

Bhilai Steel Plant, Bhilai

Unit profile:

Bhilai Steel Plant, a unit of Steel Authority of India Ltd. - a public sector undertaking was conceived under aegis of Indo-USSR Treaty in the 2nd Five year plan. This was in accordance with erstwhile government policy for strengthening economy and self reliance through development of core sector.

The plant is located at the central position of India, which is one of the major iron belt of India, and it is about 40 kilometer from Raipur, capital of newly born state Chattisgarh. The captive mines of the plant located at Dalli-Rajahara supplies iron ore and lime stone used to be available from Nandini captive mines. At present lime stone is procured from outside. The other major raw material, coal is purchased from outside either through import or from indigenous market.

Bhilai Steel Plant, an integrated steel works, was commissioned in 1959 with production capacity of 1.0 million tonne of steel. In successive phases, capacity was enhanced to 2.5 and 4.0 million tonne in the year 1962 and 1984 respectively. Figure depicts facilities available with Bhilai Steel Plant for 4.0 mt production. As of now this is the largest steel plant in India with present capacity utilisation more than 100%.

Living upto the demand of the growing economy of the country, the plant produces wide range of products. This includes Rails, Wire Rods, Plates and Merchant products. Commitment to quality and customer satisfaction has resulted in consistent R & D efforts culminating in development and commercialisation of distinctive new grades like SAILMA, UTS-90 etc. Bhilai Steel Plant could dream and implement the project of long rail (78 meter and above) in consistence with it's reputation with in-house know-how. This was a basic demand from Indian Railways for enhancement of country's economy.

Human resource management is exemplary in Bhilai Steel Plant. It is worthwhile to note that Bhilai Steel Plant registered maximum profit in 2004-05 among all public sector steel plants in spite of coal crises during first six month and hike in coal prise.

Facilities Available in Bhilai Steel Plant

Sl.No.	Department	Unit	Capacity
1	Coke Oven	8 Batteries of 65 ovens and 4.3 M high 2 Batteries of 67 ovens and 7.0 M high	3.3 million ton of BF Coke
2	Sinter Plants	1) 3 Machine of 50 Sq M hearth area 2) 3 machine of 75 Sq M and 1 Machine and 1 Machine of 80 Sq M hearth area 3) 1 Machine of 320 Sq M hearth area	8.3 mt of sinter
3	Blast Furnace	3 Furnaces of 1033 Cum 3 Furnaces of 1719 Cum 1 Furnace of 2000 Cum	4.71 mt of hot metal
4	SMS - 1	4 Twin Hearth Furnaces	2.5 mt of steel
5	SMS - 2	3 BOF of 100/130 T capacity	1.425 mt of steel
6	Concast	3 Single strand & 1 Combi caster	1.425 mt of steel
7	Blooming & Billet Mill	1150 mm Blooming Mill 1000/700/500 mm Cont. Billet Mill	2.15 mt of bloom
8	Rail & Structural Mill	950/800 2 high reverseing Mill	.75 mt of product

9	Merch. Mill	350 mm Cross Country Mill	.5 mt of product
10	Wire Rod Mill	4 strand continuous Mill	.4 mt of product
11	Plate Mill	3600 mm 4 high reverseing mill	0.95 mt of product

The production indices of Bhilai Steel Plant for the year 2004-05 is 4.551 million tonne of hot metal, 4.582million tonne of crude steel and 3.863 million tonne of saleable steel.

The annual turn over of the company for the year 2004-05 is Rs 11389 crores with net profit margin of Rs. 4041 crores.

Bhilai Steel Plant symbolises Indian Industrial Growth. Many laurels were bestowed on Bhilai Steel Plant. It has been honoured five times with coveted **“Prime Minister’s Trophy”** as best Integrated Steel Plant of the country.

Energy Consumption:

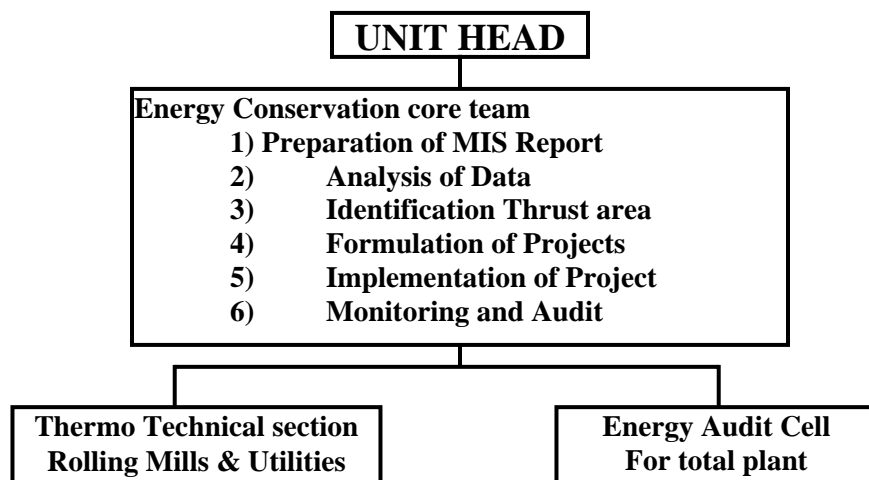
Steel production in Bhilai Steel Plant, like any other integrated steel works, is highly energy intensive. The gross energy consumption in the plant for the year 2004-2005 is 3688 GCal/Hr. which is approximately equivalent of 3.2 million TOE (ton of oil equivalent) per year. The primary energy input for the year 2004-2005 constitute 3.76 million tonne of Coking Coal, 0.24 million tonne of Boiler Coal, purchased electrical power of 203MW and 12748 kilo litres of petro-fuel.

The demand of other energy items, viz, steam, compressed air, oxygen etc. are completely met by in-house auxiliary units. 40% of the total power demand of the plant is met by captive power plants including power from joint venture. Specific energy consumption, specific power consumption and specific petro-fuel consumption are given in figures attached herewith.

It may also be noted that Bhilai Steel Plant is the **only steel plant in India continuing with “Ingot Casting & Soaking Pit with Blooming Mill” route for steel making.** About 50-55% of the total steel is made through this route. This route is energy inefficient and consumes about 0.35 – 0.4 Gcal of energy per ton of crude steel. Even after this handicap specific energy consumption per ton of crude steel is best among SAIL plants and Tisco shows the grit and commitment of Bhilai collective towards energy conservation.

The annual energy bill for the company is around Rs. 2630 Crores which comprises around 35 % of the total production cost.

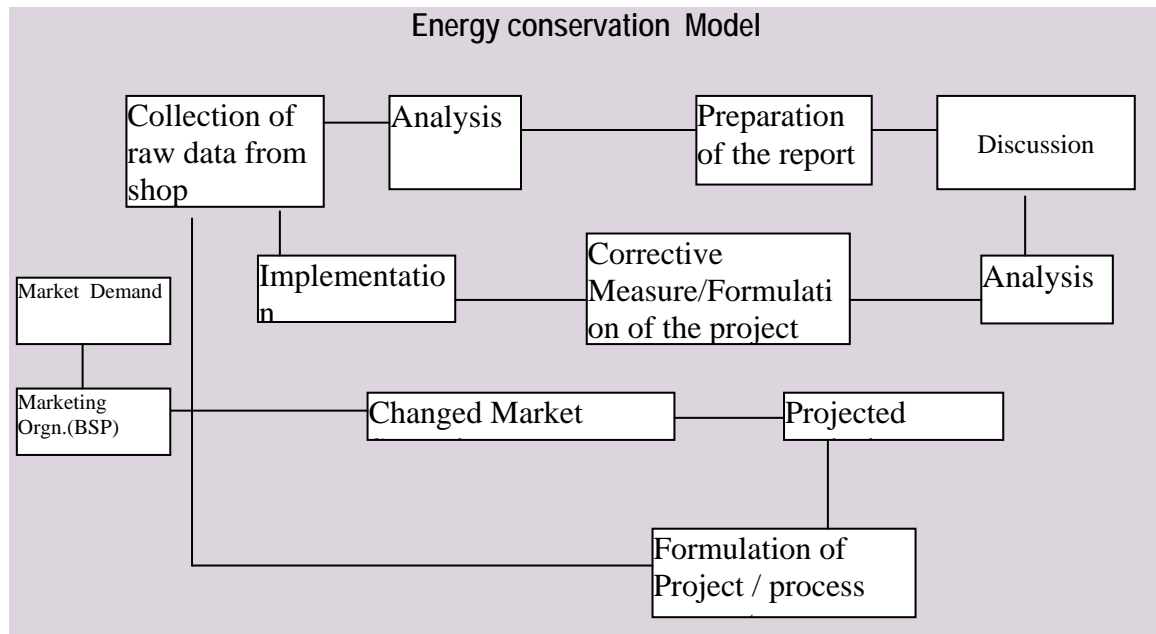
ENERGY CONSERVATION TEAM STRUCTURE



The competent group carries out cost analysis on the monthly basis. Their prime task is to translate the deviation in energy performance indices in the term of cost and its impact on the profitability of the plant.

The respective departments of the plant initiate modification and retrofitting of energy efficient equipments in the existing technology. A committee designated by management clears these projects purely on priority basis.

MIS group of Energy Conservation Cell prepares energy performance of the plant daily, weekly and monthly basis. These reports are reviewed on regular basis by respective Head of Department in plant level meeting chaired by Executive Director, Works to enhance Plant performance. The model for energy conservation is given in figure:



Energy Conservation Achievement:

The specific energy consumption in last few years registered steady decline. Specific energy consumption of the plant per tonne of cast steel was 7.25 Gcal in 2000-2001 when production target was lowered to cope to the market demand. The year 2000-01 was bad for steel industry in India. The recessionary trend resulted in uneven market demand. This has adversely affected energy consumption figure for the year 2000-01. The same came down to 7.07 in the year 2001-02 and further reduced to 6.844 Gcal/tcs in the year 2002-03 and 6.841 in the year 2004-05. The increase in energy consumption has already been explained and it is due to severe coal crisis. Judicious selection of cheaper fuel over costly fuel, optimum utilisation of available facilities and constant vigil over plant performance indices are few key parameters that are prime reason for reduction of specific energy consumption. The specific energy consumption over the year is given in Figure below and table gives the reduction in energy consumption over 2001-02.

Year	Product	Kwh/Tonne	% Reduction over 02-03	Gcal / Tonne	% Reduction over 02-03
2002-03	Crude steel	424		6.844	
2003-04	Crude steel	402	-5.7	6.862	+0.20
2004-05	Crude steel	416	-1.88	6.841	-0.04

Energy Conservation measures implemented during 2004-2005 are given below :

1. Coal dust injection in Blast furnace –1, 5, 7

Coal dust is a substitute of COKE in Blast Furnace as a auxiliary fuel. The replacement ratio is 1:1.2 approx. Using coal dust in Blast furnace directly through tuyers reduces the requirement of Coke. In Coke Ovens 1.8 gcal energy consume for converting Coal to coke, this energy is saved.

2. VVVF drive commissioned in ID fan motor of SMS-2

The ID fan motor(1200 kw) capacity for converter –C was running continuously at rated speed during process and as well as during idle time. After installation of VVVF drive during idle period, the motor run at 42 % of the rated speed. Thereby saving of 7500 kwh/day.

3. Development of low power dedicated Ventilation system for leveler-2 (75 kw by 3 kw) in Plate Mill.

75 KW ventilation system had been installed for leveller-2 cooling system. But due to low loading on leveller-2 it was observed that the requirement is very less. Accordingly 75 KW system has been replaced by 3.75 kw ventilation system.

4. Coal Tar Injection in Blast Furnace

Coal Tar is a by-product of coke making process. The year when severe coal crisis was experienced by all Indian steel plants. Then it was decided by Bhilai management to inject coal tar as a measure to conserve coke consumption in Blast Furnace. Technology was developed with in-house know how and required installation was erected in Blast Furnace # 3. At present about 30-40 liter of coal tar is injected through tuyers of the furnace and it is observed that the replacement ratio is about 1.4 kg of BF coke per liter of coal tar. Encouraged by the result obtained, management has decided to extend to Blast furnace # 2 also. Plant scale trial is going on to establish the obtained result.

5. Modifying the field of Vertical stand and Finishing stand Screw Down to low voltage system (220 V to 145 V) in Plate Mill.

The 230 V supply of Vertical & Finishing stand motor were fed through resistance boxes. It was observed that actual field supply requirement is only 145 V and 75 V is being dropped in resistance box. That is why only 145 V direct fed to field winding without resistance box by changing incoming supply from 11 KV to 6.6 KV of CVDC transformer.

6. Extension of Unloading bay for reducing unloading time of LSHS

The time taken for unloading a rake of LSHS fuel (70 wagons) was about 65 hrs , this was due to insufficient unloading points. It was observed that if 6 no of unloading points are increased the time for unloading can be reduced to 40 hrs. After this modification (in house) total steaming time was reduced .

7. Utilisation of waste Lubrication oil in Lime Kiln.

The waste lubrication oil(used) about 100 KL per year earlier was disposed at low price . A unit is commissioned to reclaim this oil by mixing in LSHS fuel in a ratio of 1 to 1.5 % and successfully consumed in Lime Kiln with out any major effect.

8. Blast Furnace gas firing in Boiler No-6 of Power and Blowing Station.

The Boiler No –6 of PBS was commissioned with out BF gas firing system and was consuming coal . In Bhila steel plant BF gas is available in excess and was flared in the atmosphere , to use this gas Boiler No-6 was modified by providing Burners , and after this about 60000 M3 /hr BF gas is able to consume in Boiler . This has saved Boiler coal about 240 Tones per day.

Energy Conservation Plans and Targets:

The company has set up a challenging target of reducing specific energy consumption by 2% in every successive year and to reach International Norm. In line with that, Bhilai Steel Plant has undertaken a major programme for investment in capacity enhancement and introduction of energy efficient technologies. The following is the brief outline of envisaged projects:

- I. Introduction of SMS – 3 for production of steel through BOF & Concast route
- II. Introduction of Thin Slab caster
- III. Introduction of Walking Beam Furnaces in Rolling Mills in phases
- IV. Phasing out of Ingot Casting & Blooming Mill route
- V. Introduction of Pellet Plant
- VI. Introduction of Gas Fired Boiler

Energy Conservation is an aggregate of total working of the plant and it has to be achieved by every one. For achieving target of energy consumption, energy bearing indices are identified for all major shops and norms are set at the beginning of the year. These norms have the approval of the Executive Director (Works) and all shops are asked to adhere to these norms. The impact of these norms are also explained to them for their awareness. The table below gives the impact of deviation of these norms on energy consumption per ton of crude steel.

S.No.	Parameter	Variation	Impact on Energy
I	Coke Rate	+ 10 Kg/THM	0.085 Gcal/tcs
II	Hot Metal Rate	+ 10 Kg/T CS	0.052 Gcal/tcs
III	Power Cons	+ 10 Kwh/TCS	0.03 Gcal/tcs
IV	Steam Cons	+ 10 Kg/TCS	0.007 Gcal/tcs
V	Boiler Coal	+ 10 Kg/TCS	0.042 Gcal/tcs
VI	Oxygen	+ 1 M3/TCS	0.0025 Gcal/tcs

The proposed short term future plans for energy conservation are as follows:

1. Augmentation of L.D. Gas Evacuation Scheme for maximisation of L.D. gas recovery.
2. Introduction of Coal Dust Injection in 2 more Blast Furnaces.
3. Introduction of energy efficient multi-slit burner in sintering machine.

It has been estimated that with introduction of modern technologies and energy conservation schemes, the specific energy consumption will come down to 5.7 Gcal/tcs by 2012 and that will be at par with international norm. The table below gives the impact of various project that are envisaged as a part of future program on energy conservation.

Short Term Energy Project (2004-2007)

Area	Project	Impact gcal/tcs	Year of implementation
Coke Making	Rebuilding Coke oven Batt # 6	.003	2007
	UP-gradation of Benzol Rec. plant	.0001	2007
Iron Making (Bfco productivity and Coke Rate will be improved)	Auxiliary Fuel Injection	.116	April-04 March-05 Sep-05
	a. Coal Tar in BF 3 & 2		
	b. CDI in BF 7		
	c. CDI in BF 1 & 5		
	II. Coke Rate reduction	.207	
	a. Modernisation of BF# 7		Dec-05
	b. Modernisation of BF# 5		Jun-06
	c. Modernisation of BF# 3		Dec-06
	d. Modernisation of BF# 6		June-07
	e. Pallet Plant		2007
	f. Screening and washing plant at Rajhara Mines		2006
	Modernisation of SP-2 with slit burner ignition furnace.	.02	2005
Steel Making	Introduction of SMS-3 & phasing out SMS-1 & BBM	.35	2007
	Increase LD Gas Recovery @90 M3/T	.017	Dec-04
	Total Savings	.713	

Target for 2007 $6.86-.71 = 6.15$ gcal/tcs

Long Term Project s(2007-2012)

Area	Project	Impact gcal/tcs	Year of implementation
Iron Making	I. Installation of TRT in BF-7	.06	2009
	II. Coke Rate Reduction	.086	
	a. Modernisation of BF# 4		2010
	b. Modernisation of BF# 2		2008
Coke Making	I. Rebuilding Batt # 9 with CDQ	.09	2012
	II. Rebuilding Coke oven Batt # 5	.003	2008
Mills	1. Installation of Walking beam Fces in MM, WRM, PM & RSM	.2	2012
Boilers Aux.	I. Up-gradation of TG's	.02	2010
	II. Improved technology for Oxygen making and utilization of BY-product fuels.	.12	
	Total savings	.579	

Target for 2012 $6.15-.58 = 5.57$ gcal

Environment and Safety:

The company's commitment to Safety and Environment control is of equal importance along with energy conservation. Though energy conservation through technological discipline gives better environment control, company's incessant efforts for green and clean environment was duly recognised. Bhilai Steel Plant is recipient of "**Paryawaran Award**" for six consecutive years.

Commitment to safety is another prime aspect for Bhilai Steel Plant, Safety Engineering Department under the guidance of Deputy General Manager (Safety) regularly inspect, monitor and ensure implementation of safe working practices in all units of the plant. Structured internal safety audits are conducted twice a year with a view to ensure healthy and safe working environment for employees. Necessary preventive actions are initiated based on the audit findings and yearly mock drill results. The safety points are reviewed through various levels at regular interval which include departmental safety meeting, joint safety committee meeting, zonal safety committee meeting and coordination meeting chaired by ED (Works). In addition to centralised Safety Engineering Department, each department has one nominated Safety Officer for better co-ordination with Safety Engineering Department and to ensure safe working on daily basis.