI Reference Plant	4.5

Normalization of Specific Energy Consumption

Hot Metal Usage in Steel Making.

Parameter	Unit	Indian steel industry	IISI reference plant	POSCO
SEC	Gcal/tcs	6.80	4.5	5.4
Hot Metal Rate	Kg/tcs	1060	880	883
Difference in Hot Metal Rate	Kg/tcs		180	177
Impact on energy Consumption	Mcal/tcs		810	796.5
Normalized Specific Energy Consumption	Gcal/tcs	5.99		

Generation Efficiency of Utilities

Low capacity Power Plants(30 MW units, 60 MW units

Usage of By product gases-High flue gas generation,High flue gas temperature

Parameter	Unit	Indian Steel Industry	International
Power Generation efficiency	%	<30	38-40%
Power Consumption in Oxygen Plants	Kwh/thcum	800	600

Energy Consumption by Process Route

- **Integrated Steel Plants are tested and comprehensive, energy intensive as they process virigin raw material**
- **Electric Arc Furnace/Induction furnace route process steel scrap. No up stream energy.**
- **Energy requirements are only for melting and casting and rolling. Energy Consumption are low in EAF route**

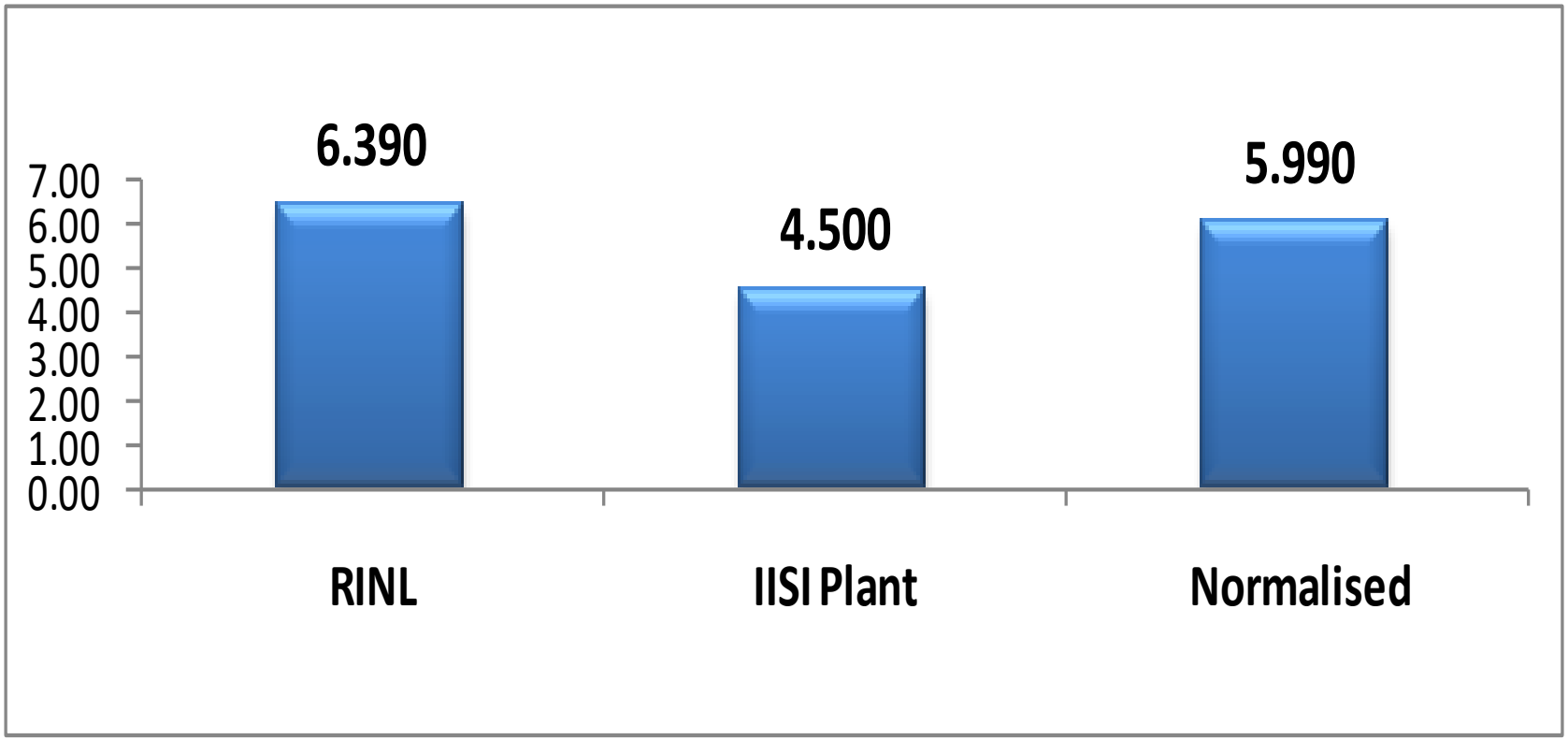
Parameter	Unit	BF-BOF Route	EAF Route
SEC	Gcal/tCS	6.8	4

Energy Consumption by Alternative Iron Making Routes

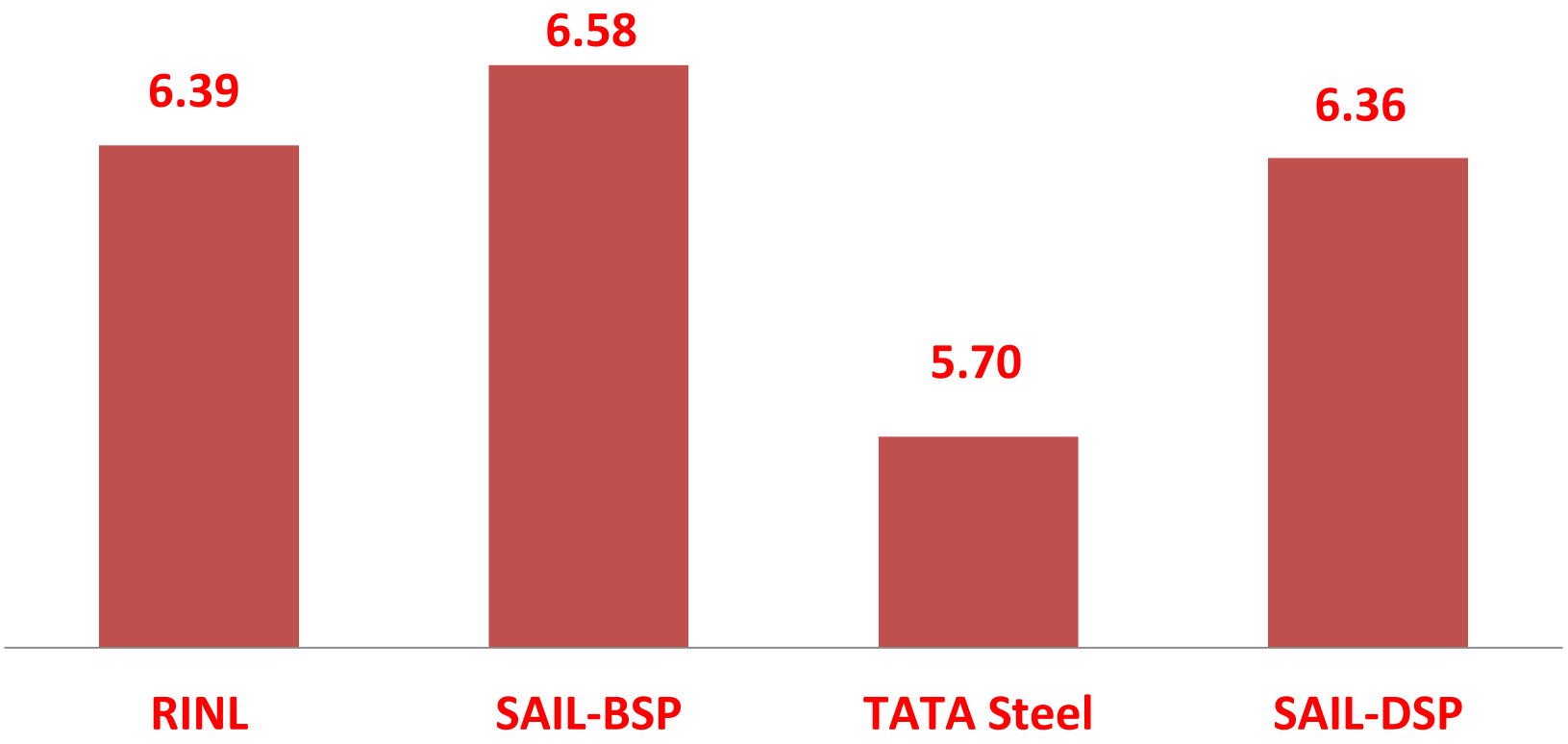
- Producing Iron other than BF route(Coke Ovens,Sinter and BF)
- FINEX Route, COREX Process, Midrex Process
- Avoid Coke Ovens, Sintering
- Using fines

Parameter	Unit	BF-BOF Route	Altrenative Iron Making Route(Corex)
Coke Making	Gcal/tCS	0.802	5.194
Sinter Making	Gcal/tCS	0.660	
Iron Making	Gcal/tCS	3.200	
Total	Gcal/tCS	4.662	5.194

International Bench Marking of SEC(Gcal/tCS)



Benchmarking of Energy Consumption-Gcal/tCS



Bench Marking with Nippon Steel(2009-10)

Energy(2009-10)		GHG Emission		Gap :0.661 Gcal/tCS
RINL	NSC	RINL	NSC	1) Scrap usage : 200 kg/thm(As per Japanese Industry)-RINL:80 kg/tcS 2) All Energy Conservation technologies Coke Dry Quenching, Top Pressure Recovery Turbine, BOF Gas Recovery, Sinter Cooler waste heat recovery Pulverized Coal Injection, BF stoves Heat Recovery, Billet Caster, Hot Charging, Regenerative Burners, Coal Moisture Control Sensible Heat recovery from BOF gas 3) Waste Plastics Injection and tires(0.2 million tons-6 kg/tCS) 4) Petro fuel 16 lts/Tcs
6.06	5.439	2.615	1.943	

Process Bench Marking-Energy Consumption Shop Wise

SL No	Unit	RINL 2016-17	IISI reference Plant	Remarks
CO	Mcal/tc	1607	1233	Coal Moisture Control System, High Efficiency Coke Dry Quenching, Computerized Combustion Control System
SP	Mcal/tGs	563	407.6	Sinter Heat Recovery System Energy Efficient Burners Exhauster Heat Recovery System
BF	Mcal/tHM	3491	2978	Stoves Waste Heat Recovery High Top Pressure Pulverized Coal Injection Top Gas Recovery High performance Blast Furnace
SMS	Mcal/tCS	241	86	LD Gas Recovery Recuperative Burners Concast
Rolling Mills	Mcal/tCS	757	767	High performance reheating furnaces. Regernerative Burners, Direct/Hot charging
Others	Mcal/tCS	327	126	

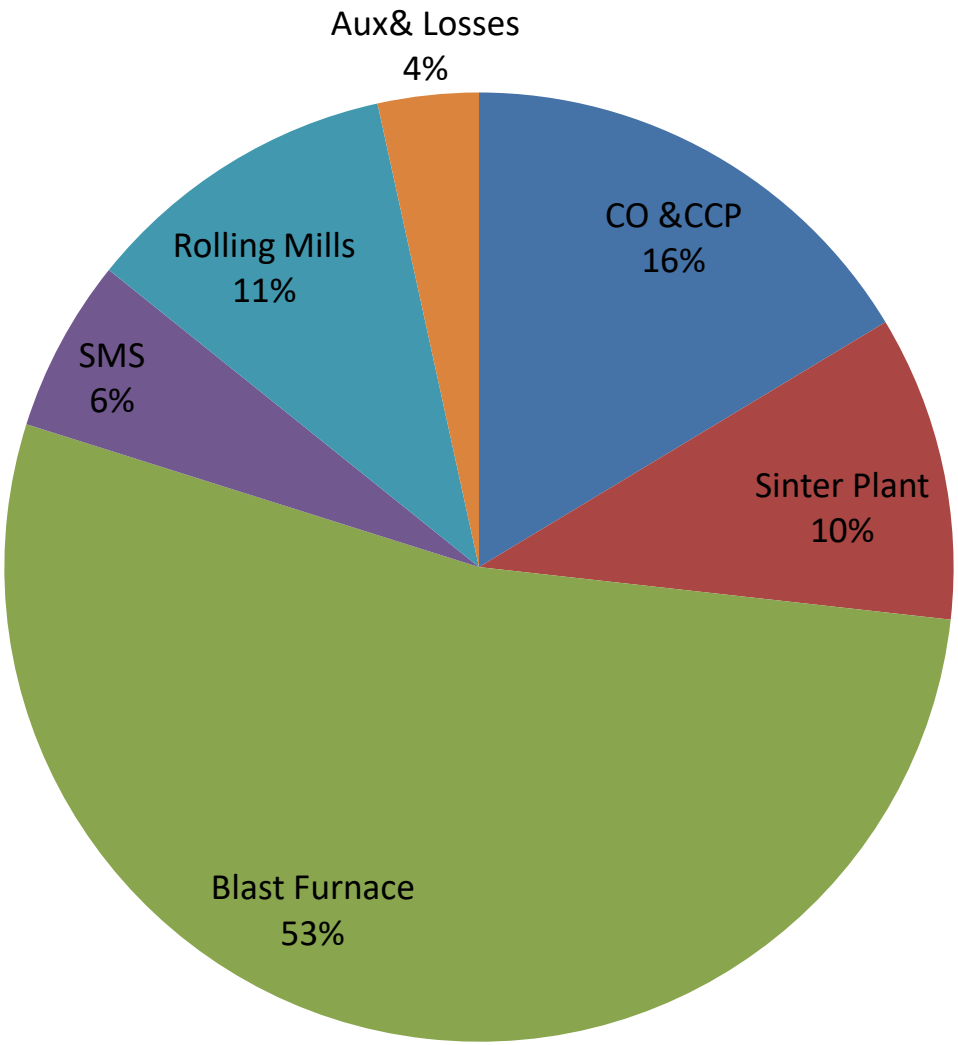
Technology Deployment

Dept	Energy Conservation Options	Identified	Remarks
CO	Coke Dry Quenching	Yes	
	Coal Moisture Control	No	Non feasible due to High capital cost,high moisture for short duration
	Computerised Combustion Control System	No	High capital cost
SP	Sinter Heat Recovery	Yes	
	Energy Efficient Burners	Yes	
	Exhaust Heat recovery	No	High capital cost
BF	Stoves WHR	Yes (one BF)	Layout constraints for other BFs
	PCI	Yes	
	TRT	Yes	
SMS	LD Gas Recovery	Yes	
	LD Gas Sensible Heat recovery	No	High capital cost
	Recuperative Burner	Yes (installed in SMS-2)	
	Continuous caste	Yes	Bloomed casting installed in SMS-1 and Billet casting installed in SMS-2.

Technology Deployment

Dept	Energy Conservation Options	Identified	Remarks
Rolling Mills	High Performance Furnace	No	
	Regenerative Burner	No	Long shutdown required High capital cost
Calcination Plant	Waste heat recovery	Yes	Vertical shaft kilns
Power generation	Direct/Hot Charging Combined cycle gas turbine (CCGT)	Yes (partially) No	High capital cost. However RINL installed 120MW BF gas based power plant to utilize surplus BF gas.

Specific Energy Consumption-



Bench Marking of BF Energy Consumption

Comparison of BF Energy Consumption			
Parameters	Unit	RINL (BF-3)	POSCO
Specific Energy Consumption	Gcal/t	3396	2978
BF Productivity	T/D/CUM	2.05	2.75
Fuel Rate	KG/THM	535	489
Coke Rate	Kg/tHM	493	321
PCI Rate	Kg/tHM	42	168
Coke -Ash Content	%	13.97	11.72
Carbon Rate	Kg/tHM	456	414
Hot Blast Temp	DegC	992	1159
Top pressure	Kg/cm2	2.0	2.61
Si in HM	%	0.50	0.25
CSR-Coke	%	65.3	69.8
Al2o3 in Sinter	%	2.06	1.52
BF Slag Rate	Kg/tHM	324	277
Oxygen enrichment	%	1.98	4.02

Adoption of Green Technologies

Name of Technology	Features	Energy Savings(TOE)	GHG redn(tCo2)
Coke Dry Quenching Plant	Power gen: 2X7.5MW	115285	689586
Top Pressure Recovery Turbine	Power gen; 2x12 MW	21257	127152
LD Gas Recovery System	80000 Cum	58022	347060
Evaporative Cooling System	13 ata steam: 19 t/hr	12173	72814
Preheating of combustion air at CRMP	Air preheating: 250degc	3469	21062
Gas and air recuperators in ROLLING MILLS	Air : 450 degC Gas:250 degC	16105	57088
Reducing GHG emission by about 13 lakh tons annually			

Energy Conservation Technologies in Expansion and Modernization

NAME OF THE PROJECT	ENERGY SAVINGS (GCALS)	GHG EMISSION REDUCTION (tCo2)
PCI IN BLAST FURNACES	1518750	910164
POWER GEN FROM COOLING OF COKE in Batt-4	207384	124282
ENERGY EFFICIENT BURNERS AND WHR IN SP-2.	73349	89294
20.6 MW WHR ON SINTER STRAIGHT-LINE COOLER	368130	220612
BF-3 STOVES WASTE HEAT RECOVERY.	149008	43958
BILLET CASTER IN SMS-2	1807185	1083030
ENERGY EFFICIENT VERTICAL SHAFT KILN	141000	51912
ENERGY EFFICIENT AIR SEPARATION UNIT	61939	23227
SINTER PLANT 1&2 CAPACITY ENHANCEMENT	279125	167475
BF-1 &2 MODERNISATION & UPGRADATION	652800	391200
	5196731	3081927

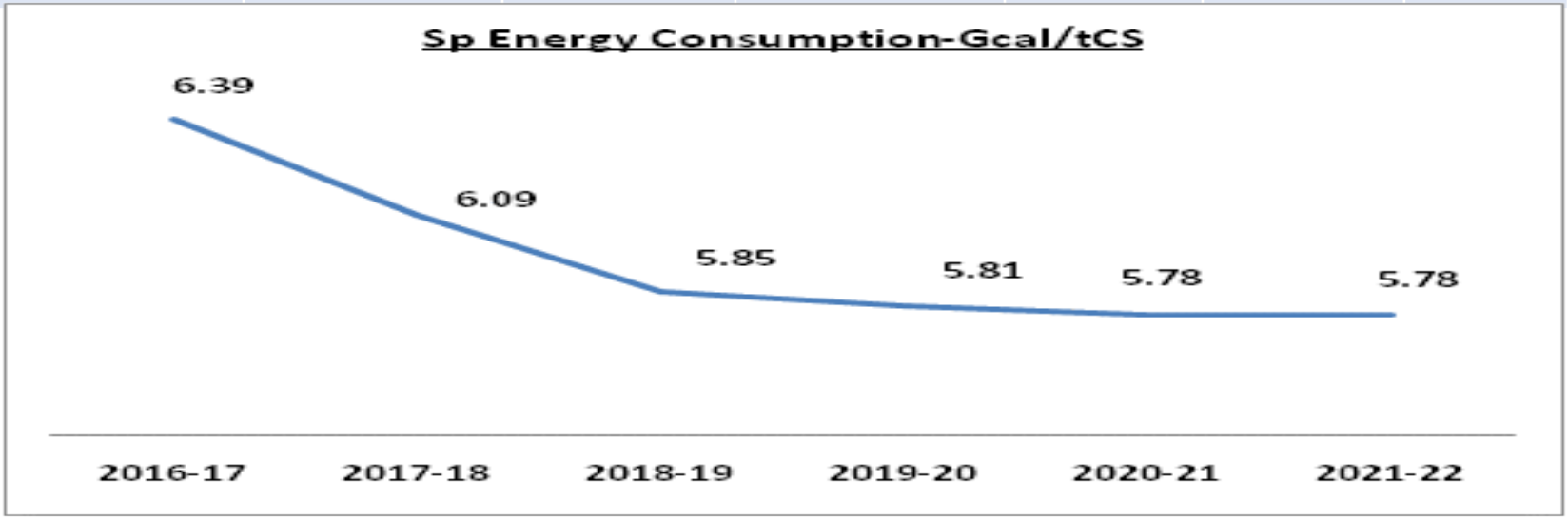
Roadmap for Sp. Energy Consumption (Gcals/tCS) & CO2 emissions(tCo2/tCS)

	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
SEC Gcal/tCS	6.37	6.40	6.39	6.09	5.85	5.78
GHG Emission tCo2/tCS	2.79	2.787	2.785	2.60	2.5	2.3

4.5~5.5

1.8-2.2

International BM



Energy Management System ISO:50001

- **Features:**

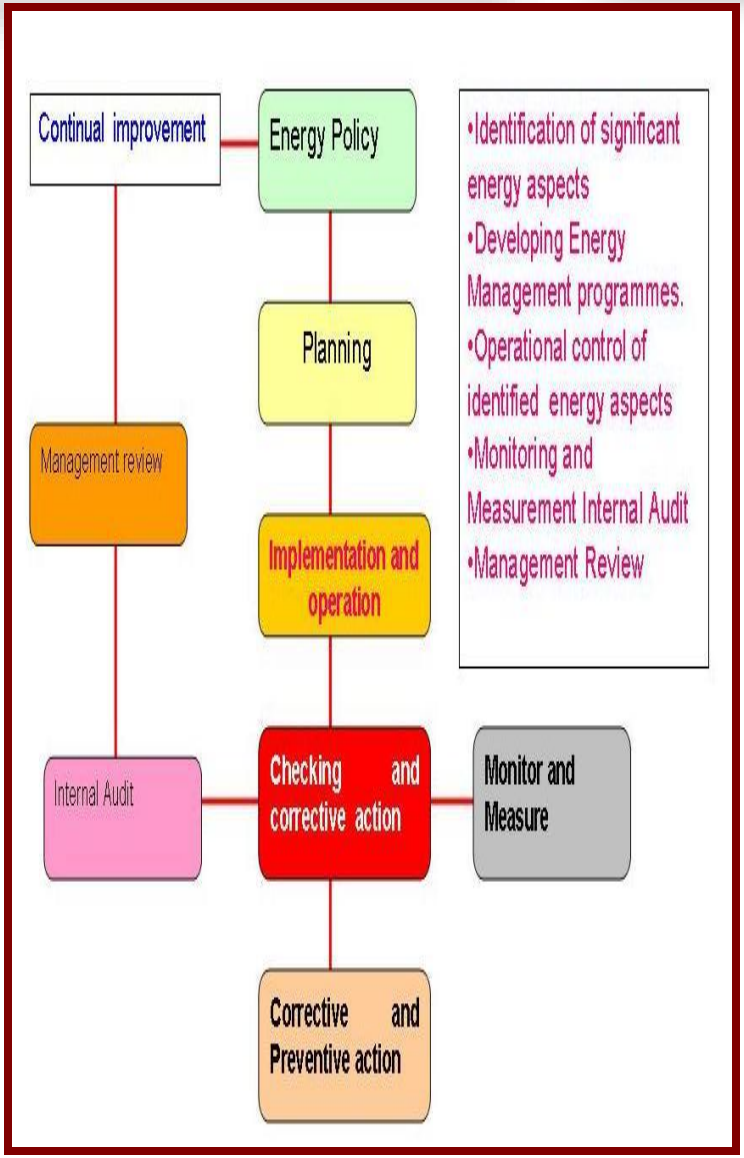
- ❑ **Identification of significant energy aspects**
- ❑ **Developing Energy Management programmes.**
- ❑ **Operational control of identified energy aspects**
- ❑ **Monitoring and Measurement**
- ❑ **Internal Audit**
- ❑ **Management Review**

RINL implemented BS EN: 16001 Energy Management systems at VSP work division and certified in Dec, 2010.

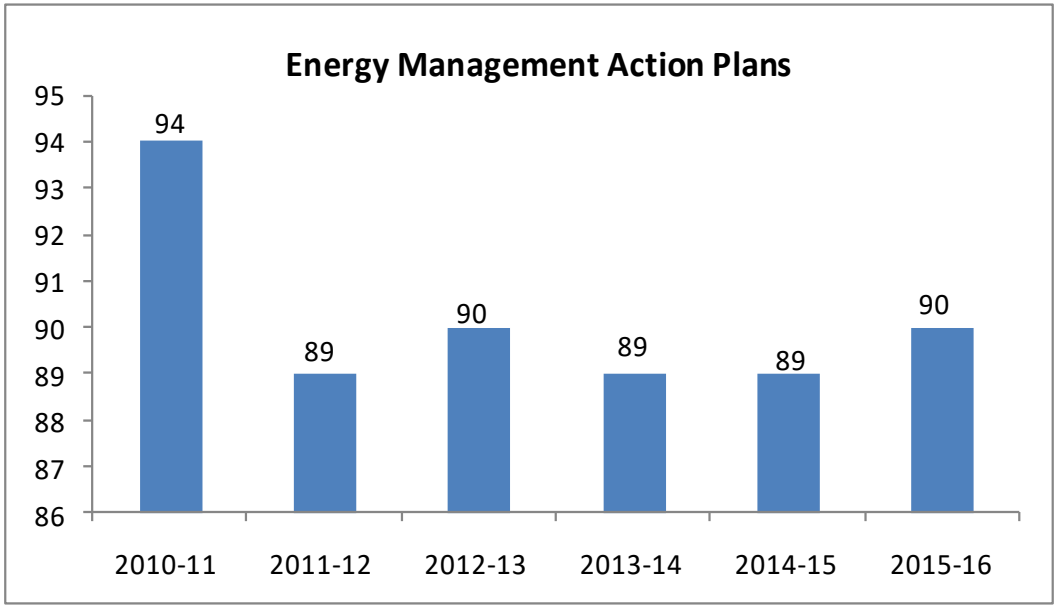
First PSU & Integrated Steel Plant to be certified for BS EN: 16001 energy management system

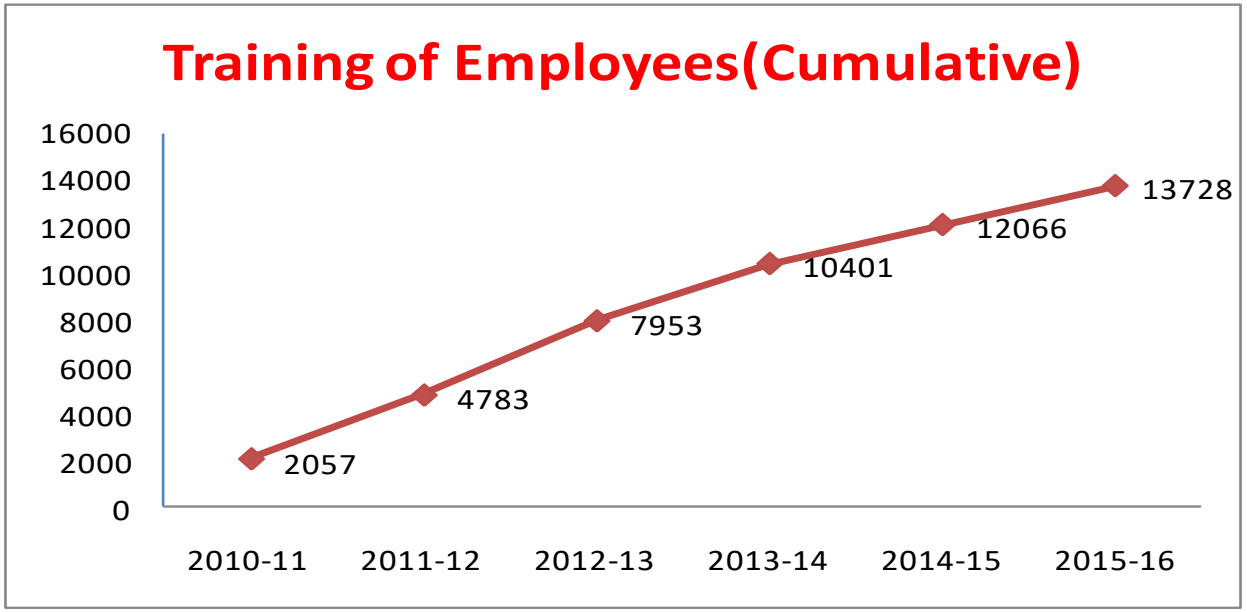
Certified for ISO: 50001 in Aug'12

Completed 2nd recertification in Dec'16



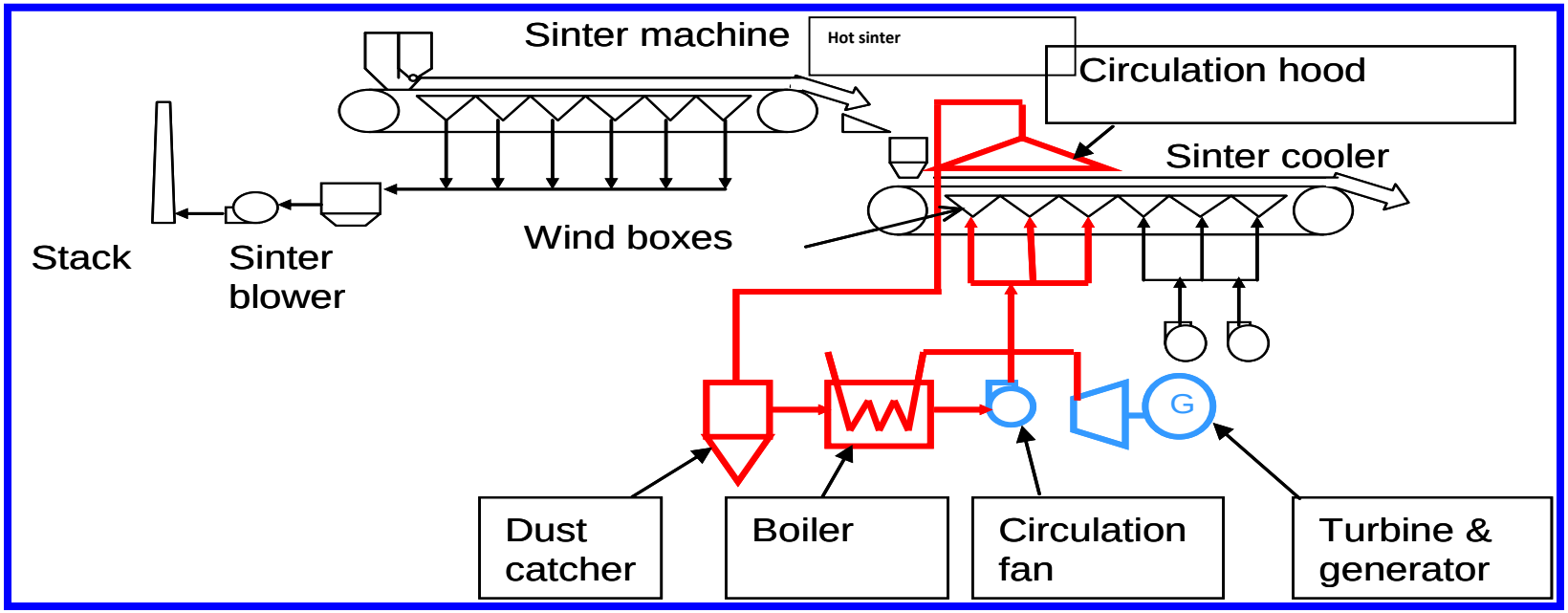
Energy Management System





International Cooperation

Installation of 20.6MW waste heat recovery power plant at straight line cooler of Sinter plant-1 under green aid plan by NEDO, Japan



CDM Projects

No of Projects Registered(BF3 TRT,COB4 , BF3 WHR, BF gas based CPP-2)	4
Verification completed (COB4)*	1

* UNFCCC issued 70,516 CER to RINL

Renewable Energy Utilization

RINL commissioned 5 MW Solar Power Plant
Investment: Rs 36 cr

Installing 1MW Roof Top Solar Power Plant at various Building

Thank you

राष्ट्रीय इस्पात निगम लिमिटेड

RASHTRIYA ISPAT NIGAM LIMITED