

# **Overview of Energy Efficiency Trend in Industry Sector ( Iron & Steel )**

# Sectoral Energy Consumption v/s Contribution to the country's GDP

Sector	% Energy Consumption	% Contribution to GDP
Industry	40	27
Agri, AH & Fisheries	7	19
Commercial & Services	43	54
Household & Others	10	-

Source : Energy Conservation Guide, PCRA

## Steel Industry – Highlights

Year	Capacity (‘000 tonnes)	Crude steel Production (‘000 tonnes)	Capacity utilisation (%)
2003-04	43910	38727	88
2004-05	47995	43437	91
2005-06	51171	46460	91
2006-07	56843	50817	89
2007-08	59845	53857	91
2008-09	64400*	54520	85

*Source: JPC \* = 3 million tonne capacity added in December 2008*

**Crude steel production was at 54.52 million tonnes, a growth of 1.23% over last year with capacity utilisation at 85% during the year. It grew at more than 9% annually from 38.72 million tonnes (MT) in 2003-04.**

**The growth was driven by capacity expansion from 43.91 million tonnes per annum (MTPA) in 2003-04 to 64.40 MTPA in 2008-09.**

**The induction furnace route accounted for 33% of total crude steel production during 2008-2009.**

## Steel Industry – Highlights

Crude steel production by Process Route	Percentage share (%)	
	2003-04	2008-09*
Basic Oxygen Furnace (BOF)	57	47
Electric Arc Furnace (EAF)	16	20
Induction Furnace (IF)	27	33
Total	100	100

Source: JPC, \* = Provisional

### World crude steel production

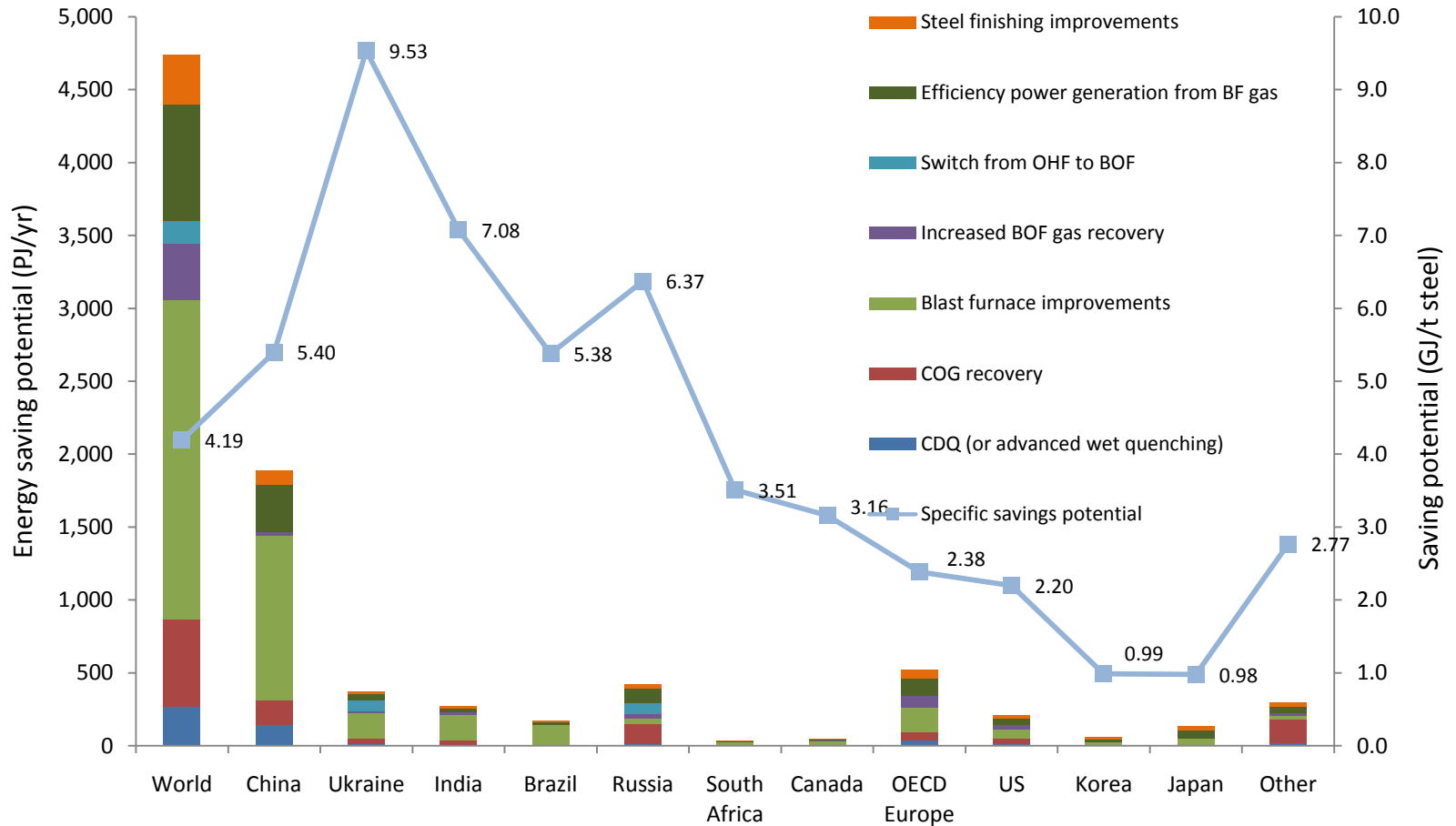
Country	Rank	2008 (in million tonnes)
China	1	502
Japan	2	119
United States	3	92
Russia	4	69
India	5	55
South Korea	6	54
Germany	7	46
Ukraine	8	37
Brazil	9	34
Italy	10	31

Source: World Steel Association

## **Steel Industry – Some Energy Fact File !**

- Major Energy Source** : Coking Coal, Non-Coking Coal, Coke, Electricity
- Energy Demand** : Expected about 28% of total industry by 2030
- Energy Consumption** : About 35.5 MtoE in 2007-8 (Integrated Steel)
- No. of DCs** : 98 as on 2008-09 (with more than 30000 mtoe p.a)
- SEC** : 25.5 – 34.2 GJ/tcs (World Benchmark 16.5 – 18.5 GJ/Ton)
- Major Energy Consuming Area** :
- Coking, Sinter making & Blast Furnace (62%)**
  - Slabbing & Hot Strip Mill (38%)**

# Energy efficiency potential, using best available technology



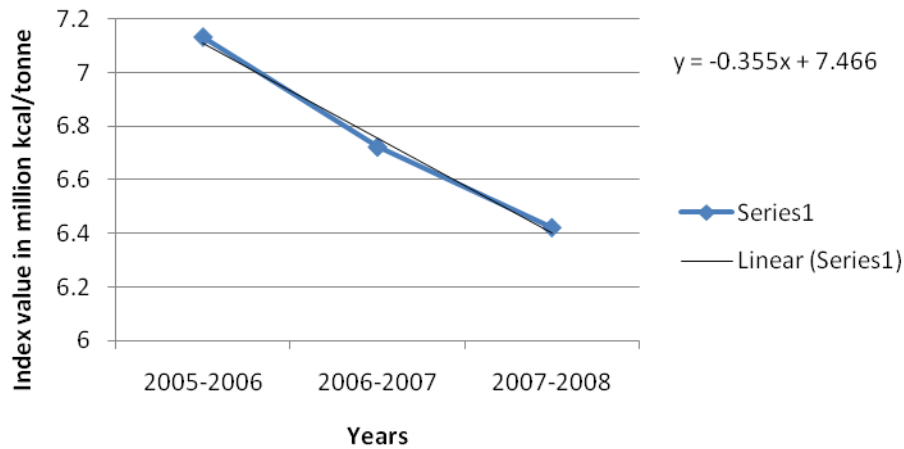
# SEC (GJ/tcs) of Main Steel Producers

<i>Plant</i>	<i>2006-07</i>
Bhilai Steel Plant (BSP)	28.53
Durgapur Steel Plant (DSP)	29.58
Rourkela Steel Plant (RSP)	33.39
Bokaro Steel Plant (BSL)	29.66
IISCO Steel Plant (ISP)	34.26
SAIL (as a whole)	29.95
RINL	27.32
TATA Steel	28.07
JSW Steel	25.52

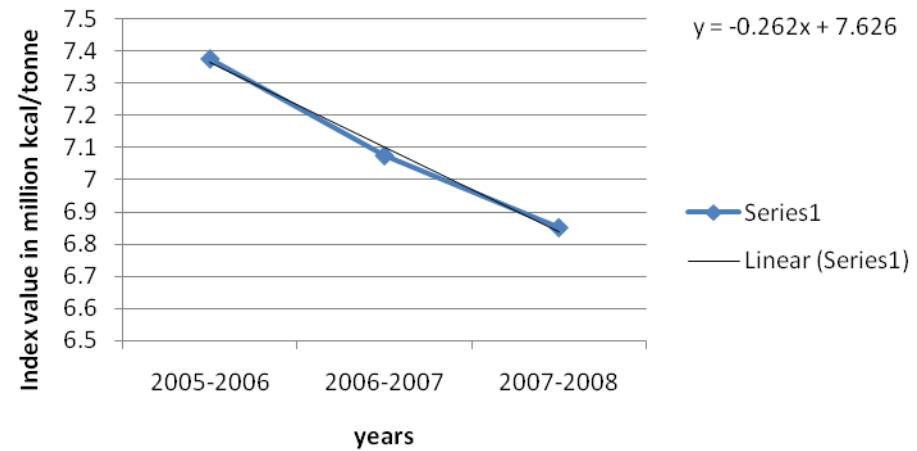
(Source : Annual Report of Ministry of Steel, GoI, 2007-08)

# SPECIFIC ENERGY CONSUMPTION AND ITS TRENDS

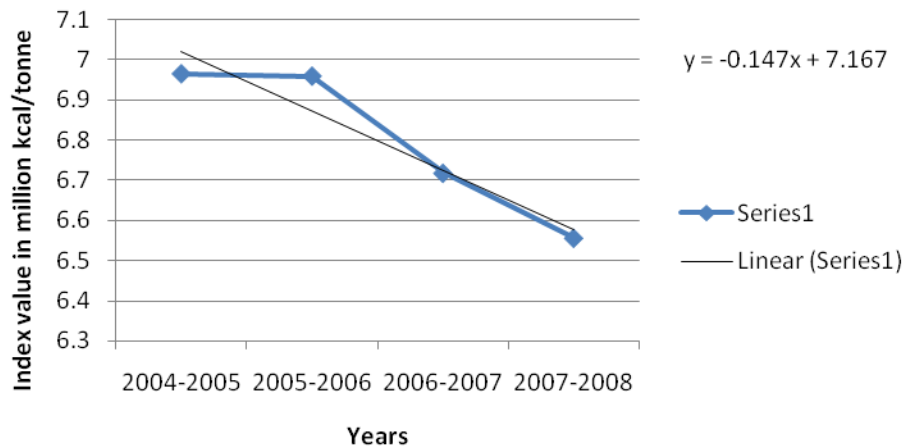
## Jindal Steel & Power Ltd



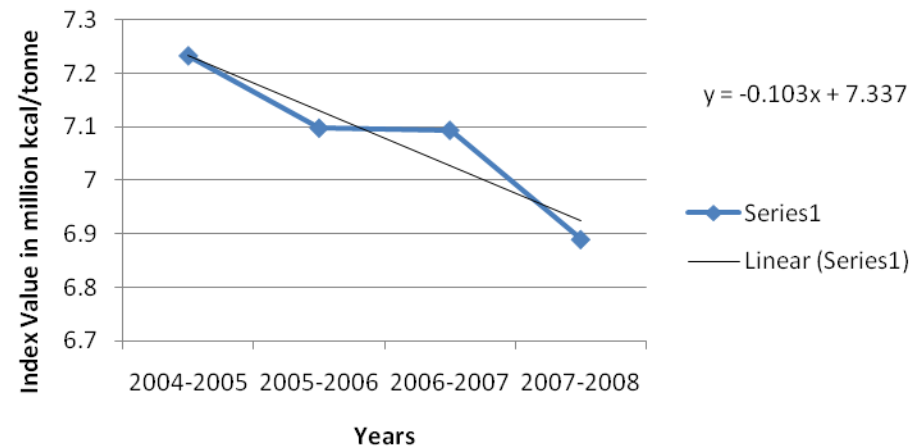
## Durgapur Steel plant



## Tata Steel Ltd, Jamshedpur

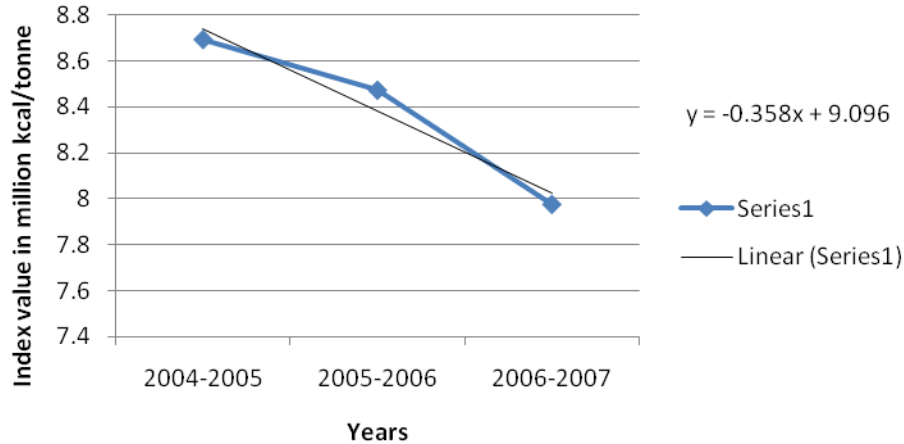


## Bokaro Steel Plant, Jharkhand

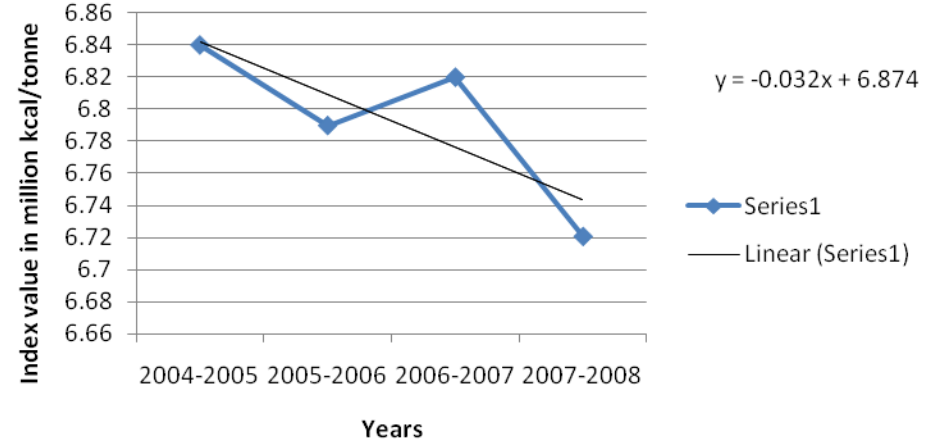


# SPECIFIC ENERGY CONSUMPTION AND ITS TRENDS

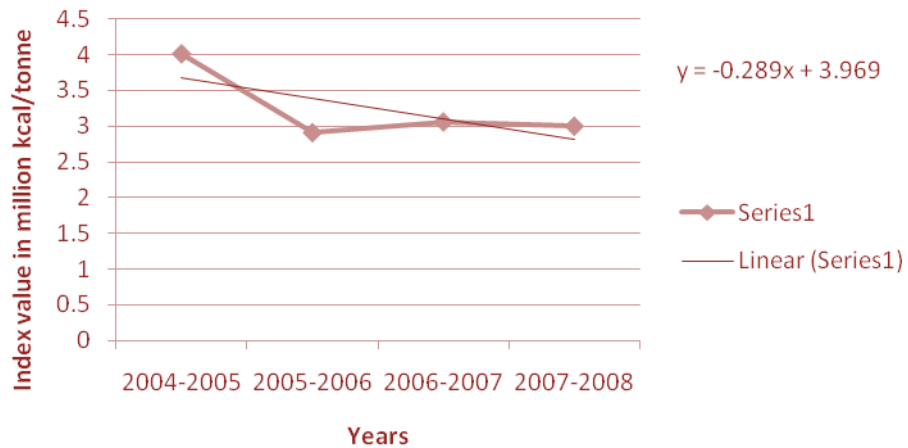
## SAIL, Rourkela



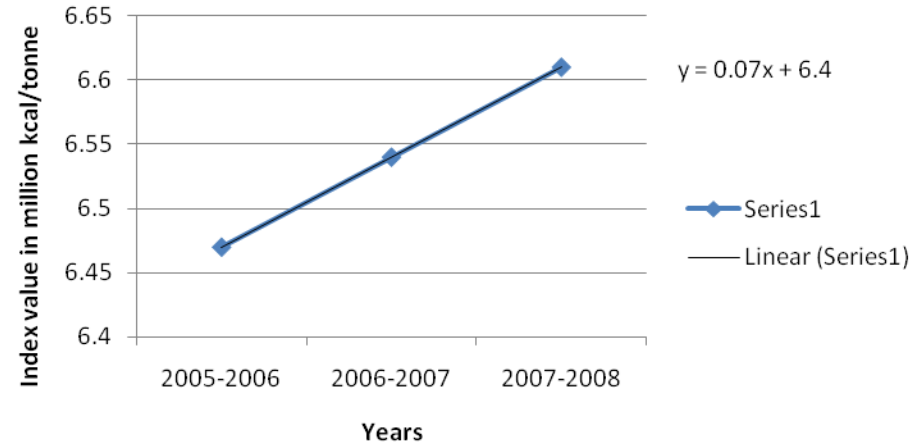
## Bhilai Steel Plant



## Essar Steel Ltd, Hazira



## Rashtriya Ispat Nigam Ltd



# Integrated Steel Plants

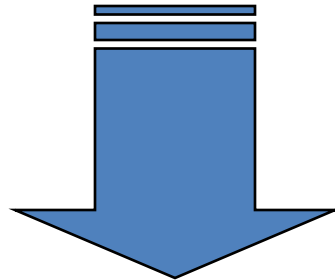
<b>Band Width</b>	<b>Range of SPC (kWh/ton of Crude Steel)</b>	
Upto 2 Million Ton Hot Metal Processing	453 to 580	Based on Last three Years Data (details given below)
Between 2 to 5 Million Ton Hot Metal Processing	418 to 485	
Above 5 Million Ton Hot Metal Processing	400 to 438	

## Steel Plants based on DRI/ EAF Route

<b>Band Width</b>	<b>Coverage (no of Plants Surveyed)</b>	<b>Range of SPC</b>	
1 to 5 Lac TPA	15	500- 534 Kwh/ton	Based on Last three Years Data
Above 5 Lac TPA	8	475- 510 Kwh/ton	Based on Last three Years Data

**Hence, it may be seen that there is a large 'Bandwidth' in SEC in Iron and Steel sector due to one or more factors.**

**[In almost every sector, the most energy efficient unit is also amongst the most efficient units in the world]**

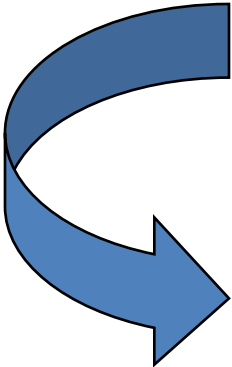


**This implies that the energy efficiency improvement targets would have to be**

**'UNIT SPECIFIC'**

# Challenge before the NMEEE

- In order to achieve the target set for the industry in a sector, the industry has to look for
  - Efficiency improvement in existing plant through retrofit options
  - Introduce best available technology
  - R & M of existing plants
  - Recovery of Waste Energy



**It is quite necessary to overcome the barrier (High Initial Cost) to make the energy efficient technologies as an attractive option.**

**Technology Transfer is quite necessary at an affordable cost and acceptable mechanism.**

# Steel SME Sector

## Steel SME Sector

Steel SME Sector mainly consists of

- Induction furnace units
- Arc furnaces,
- sponge iron units,
- Re-Rolling Mills
- Forging units etc.

# SP. Energy Consumption in SMES

- **Present S.E.C Level in SMEs**
  - I.F Melting M.S : 800 -1000 KWH /T
  - Rolling : 100 -130 KWH/T and 40 - 45 Litres F.O/T
- **Energy saving potential : 10% to 20%**
  - 1 KWH/T Saved = 20000 MWH of electricity per annum (**Rs. 8 Cr p.a**) or 40000 MWH on generation side
  - 1 liter F.O/T Saved = 20000 KL p.a. (**Rs. 80 Cr p.a**)  
Reduction in import bill
- Saving in generation and F.O burning will reduce **GHG** emmission. Earning of **Carbon Credit**.
- **Energy audit** exercise is a '**must-to-do**' for each and every industry to reduce its cost of production.

# Applications of VFD in Re-rolling Mills

- VFD can be very helpful in the following applications for better control and saving of electrical energy
  - Reheating furnace blowers
  - Mill and TMT water pumps
  - Cooling tower fans

# Case Study – Energy Audit (Elect. Power Saving in Reheating Furnace Blower)

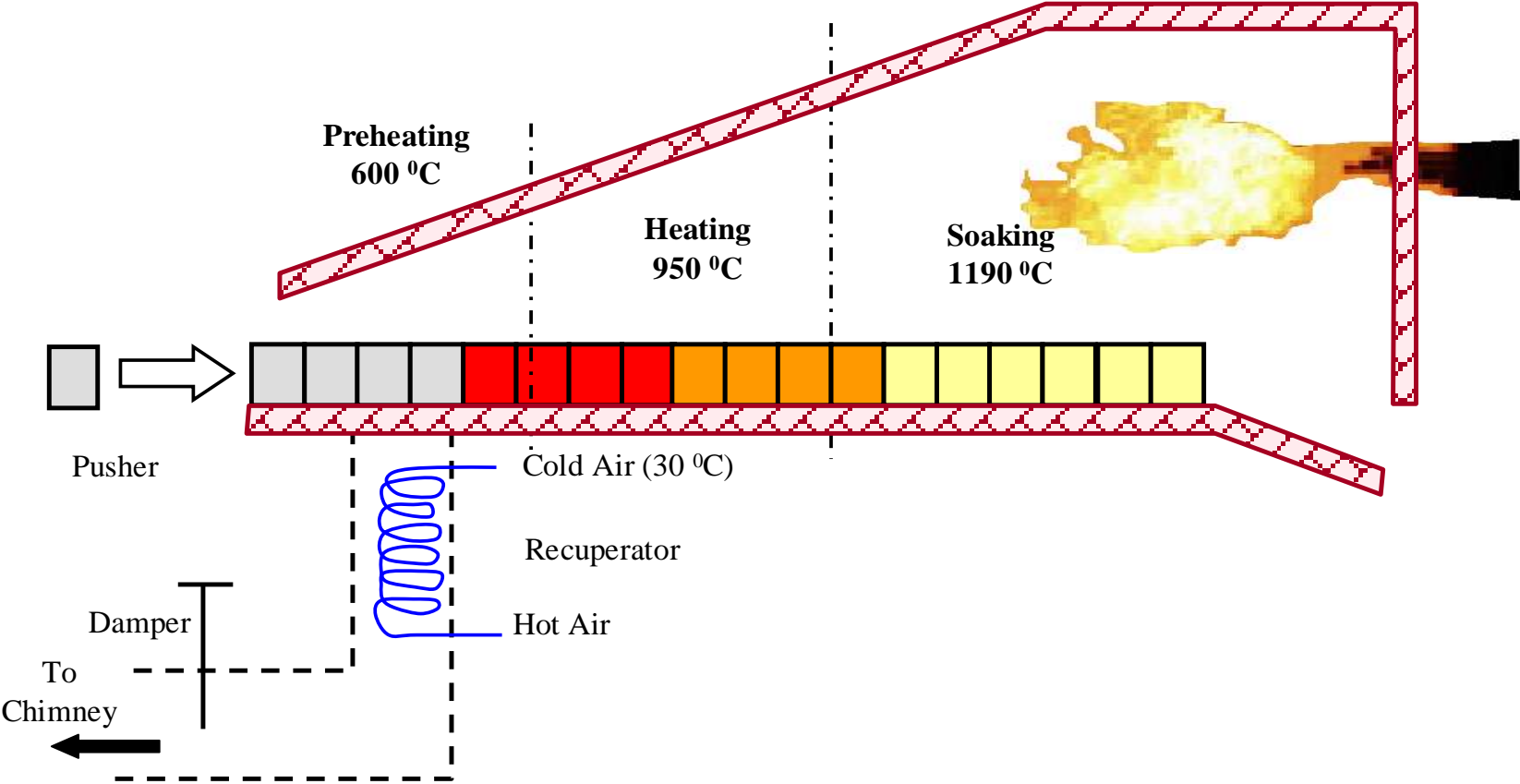
<b>NAME OF MOTOR/ LOAD CENTER</b>	<b>Rating (KW)</b>	<b>Power Range (KW)</b>	<b>AVG. Power Factor</b>	<b>AVG. Power (KW)</b>	<b>AVG. % LOADI NG (%)</b>
R.H Fce. Blower 1&2 <b>(Before Modification)</b>	<b>45</b> 30&15	20-24	<b>0.63</b>	<b>22.1</b>	<b>42</b>
R.H Fce. Blower 1&2 <b>(After modification)</b>	<b>45</b> 30&15	11-16	<b>0.7</b>	<b>13.6</b>	<b>26</b>
R.H Fce. Blower 1 <b>(Before modification)</b>	<b>30</b>	13.9 - 17.5	<b>0.73</b>	<b>16.6</b>	<b>47</b>
R.H Fce. Blower 1 <b>(After modification)</b>	<b>30</b>	7.2-8.5	<b>0.89</b>	<b>8.0</b>	<b>23</b>

# CASE STUDY- Base Line Data

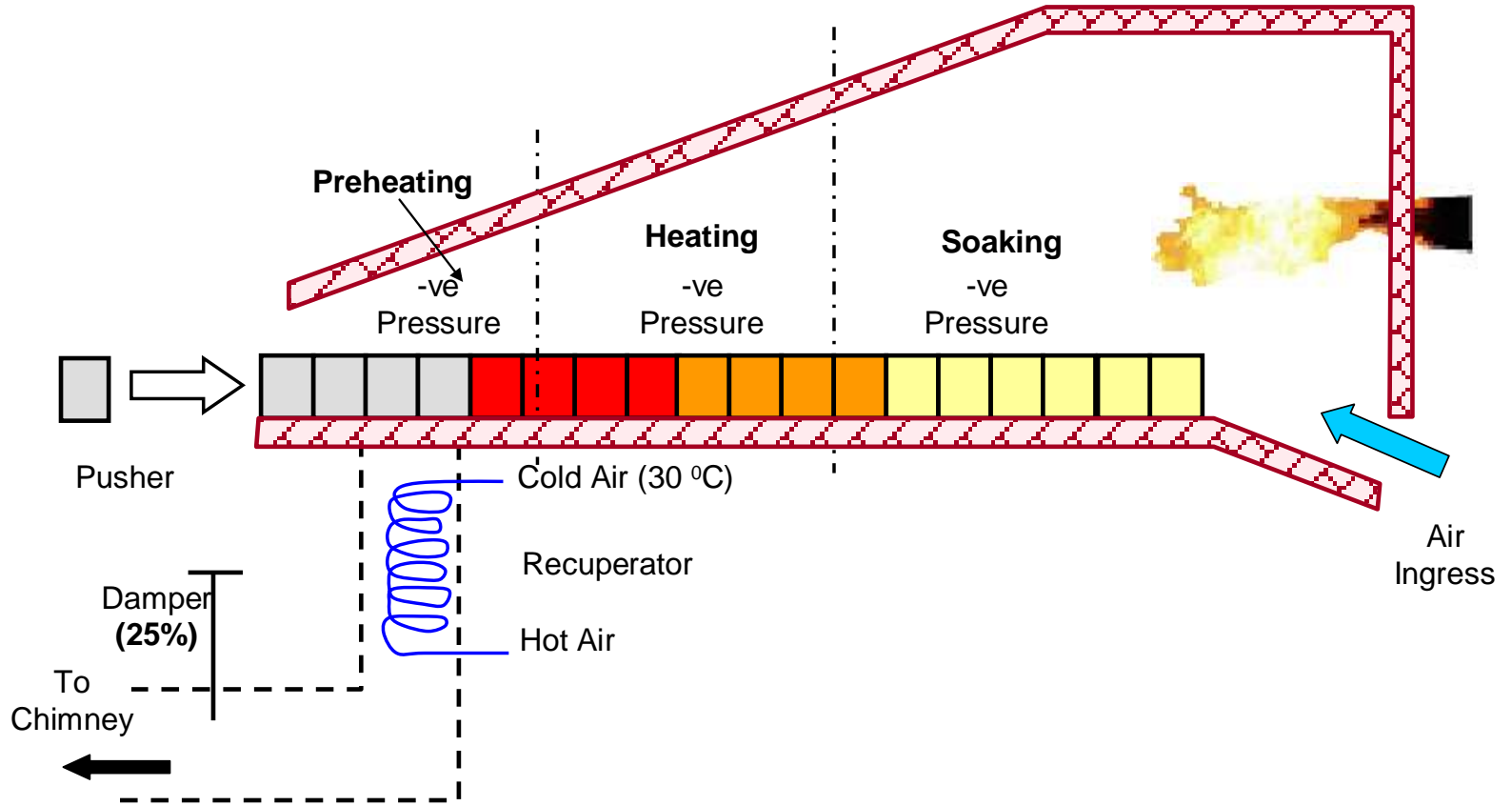
## Before Demonstration

• Re-rolling Mill Furnace Capacity	= 10 tons/hr
• Mill Operation per day	= 10 hrs
• Operating days per year	= 250
• Production during 2004 (Jan-Dec.)	= 14721 tons
• Specific oil consumption (Heat up time + production)	= 115 litres/ton
• Cost of Oil	= 60US\$/kL
• Specific Power Consumption	= 111.65 kwh/ton
• Cost of Power	= 0.13 \$/kwh
• Total Cost of Energy	
– Oil	= 101575 \$
– Electricity	= 213668\$
	-----
Total	= 315243 \$

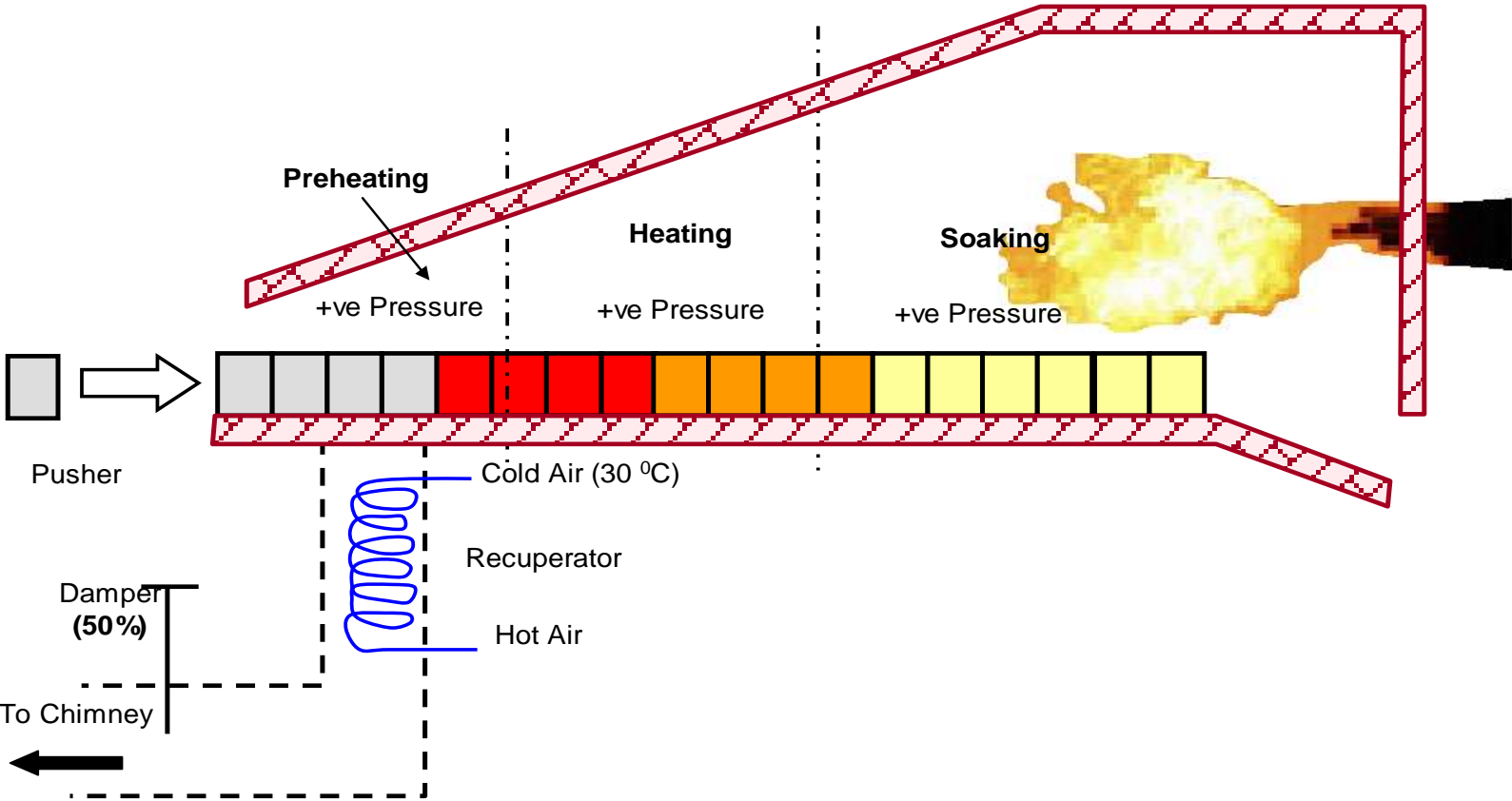
# Re-rolling Mill Furnace



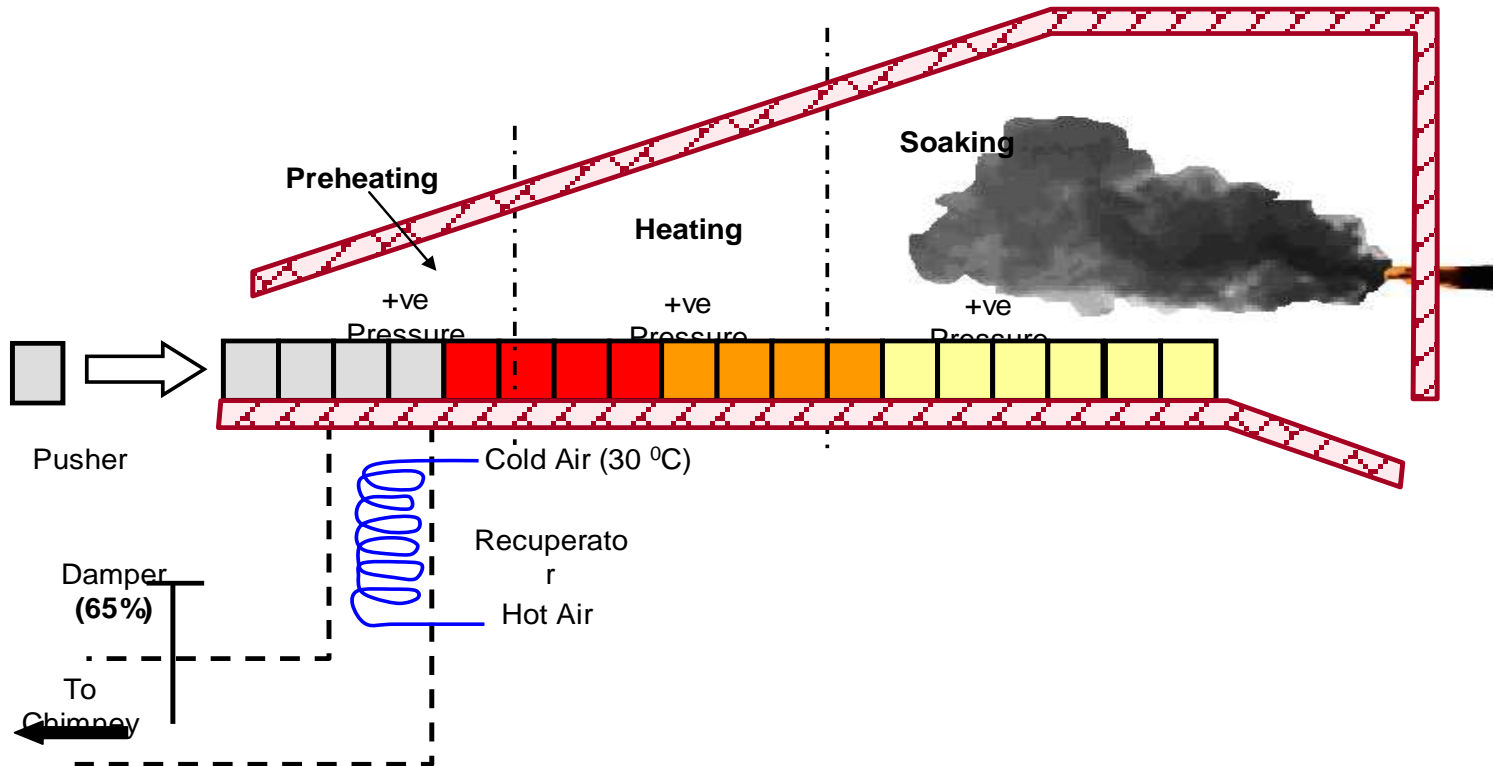
# Re-rolling Mill Furnace



# Re-rolling Mill Furnace



# Re-rolling Mill Furnace



## Furnace Operating Parameters After Demonstration

	Month	Oil Consumption During Heat Up Time	Oil Consumption During Production 07.00 hrs to 17.00 hrs	Production in Tonnes	% Yield	Specific Oil Consumption Liters/ton		
						Over all	During Production	
<b>Furnace Under Demonstration</b>	16 <sup>th</sup> Mar 05	2000	2700	61.59	93.76	76.3	43.8	
	17 <sup>th</sup> Mar 05	1750	3950	80.13	94.44	71.1	49.2	
	18 <sup>th</sup> Mar 05	2000	3700	73.26	96.63	77.8	50.5	
	19 <sup>th</sup> Mar 05	2000	3900	80.73	94.63	73	48.3	
	20 <sup>th</sup> Mar 05	No Production						
	21 <sup>st</sup> Mar 05	1700	3150	51.13	93.59	94.8	61.6	
	22 <sup>nd</sup> Mar 05	2000	3000	49.34	96.59	101.3	60.8	
	23 <sup>rd</sup> Mar 05	2000	3500	86.96	95.65	63.2	40.2	
	24 <sup>th</sup> Mar 05		Shut-down					
	25 <sup>th</sup> Mar 05		Shut-down					
	26 <sup>th</sup> Mar 05		Shut-down					
	27 <sup>th</sup> Mar 05		No Reading					
	28 <sup>th</sup> Mar 05		No Reading					
	29 <sup>th</sup> Mar 05	2000	4100	89.97	93.03	67.8	45.5	
	30 <sup>th</sup> Mar 05	2000	6000 (Till 10 PM)	93.28	94.45	85.7	64.3	
	31 <sup>st</sup> Mar 05	2000	4000	71.98	97.62	83.3	55.5	
	<b>TOTAL</b>	<b>19450</b>	<b>38000</b>	<b>738.37</b>	<b>95.039 (Avg)</b>	<b>77.8</b>	<b>51.46</b>	

### SPECIFIC OIL CONSUMPTION BEFORE DEMONSTRATION:

- \*Heat up time + production = 115 liters/ton
- During production = 78 liters/ton
- Production during 2004 (Jan.-Dec.) = 14721.22 tons

\* The Oil consumption during heat up time i.e. 01=00 to 07=00 hrs is not measured. The estimated specific oil consumption figure of 115 lit/ton was given by unit.

# Percentage Yield Comparison

<b>BEFORE DEMONSTRATION</b>			
Date	Input Materials (Tons)	Finished Product (Tons)	% Yield
7 <sup>th</sup> Aug.'04	67.35	62.09	92.1%
10 <sup>th</sup> Aug.'04	70.92	64.90	91.5%
12 <sup>th</sup> Aug.'04	73.61	67.91	92.25%
<b>TOTAL</b>	<b>211.88</b>	<b>194.9</b>	<b>91.986%</b>
<b>AFTER DEMONSTRATION</b>			
16 <sup>th</sup> , 17 <sup>th</sup> , 18 <sup>th</sup> , 19 <sup>th</sup> , 21 <sup>st</sup> , 22 <sup>nd</sup> , 23 <sup>rd</sup> , 29 <sup>th</sup> , 30 <sup>th</sup> , 31 <sup>st</sup> March 2005	776.9126	738.37	95.039%

# Results Of Energy Efficiency Demonstration Project

## I. OIL SAVINGS

- Specific Oil Consumption before implementation = 115 lits/ton
- Specific Oil consumption after implementation = 77.8 lits/ton
- Reduction in oil consumptions = 37.2 lits/T
- % Reduction in oil consumption = 32.3%
- Annual reduction in oil consumption = 37.2 x 14721  
= 547.6 K.L/Yr  
(60\$/kL)
- Annual Monetary savings = 547.6x60  
= 19714\$
- Reduction in GHG emission = 1642.8 tons/yr

# Results of GP- Energy Efficiency Demonstration Project

## II. POWER SAVINGS

- Specific power consumption before implementation = 111.65 kwh/T
- Specific power consumption after implementation = 76.17 kwh/T
- Reduction in power consumption =  $111.65 - 76.17$   
= 35.48 kWh/T
- Annual Power Savings =  $35.48 \times 14721$   
= 0.522 Million  
kwh/yr
- Monetary savings = 67,860 \$/yr

# Results - Energy Efficiency Demonstration Project

## III. SAVINGS DUE TO % YIELD IMPLEMENTATION

- Average yield before demonstration = 91.986%
- Average yield improvement after demonstration = 95.039%
- Increase yield percentage = 3.053%
- Average production during 2004 (Jan. - Dec.) = 14721 tons
- Extra production due to yield improvement =  
449.4 tons
- Cost of finished product = US\$ 600/ton
- Average yield before demonstration = 91.986%
- Monetary benefit = 449.4 x 600  
= US\$ 2,69,640

Total monetary gains to the unit after implementing GP-EE  
measures

$$\begin{aligned} &= 19714 + 67860 + 2,69,640 \\ &= 3,55,214 \text{ US\$/yr} \end{aligned}$$

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