

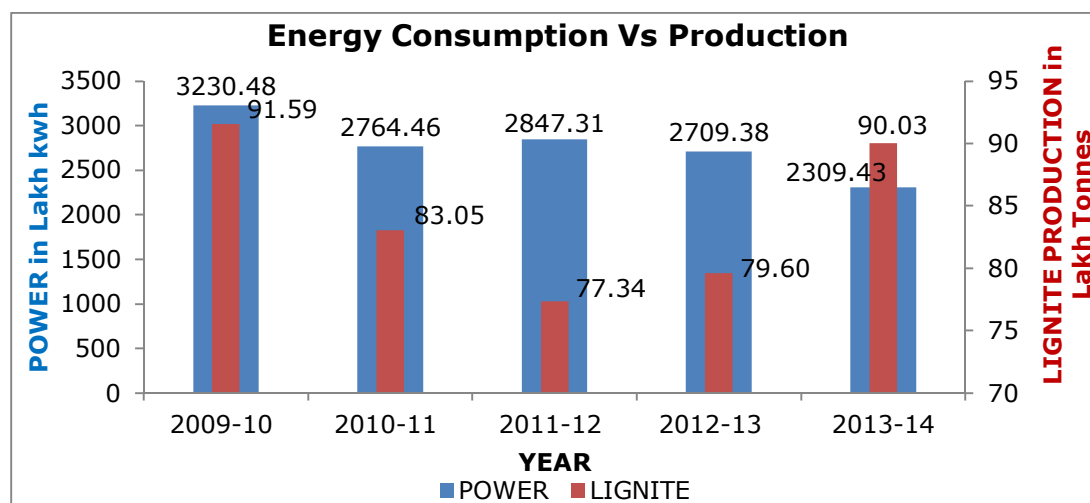
## NEYVELI LIGNITE CORPORATION LIMITED MINE - I Neyveli (Tamil Nadu)

### Unit Profile

This mine has a production capacity of 10.5 million tones of lignite per annum and feeds lignite to the 600 MW capacity of First Thermal Power Station and 420 MW Thermal Power Station-I Expansion. The lignite seam was first exposed in August 1961 and regular mining of lignite commenced in May 1962.

Particulars	Unit	Mine - I
Mining Area	sq. km.	27.0
Capacity / Annum	MT	10.5
Lignite Reserve	MT	429
OB Thickness	Mts.	45 to 110
Lignite Thickness	Mts.	8 to 26
Average Stripping Ratio	Tons: m <sup>3</sup>	1: 5.5
Mining Started on	Date	20.05.1957
Lignite First Exposed	Date	24.08.1961
Overburden Excavated 2013-14	MM <sup>3</sup>	56.34
Lignite Mined 2013-14	MT	9.003
Linked Power Stations	Name	TPS-I (600 MW) & TPS-I Expn. (2 X 210 MW)
Generation Capacity	MW	1020

### Energy Consumption & Production



## ***Energy Conservation Measures carried out in Mine-I, NLC Ltd, during 2013-14***

### **1. Optimization of conveyor length and lift in New Surface Bench**

In Mine I, Overburden is removed in five benches and then lignite is excavated. The system used for both the operations is the combination of Bucket Wheel Excavator-Conveyor-Spreader.

The Overburden is removed in five benches. The top most bench is called as New Surface Bench (NSB). In the year 2012-13, NSB was operated with 8 conveyors of 2400 mm belt width for a length of 7.57 km. The total number of drives (1250 kW capacity) used in all the 8 conveyors are 28. During April 2013, the conveyors lengths are optimized by re-arranging the dumping conveyors, thereby reducing the length from 7.57 km to 5.19 km. The conveyor length of NSB by end of 2013-14 was 5.5 km. The lift of NSB conveyors (the level difference from first conveyor to last conveyor) was reduced by 100 m during 2013-14 compared to 2012-13. By this, 3 nos. 2400 mm Drive Heads are eliminated from operation. The number of drives in operation also reduced from 28 to 15.

### **2. Optimization of conveyor length Lignite Bench**

In Lignite bench the number of conveyors operated during 2012-13 was 10 of 2000 mm belt width for a length of 7.58 km. The total number of drives (630 kW capacity) used in all 10 conveyors are 24. During 2013-14, the numbers of conveyors are reduced from 10 to 8 and thereby eliminating 2 Nos. 2000 mm drive heads. The length of conveyors is reduced to 6.42 km. The number of drives in operation also reduced from 24 to 20.

### **3. Optimization of conveyor length and lift in New Surface Bench**

In Top Bench also the optimization of conveyor length was carried out during 2013-14. The numbers of conveyors are reduced from 8 to 5, length from 5.77 km to 2.53 km and the number of drives from 25 to 15. The lift of Top Bench conveyors is reduced by 30 m.

### **Energy Saved**

- By carrying out all the above activities the electrical energy consumed was reduced from 2709.37 Lakhs kWh/2012-13 to 2309.43 Lakhs kWh/2013-14 with the increase in production of Lignite from 7.959 Million Tonnes/2012-13 to 9.003 Million Tonnes/2013-14.
- The savings in electrical energy was 399.94 Lakhs kWh during 2013-14 as compared with 2012-13.
- The specific energy consumption was reduced from 34.04 kWh/Ton (2012-13) to 25.65 kWh/Ton (2013-14)

## **SUKINDA CHROMITE MINES CHROME ORE BENEFICIATION PLANT Jajpur (Odisha)**

### **Unit Profile**

Tata Steel Ltd. was Established in 1907 as Asia's first integrated private sector steel company, Tata Steel Group is among the top-ten global steel companies with an annual crude steel capacity of over 29 million tonnes per annum. It is now the world's second-most geographically-diversified steel producer, with operations in 26 countries and a commercial presence in over 50 countries. The Tata Steel Group, with a turnover of Rs. 1,48,614 crores in FY 14, has over 80,000 employees across five continents and is a Fortune 500 company.

It was this exploratory zeal of Tata Steel, which led to the discovery of the first Chromite deposit in the Sukinda valley of Odisha (1949), when the world was still to fully appreciate the value of Chrome. The Sukinda Chromite Mine (SCM) is the largest open cast Chromite mine in India which comes under TATA STEEL Ferro Alloy and Mineral Division. It is the first mechanized chromite open cast mine in India operating with more than 100 no. of Dumpers (35-50 Tonne), more than 15 no.



Shovel supported by well-designed fleet of Dozer, Loader, Grader and Water Sprinkler. It is first mine in Asia to get ISO-9001 certification for its quality systems and first in world to be accredited SA 8000.

During the course of mining, a substantial quantity of low-grade ore is generated. In order to conserve scarce chrome ore, the Steel Company set up the largest Chrome Ore Beneficiation Plant (COBP) in India with a designed capacity of 1.08 lakh Tonne/Annum, within its lease area in the year 1990. The plant was designed by

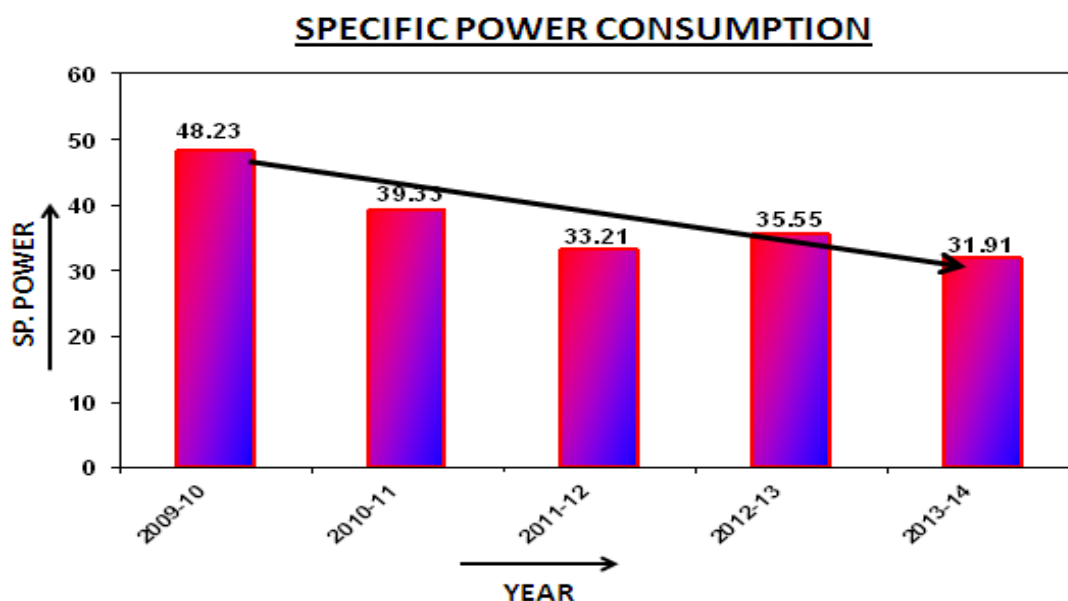
MDL Australia and subsequently upgraded by Outokumpu in 2005 and the plant production capacity was enhanced to 5.30 lakh Tonne/Annum.

### **Salient Features of Beneficiation Plant**

- Tata Steel Ltd. COB Plant is the first state of art Chrome Ore Beneficiation plant of the country.
- This is largest chrome concentrate producing plant in India.
- This is the only plant in India which can supply refractory grade and Hexa free (Green) chrome concentrate.
- Tata Steel Ltd. COB plant has developed own patented technology of hexavalent treatment using herbs, recognized with DSIR (Department of Scientific Industrial Research, India) award.
- This is the only Chrome Ore Beneficiation plant in India to have tailings dewatering facility.

### **Specific Energy Consumption**

YEAR	CONCENTRATE PRODUCTION (MT)	ENERGY CONSUMPTION (kWh)	SPECIFIC ENERGY CONSUMPTION (kWh/MT)
2009-10	326165	15729455	48.23
2010-11	417065	16403439	39.33
2011-12	443135	14716635	33.21
2012-13	359675	12787058	35.55
2013-14	431030	13754690	31.91



## **ENERGY CONSERVATION ACHIEVEMENTS IN THE YEAR 2013-14**

### **1. GRAVITY DISCHARGE OF TAILINGS**

COB Plant produces chrome concentrate from low grade Chrome ore and there by generates Tailings as waste with plant operation 24 x 7. Plant yield is approximately 55 %. In the year 2013-14, total Chrome concentrate production is about 4.31 LMT/Annum generating 3.52 LMT/Annum tailings. Entire Tailings produced during the process of beneficiation is discharged to thickener to recover water present in them through a 75 kW slurry pump.

The idea of Gravity discharge of tailings of the COB plant was generated during the brain storming session conducted for "MANTHAN AB SHOP FLOOR SE" (MASS) an initiative to involve shop floor people in improvement activities. This project completely eliminated one no. of 75 kW pump which approximately consumed energy of 3,99,648 kWh/Annum. This resulted in savings of Rs. 22 lakh due to energy saving. This not only saved energy, it also saved Rs. 4.53 lakhs against the spares for pumps. This has helped in reducing CO<sub>2</sub> emission.

### **2. DCS BASED AUTO RUNNING SYSTEM OF TAILINGS PUMP**

Chrome concentrate and tailings are produced in the process of beneficiation. Tailings generated in the process are discharged to thickener by gravity discharge to recover the water presents in the tailings. As per IBM (Indian Bureau of Mines), tailings generated cannot be discarded above threshold limit. Therefore, tailings from the Thickener are pumped to the Tailing Pond which acts as a temporary storage of tailings. The distance of tailing pond from the plant is approximately 1000 meter. 2 nos. of slurry pumps of capacity 55 kW were used to pump these Tailings from thickener to tailing pond. These pumps were operated manually by the pump operator. Due to manual operation it was difficult to know the quantity of tailings, hence, operator use to run both the pumps for 24 hours. After Automation of pumping done through DCS (Distributed Control System), a study was carried out and it was found that when the plant is operated more than 95 % of load only in that condition it is required to operate both pump, otherwise one pump is sufficient. This gives a saving of 2,93,075 kWh/Annum.

<b>% Loading of Plant</b>	<b>No. of Pumps in Manual Pump Operation</b>	<b>No. of pump in Automatic operation of Pump</b>	<b>% Energy savings due to Automation</b>
Up to 25%	Single pump	Single pump	0%
25% - 50%	Dual pump	Single pump	50%
50% - 75%	Dual pump	Single pump	50%
75% - 95%	Dual pump	Single pump	50%
95% - 100%	Dual pump	Dual pump	0%

### **3. CLOSED LOOP CONTROL OF BALL MILL THROUGH DCS**

For beneficiation of Chrome ore the size of ore required in beneficiation circuit is less than 1 mm. The feeding size from the mines to plant is less than 200 mm. The ore is crushed to 25 mm – 3 mm size through different crushing units. 25 mm – 3 mm sized ore is then feed to the Ball Mill where it is reduced to less than 1 mm size. The Ball Mill is having one 700 kW, 3.3 kV Slip Ring Induction Motor. The Ball Mill consumes about 1/3rd of the total power consumption of COB Plant. The optimum loading of Ball Mill depends upon the Grinding efficiency of Ball Mill. The Grinding Efficiency of Ball mill depends on the Pulp density inside the Ball Mill which in turn depends upon the ore feeding to the Ball mill and addition of water inside the Ball Mill. Earlier practice was to add water at a constant rate. With the help of Research & Develop team have established a theoretical formula for different pulp density. Based on the formula, unit has done automation of the Ball Mill by controlling water addition through in-house resource which resulted in approximately savings of 3,21,662 kWh/Annum.

### **4. USE OF PIPE LIGHTS**

Use of pipe lights to eliminate 36 watt tube light and 70 watt sodium vapour lights to provide sufficient illumination in low illuminated area during working hours i.e. from 6 AM to 5 PM. Light tubes or light pipes are physical structures used for transporting or distributing natural or artificial light for the purpose of illumination. Installation of the equipment helped unit in reducing power consumption as well as carbon footprint to a great extent. They have absolute zero maintenance costs. This has resulted into energy saving of 4,942 kWh /Annum.

### **5. USE OF TURBO VENTILATORS**

Turbo ventilators are installed at roof tops of plant replacing exhaust fans and requirement of man-cooler of 100 Watts operating 24 hours. Turbo ventilators run on wind and convective currents and helps remove heat, smoke, obnoxious gases, dust and fumes. Maintenance cost of turbo ventilators is absolute zero. Electricity consumption has been reduced to zero thereby helping in reduction of carbon footprint. This has resulted in to energy saving of 10,080 kWh/annum.

### **6. TIMER CONTROLLED SWITCHING ON AND OFF LIGHTS**

Logic is developed in Distributed Control System (DCS) to automatically switch ON and switch OFF Plant inside and peripheral Lights at a prescheduled timing. It has significantly helped in elimination of power wastage due to prolonged switched ON Lights due to manual control. This has resulted in to energy saving of 1,07,857 kWh/annum.

### **7. AUTOMATIC TEMPERATURE CONTROL OF MCC AND PCC ROOM**

Ventilation system in the PCC & MCC Room of COB Plant is installed to maintain a certain temperature inside the room to avoid overheating of Breakers & Bus-bars. Automatic temperature control logic is developed in DCS. A PT100 RTD is installed in

Rooms for sensing the room temperature which sends feedback to DCS for operation of the ventilation system. Logic is configured such that when the room temperature reaches to 30 degree celsius, one fan starts, at 31 degree celsius, two fans starts and at 32 degree celsius, all the three fans starts automatically. Similarly, during stoppage, when the room temperature goes down to 32 degree celsius, one stops, at 31 degree celsius, two fans stops and at 30 degree celsius, all the three fans will be stop automatically. This has resulted in to energy saving of 1,25,925 kWh/annum.

## 8. USE of LEVEL SENSOR

Sump pumps P#29 & P#33 are controlled through logic developed in Distributed Control System (DCS). DCS gets the feedback from level sensors installed at site and thereby operate the pumps when the water level rises above the marked level.

Pump No.	Energy consumed in kWh before installation of level sensor	Energy consumed in kWh after installation of level sensor	% energy saving
P#29	1,64,250	1,31,400	20%
P#33	57,487	45,990	20%

## 9. Reduction of lightning voltage to 230V

Electrical Research and Development Association, Vadodara during Energy Audit recommended that for lightning load, 230 V is the ideal supply voltage for getting the required lumens. If the supply voltage is more than 230 volts, it increases the power consumption by the lamps, reduces its burning life and more failure rates. As per the suggestion, tap position of transformer#2 (150 kVA) was set to reduce supply voltage to 230 volts resulting in energy saving of 24,090 kWh/annum.

## 10. IMPROVING THROUGH PUT RATE OF THE PLANT

The plant productivity is increased by increase in through put from 108 tonnes/hour to 115 tonnes/hour in spite of designed throughput of 108 tonnes/hour by implementing following measures identified through six sigma project:

- Buffer Management of Feeding material at feeding yard
- Use of ultra sonic level sensor in the raw material hoppers to ensure continuous feeding of material to plant.
- Interlocking of Secondary Apron feeder with zero speed sensor installed at Wobbler bar to reduce the plant detention hours due to jamming.
- Installation of vibrating fork level sensor in rotary scrubber inlet chute to give an early indication for jamming.

## **11. IMPROVING THE PUMP EFFICIENCY**

P # 36 Pump having ratings of 45 kW is used to receive the process water from clarifier tank and delivering water to the plant for its requirement. Energy audit was carried out by third party and found the pump efficiency is 24 % against 66% of similar ratings pump.

## **12. USE OF DRY TYPE TRANSFORMER**

The LT load of the Plant is supplied through 4 nos. of 1250 kVA 3.3 kV/ 440 volt Transformer. 2 nos. of oil cooled transformer were replaced with 1250 kVA 3.3 kV/ 440 volt dry transformer. This resulted in 23 % savings due to reduction in the losses of transformers.

## **13. USE OF TRANSPARENT SHEET**

Transparent sheets are fixed to plant structure in low illuminated areas to provide sufficient illumination during day time. It has resulted in switching OFF of lights during day time thereby reducing significant power consumption and carbon footprint.

## **14. USE OF 5 STAR RATING AIR CONDITIONER**

All new air conditioners installed are ensured to be 5 stars rated.

## **15. USE OF LED TYPE STREET LIGHT**

On a trial basis 70 watt LED Type Street light are installed to replace 250 watt sodium vapour light, thereby savings 72 % of energy.

## **16. USE OF ENERGY EFFICIENT T-5 AND CFL LIGHT**

Existing 100W and 200 W Sodium Vapour Lights and 40 W tube lights are replaced with T-5 series tube lights and CFL's in a phased manner. This has resulted in energy saving at optimum cost.

## **17. INTRODUCTION OF INDIVIDUAL AUTOMATIC POWER FACTOR CORRECTION UNIT FOR HIGH CAPACITIES INDUCTION MOTOR.**

Individual APFC is installed near the High capacities induction motors which reduces the kVA demand and hence reduce the  $I^2R$  loss.