



## A brief write up of Bhilai steel plant

### i) Unit profile :

Bhilai Steel Plant, a unit of Steel Authority of India Ltd. is a public sector undertaking and was conceived under 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 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 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 ( 230 meter long ) in consistence with it's reputation. This was a basic demand from Indian Railways for enhancement of country's economy.

Bhilai steel plant is planning to expand its production to 7.0 Mt by the year 2011-12. During its expansion plan all energy efficient technology will be installed, after this the energy consumption may come down to 5.7 gcal/tcs.

Human resource management is exemplary in Bhilai Steel Plant. It is worthwhile to note that Bhilai Steel Plant registered maximum profit for 2006-07 also among all public sector steel plants.

### 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) 4 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 2006-07 is 4.8166 million tonne of hot metal, 4.7985 million tonne of crude steel and 4.222 million tonne of saleable steel.

The annual turn over of the company for the year 2006-07 is Rs. 13526 crores with net profit margin of Rs. 4287 crores.

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

## ii) Energy Management Plan and Monitoring

Effective planning for current year is done based on the report of various committees who recommends the specific consumption of all utilities. These recommendations takes into account past performance, present production plan, implementation status of energy conservation programmes and future change in processes for both short and long term. These figures are then put into model to work out the projected of Specific energy consumption / tcs and expected requirement of purchase energy. Energy considerations are infect guide lines for election of appropriate technology under unit perspective plan 2012.

## iii) 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 2006-2007 is **4155** GCal/Hr. which is approximately equivalent of 4.0 million TOE ( ton of oil equivalent ) per year.

The primary energy input for the year 2006-2007 constitute 4.30 million tonne of Coking Coal, 0.136 million tonne of Boiler Coal, purchased electrical power of 205 MW and 13078 kilo litres of petro-fuel.

### Energy distribution during 2006-07

	Gcal	%
Coking coal	30819183	81.5
Boiler coal	567564	1.5
Pur Power	5393412	14.3
Pur.Steam	852988	2.3
Petrofuel	184602	0.5

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.

<b>Energy Parameters</b>	<b>2004-05(base year)</b>	<b>2005-06</b>	<b>2006-07</b>	<b>% + or -</b>
Sp-Power kwh/tcs	416.1	393.8	402.1	- 3.36
Sp.process Steam kg/tcs	419.1	405.3	418.5	-0.14
Water consumption M3/tcs	3.97	3.79	3.17	-20.1
Boiler coal cons. Tons	262954	114067	149430	- 43.17
Petrofuel consumption KL	12748	12338	13078	+ 2.59
Coke Rate Kg/thm	498	497	508.9	+2.19
Power Gen. in PBS MW	37.3	35.1	39	+4.56

The Boiler coal consumption achieved 43.17 % less due to increased BF gas consumption in Power Blowing station after modification of Boiler- 6. Petrofuel consumption is high due increased demand of calcined dolomite and lime by SMS-2. Coke Rate is high due to less coal dust & tar injections in Blast Furnaces.

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 more 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.

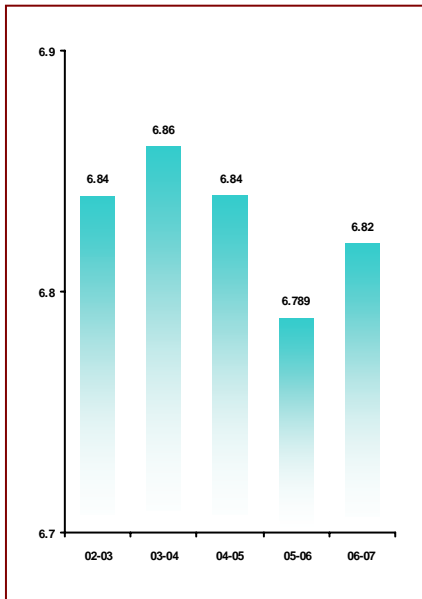
The annual energy bill for the company is around Rs. 4065 Crores which comprises around 40 % of the total production cost.

### iii) **Energy Conservation Commitment, Policy and Set up**

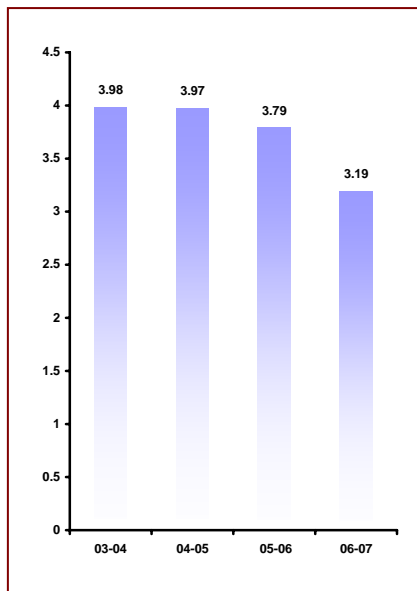
Energy intensive nature of integrated steel works and global energy crisis influenced policy makers of the company to accord high degree of priority for energy conservation as one of the major thrust areas for cost reduction along with restructuring of the plant. Bhilai Steel Plant being 50 years old, its technology is not in pace with the modern one. Only the vision of the top management coupled with the grit of the Bhilai collective, keep the flag of energy conservation high and made Bhilai Steel Plant major player in the field of energy conservation.

## **Energy Performance Indicators**

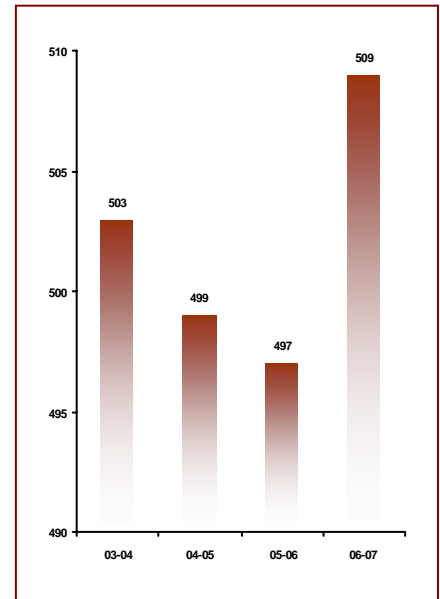
**Specific Energy Consumption (GCal/tcs)**



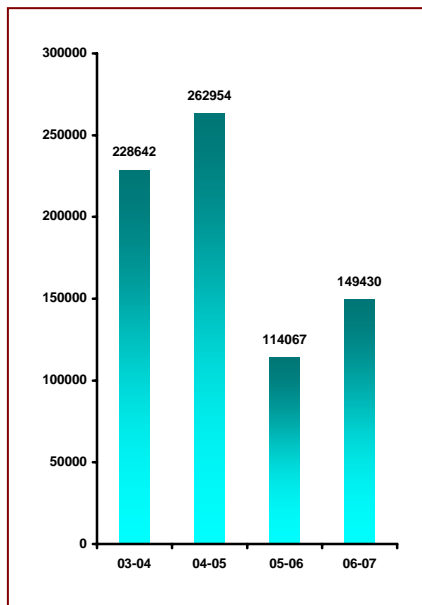
**Specific Water Consumption (m<sup>3</sup>/tcs)**



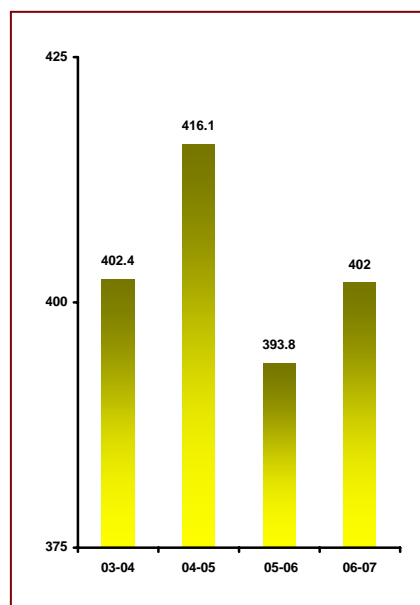
**Coke Rate (kg/thm)**



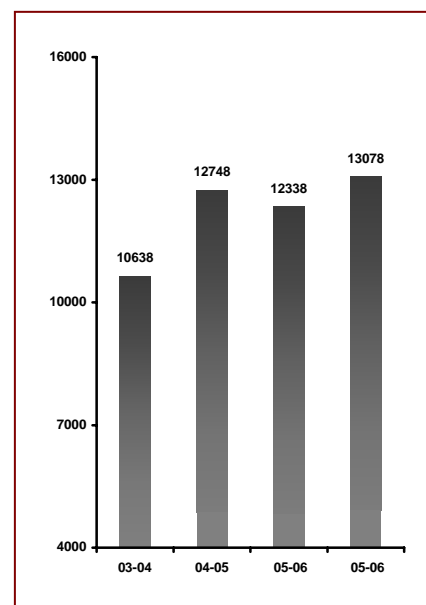
**Boiler Coal Consumption Tonnes**



**Sp. Power Consumption Norm – 402 Kwh/tcs**



**Petrofuel consumption (KL)**



Bhilai steel plant has formulated a well-defined Energy Management Policy. This reflects the commitment of leadership towards sustainable development through energy conservation and resource management.

### **Energy Management Policy**

- Reduce specific energy consumption by identifying areas with the energy saving potential..
- Conserve and optimally utilize , petroleum fuels, steam, power, compressed air, water and other resources
- Set energy consumption target and monitor continuously.
- Benchmark with the global best in the country.
- Promote culture of awareness towards energy conservation in the organization.
- Communicate Energy policy to all the employees.

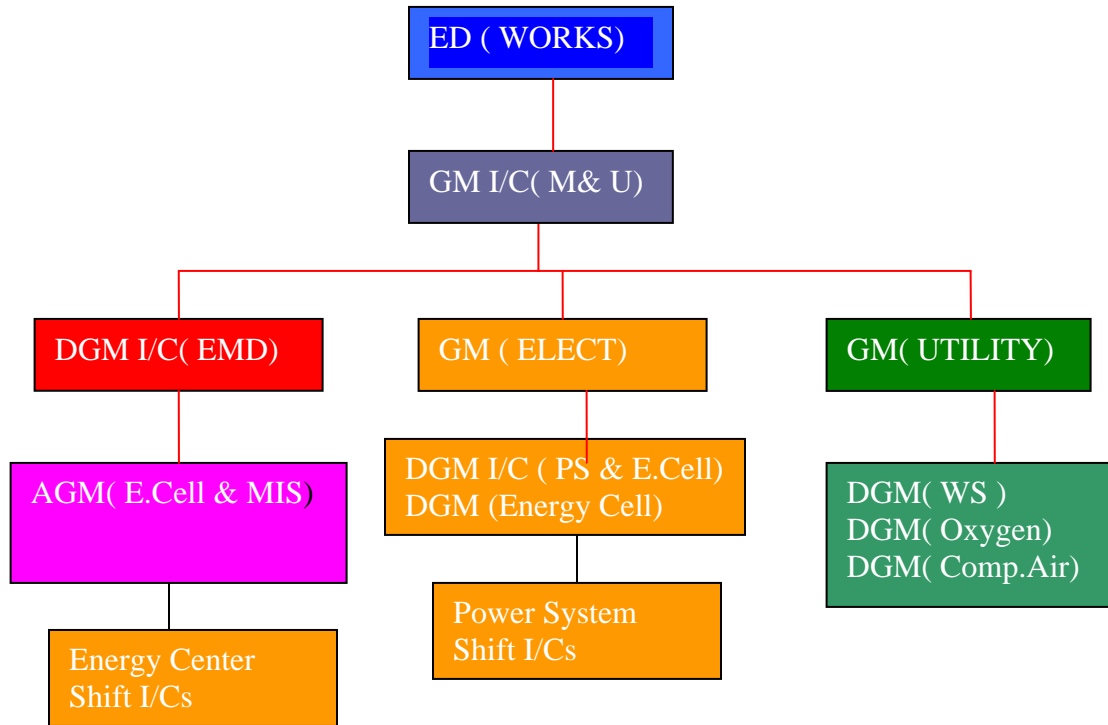
Bhilai Steel Plant has a full-fledged Energy Management Department (EMD) which functions as a nodal agency for coordinating and executing various thermal energy related activities throughout the Plant. The other activity for the group is optimal distribution of in- plant generated by-product fuel that is a prime factor for energy conservation in an integrated steel plant.

Central Electrical department is nodal agency for any power related projects. They also monitor optimal distribution of power and manage peak demand within stipulated norm in addition to the project on power.

Major role of utility is to minimize consumption of oxygen, steam, compressed air and water. These energy bearing component play very important role in specific energy consumption per ton of crude steel.

### **Constitution**

General Managers head these cells and supervise with executives and trained technicians for Energy Conservation activities throughout the Plant that is a corollary to monitoring of norm. For monitoring and advisory control of various energy parameters, the plant has been divided into four zones namely - Iron Zone, Steel Zone, Mill Zone and Auxiliary Zone. In addition to this, the overall energy planning, on monthly and yearly basis are carried out by them for various energy-related MIS functions.



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.

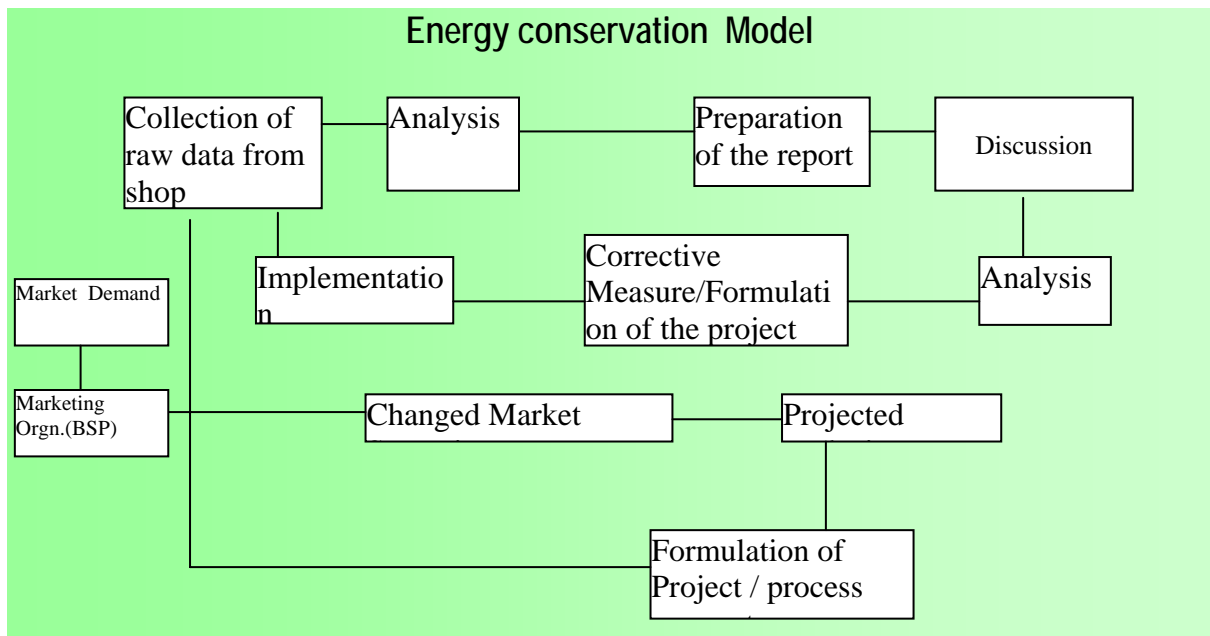
Monitoring of energy performance is given very high importance and energy reports are prepared on daily, weekly and monthly basis. Daily reports also includes the loss/gain on energy front based on the sensitivity of the permeters.

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
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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
VII	Steam loss through lakages	¼ inch hole /1/2 inch hole	0.4 Tons/hr

The figure below gives the basic model that are being followed for energy conservation.



#### iv) 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 6.82 Gcal in 2006-2007 which is the lowest for any SAIL steel plant and speaks of the achievement of Bhilai collective for energy conservation. This was achieved by capacity utilization and judicious use of energy. 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 few specific energy parameters over the year are given in annexure-1.

**Energy Conservation measures implemented during 2006-2007 are given below :**

**1. Increase in productivity of Machines in sinter plant-2 by changing chute angle from 54° to 60°.**

The feeding of raw material in Sinter Machines was improved by changing chute angle from 54° to 60°, this was done after detailed study by RDCIS, Ranchi. This has improved the permeability of bed and due better air distribution Machine productivity improved by 5 % i.e 2 T/Hr. The fuel saving achieved 8000 gcal/year.

**2. Introduction of burners in preheat- zone in furnace 1 & 2 in Rail and Structural Mill with in-house know-how.**



With the help of RDCIS, Ranchi the side burners were introduced in the Fce. 1 & 2 of Rail and Structural Mill. This has improved heat distribution in side the furnace and there by Furnace productivity was improved. The Sp. Heat consumption was reduced by 10 Mcal/T ( 6000 Gcal/Year).

**3. Installation of a new Energy efficient Dry Fog dust suppression system for BF-4 stock house.**

Substantial fugitive dust is emitted during screening, conveyor transfer and loading the charge in Skip of Blast furnaces. This dust is conventionally controlled by dust Extraction system with jet bag filters.



DRY- FOG DUST SUPPRESSION SYSTEM	
FIRST OF ITS KIND IN BHILAI STEEL PLANT	
ENERGY SAVINGS	
ENERGY CONSUMPTION BY DEDUSTING UNIT = 690.4 KWH	1. AIR COMPRESSORS - 3 Nos.
ENERGY CONSUMPTION BY DUST - SUPPRESSION SYSTEM = 267.4 KWH	CAPACITY - 682 CFM EACH.
MINIMUM SAVING = 420 KWH	PRESSURE - 7 KG/ CM
SAVINGS PER DAY (PER MONTH) Rs. 40,000.00 Rs. 12,00,000.00	2. PUMPS - 2 Nos.
	CAPACITY - 5 M <sup>3</sup> /hr.
	HEAD - 50 m
	3. NOZZLES - 320Nos
	4. FAS - 24 Nos.
	5. PRU - 50 Nos.
	6. FASR - 24 Nos.

**4. Percentage leakage doors in Coke Ovens batteries brought down to <10 % from 12 %.**



The doors of Coke Oven Batteries are subjected to leakage if proper technological discipline is not met. During the year as a special task with adhering to technological norms and close monitoring the PLD was reduced to less than 10 % compared to previous data of 12 %. This has resulted in an increase in CO Gas Yield.

**5. Revamping of BF-7 with technological up gradation was done.**



The Blast Furnace No-7 (2000 M<sup>3</sup> Volume) was modernised during Capital Repair. It was commissioned in Feb.07. After the repair its productivity has improved from 3500 T/Day to 4500 T/day and its fuel rate has reduced by 10 Kg/thm.

**6. Replacement of old insulation of steam pipe lines.**



The old insulation of steam pipe lines was made of cement coating, due to aging effect it was broken at many places and its efficiency was reduced. This insulation was replaced with insulation and Aluminium sheet cover. This has resulted in heat loss saving.

**7. Use of Granulated Blast Furnace slag for Cement making.**

The slag generated in Blast furnace during Hot Metal production has the chemistry of cement and can be used in Cement plant. It will save other raw material like limestone and waste utilisation is also achieved. Use of granulated slag in Cement plant also saves energy required for calcination of raw material as done in Cement plant.

**v) Energy Conservation Plans and Targets**

The company has set up a challenging target of reducing specific energy consumption by 1% 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 :

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

1. Introduction of energy efficient multi-slit burner in sintering machine.
2. Regular replacement of old insulation of steam pipelines.
3. Sale of Granulated slag to cement plant. Energy used for making cement will be saved.

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 2010 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 ( 2007-2009)**

Area	Project	Impact gcal/tcs	Year of implementation
Coke Making	Rebuilding Coke oven Batt # 5	0.003	2008
	UP-gradation of Benzol Rec. plant	0.0001	2008
Iron Making  (Bfco productivity and Coke Rate will be improved)	I. Coke Rate reduction	0.100	April'08 May'09
	a. Modernisation of BF# 6		
	b. Modernisation of BF# 5		
	d. Screening and washing plant at Rajhara Mines		2008
	e. Modernisation of SP-2 with slit burner ignition furnace.	0.01	2008
	f. Sale of slag to Cement Plant.	0.3	2007-08
Total Savings		0.413	

**Target for 2008       $6.82-0.413 = 6.41$  gcal/tcs**

**Long Term Projects (2008-2012)**

Area	Project	Impact gcal/tcs	Year of implementation
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Steel Making	Introduction of SMS-3 & phasing out SMS-1 & BBM	0.3	2009
Iron Making	I. Installation of TRT in BF-7	0.02	2009
	II. Coke Rate Reduction	0.056	
	a. Modernisation of BF# 4		2010
	b. Modernisation of BF# 2		2008
	c. Modernisation of BF# 1		2009
	III Installation of Blast Furnace -8		
Coke Making	I. Rebuilding Batt # 9 with CDQ	0.18	2012
	II. Rebuilding Coke oven Batt # 5	0.003	2008
Mills	Installation of Walking beam Fces in MM, WRM, PM & RSM	0.05	2012
Boilers Aux.	1.Up-gradation of TG's	0.03	2010
	2.Improved technology for Oxygen making and utilization of BY-product fuels.	0.08	
	Total savings	0.719	

**Target for 2012      6.41-0.719 = 5.71 gcal**

#### **vi) 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.

Special Achievement/Success story in the field of Environment Management (during the award year)

##### **a) ISO 14001**

Setting pace as a leader of Indian Steel Industry, Bhilai Steel Plant has obtained ISO: 14001 certification for its Environmental Management Systems as per revised ISO 14001:2004 standard covering all the major production units and service departments.. The complete EMS documentation of BSP has been maintained in electronic format through web-enabled system on BSP intranet. EMS as per ISO 14001:2004 has also been implemented at BSP Township and is certified by LRQA

##### **b) Sustainability**

Bhilai Steel Plant has prepared its 4<sup>th</sup> Sustainability Report as per Global Reporting Initiatives (GRI) G3 latest guidelines, for 2005-06, depicting the three core areas - Economic, Environmental and Social sustainability. BSP is the first public sector company in India to have published this report and second steel plant in world to publish sustainability report as per GRI G3 guidelines.



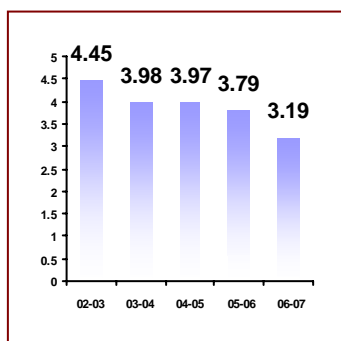
### c) Waste Management

BSP has effectively adopted waste minimization strategies including conservation at source, recovery and recycling. The overall solid waste utilization of BSP was 81.8% for the year 2005-06, surpassing the previous best of 77.1% in 2002-03. Some of the initiatives that were undertaken, for increasing the recycling of solid wastes are sale of 1.63 MT granulated slag to cement plant and 58000 t air cooled slag for slag wool industries. Recycling of 2,08,000 t LD slag, lime and dolo dust 107000 T Mill scales, utilization of 99.2% of used refractory bricks , 86.5% flue dust are the hallmark of BSP 's efforts for wast management.

### d) Water Conservation

During the year 2006-07 through increased recycling and improved management, Bhilai Steel Plant has been able to reduce its specific water consumption to 3.19 m<sup>3</sup>/tonne of crude steel, which is much lower than CREP norm of 5 m<sup>3</sup>/tcs. This conforms to the best global averages. This is also a major step in conserving a natural resource, which is becoming increasingly scarce. For minimizing discharge, treatment & recycling schemes are envisaged to recover 2100 m<sup>3</sup>/hr. This includes recycling of 800-900 m<sup>3</sup>/hr industrial water from outlet -14 and treatment & recycling of 1200 m<sup>3</sup>/hr of municipal sewage effluents.

**Specific Water Consumption  
(m<sup>3</sup>/tcs)**



#### **e) Green House Gas abatement**

As a part of conservation of non renewable resources for reduction of Green House Gases (GHGs) mainly carbon dioxide emissions, BSP has aimed to reduce energy consumption and achieving specific energy consumption benchmark of 5.92 Gcal/tcs, and achieve CO<sub>2</sub> emissions of 2.2 t/tonne of crude steel. The specific CO<sub>2</sub> emission for 2006-07 was 2.9 t/tcs.

#### **f) Clean Development Mechanism**

Under Clean Development Mechanism, BSP has obtained host country approval for two project design documents from MOEF i) Coal dust Injection to Blast Furnaces ii) BF gas firing system in Boiler # 6 of Power Plant-1.

BSP will be implementing another 10 potential CDM projects for reducing green house gas emission.

#### **g) Toxicity and environmental impacts reduction initiatives**

The initiatives undertaken by BSP for reducing toxicity and environmental impacts are described below :

- Coke oven effluent are Treated in ETP and completely recycled for quenching.
- Use of degreasing agent Carbon Tetra Chloride has been eliminated by replacing it with Trichloroethylene.
- Use of asbestos as sealing material is being replaced by Ceramic material in phases.
- Use of waste oil as fuel in Kilns.
- Non-ferrous metal waste recycled in Steel Melting Shop for replacement of fresh metal.
- Tar sludge is mixed with coal and charged to coke ovens.
- Process dust and sludges are recycled back in the system.
- Acetylene is replaced by Propane gas in SMS-2
- Use of LD slag in sill making at SMS-1 replacing Dolomite.
- Recovery & recycle of used waste refractory materials.

### **Safety Management**

Commitment to safety is another prime aspect for Bhilai Steel Plant, Safety Engineering Department under the guidance of 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.

