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Energy Audit In Vishveshvarayya Iron And Steel Plant

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Abstract: Energy is an exertion of power. It can be obtained from different sources such as oil, coal, coke, electricity, gas etc. Other sources of energy are also present in nature in the form of solar energy, wind energy etc. The primary sources of energy for steel manufacturing include coke, electricity, furnace oil, LDO and by-products. Total electricity required for the plant is sourced from the grid only. Coke is being used as main fuel and also its various by-products are being produced in various processes. These by-products are also being used as fuel as per requirement in various areas of the plant. Diesel is used for DG sets and Rail locomotives. As one unit saved is two units generated, conservation of energy is very essential because VISL is one of the energy intensive industries. Many units are working with old technology and monitoring facility is less. With the new developments in the recent years, there is enormous scope for reducing the specific energy consumption. This paper describes the production process and energy saving opportunities in a plant at various sections.

Keywords*:* Vishveshwarayya iron and steel plant, Ladle refining furnace, New receiving station, Variable voltage variable frequency drive,Steel making shop.

I. INTRODUCTION

Vishvesvaraya Iron and Steel Plant is a leading producer of alloy and special steels and Ferro alloys in India. It is started in 1918. Production of structural steels was started in 1936; hot metal through pig iron furnace in 1952, Ferro silicon in 1942 and alloys of steel over 700 varieties. VISL became a subsidiary of Steel Authority of India Limited (SAIL) in 1989 and has the distinction of being the only Iron and special steel plant having monolithic facilities starting from mining of basic raw materials such as Iron ore, Limestone, etc to finished rolled and forged bars and billets.

In VISL Steel is produced through Blast Furnace – Basic Oxygen Furnace – Ladle Refining – Vacuum Degassing route. The facilities include vacuum oxygen decarburisation, ladle refining furnaces, continuous casting machines, and 1600 Tonnes-hydraulic-high-speed forging press.

The various departments in VISL plant:

- Production planning and control department (PPC)
- Mines department
- Safety and Traffic
- Raw material handling system
- New receiving station
- Blast furnace
- Steel melting shop
- Rolling mills
- Heat treatment shop
- Forge plant
- Quality analysis lab
- Machine shop
- Material management, Finance, Marketing

The production planning and control department is mainly concerned in planning the structural format of plan to be carried out by all the departments in the forth Coming year through APP. Mining is extraction of minerals from earth crust with safety and economically**.** There are 2 types of mining has carried out, overcast mining and underground mining. Raw materials are the basic requirements for any industrial production. In VISL the major raw materials for Iron and Steel production are Iron ore, Coke, Limestone, High magnesium limestone, raw dolomite, Dunite, Different alloys required for SMS

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VISL is having a Blast Furnace of Capacity 530 m3 and it is an in-house design. SMS is a department which produces required grade steel and it has various sections. The rolling mill has 2 sections, primary mill and bar mill. In primary mill the input from the SMS is rolled to required size and length. The function of primary mill and the bar mill defers only with respect to the size of the input, that is in bar mill the inputs are of smaller size. Heat treatment is the last stage for steel making and it gives the required metallurgical properties to the steel. The metallurgical properties makes steel machinable (Annealing), harden, brittle, tough etc. It is achieved by control heating and cooling and using suitable quenching media. The Forging operation makes the grain size within the steel closer thus making it tough and can be used for making tools, shafts, wheels etc. We have a 1600 / 1200 Ton Hydraulic press and 350 tons long forging machine. For quick chemistry in the in- process steel, in the final product spectral analyzer is available. With the chemical composition of elements present in steel, heat work i.e. adding alloys to steel is carried out. Machine shop is basically a maintenance shop. It was started to produce spare parts for other departments of VISL. The procurement of materials required for VISL is carried out by materials management department. This is carried out with the help of the consuming department. Marketing Department is available for the sale of the products as well as for exploring new customers. Also Technical expertise is given to the users for the selection of steel required for their application. After Sales service helps in building up the good will of the customers. . The main marketing has 4 functions that is product, précising, promotion and placement. The function of finance department is to manage the finance as well as in fixing the price of steel to be sold. They prepare the financial reports and manage audits.

II. PROCESS FLOW

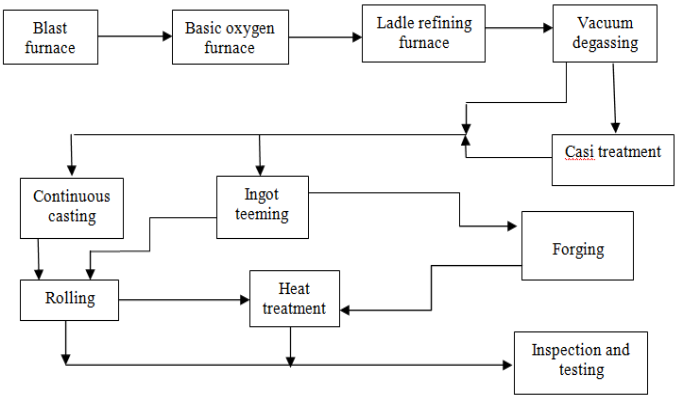

Fig.1 Block diagram of process flow in VISL plant

Steel is produced through Blast Furnace – Basic Oxygen Furnace – Ladle Refining – Vacuum Degassing route as shown in fig.1. The facilities include vacuum oxygen decarburisation, ladle refining furnaces, continuous casting machines, and 1600 Tonnes-hydraulic-high-speed forging press.

III. ENERGY SCENARIO AND USAGE PATTERN

The primary sources of energy for steel manufacturing include coke, electricity, furnace oil, LDO and by-products. Total electricity required for the plant is sourced from the grid only. The only electricity produced within the plant is through DG sets and is utilized for supplying essential loads like cooling water for furnaces, illumination and is not being used for production. Coke is being used as main fuel in blast furnace and also its by-product BF Gas is being used in various processes. This by-product is also being used as fuel as per requirement in various areas of the plant. Diesel is used in Reheating furnace, DG sets and diesel loco shed.

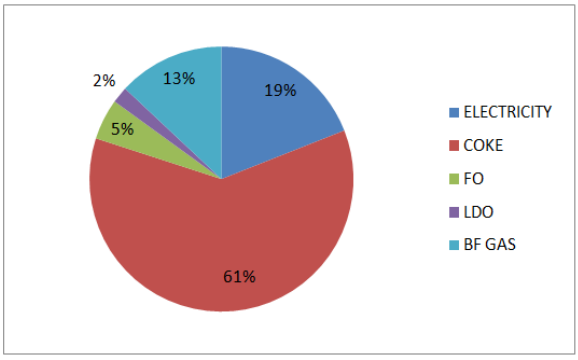

Fig.2 Energy sources consumption in VISL

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Fig.2 shows an energy sources consumption in VISL at different areas. The major contribution for total energy consumption are coke and Electricity, are considered as the main focus areas for improving energy efficiency and reducing the overall energy consumption in VISL.

IV. ENERGY SAVING OPPORTUNITIES

During the study at VISP, the possible energy saving opportunities has been explored in both electrical and thermal energy consumers. The overall approach for reducing energy consumption in VISP is proposed as below.

1) Increase the utilization of blast furnace gas and minimize the flaring of gas as minimal as possible. After increasing the utilization, improve the operating efficiency of blast furnace gas by efficient ignition.
2) Improve the operating efficiency of end users of coke, furnace oil and LDO by adopting standard operating parameters.
3) Utilize energy efficient equipment for minimizing the electrical energy consumption.

The following potential areas have been identified during the study at Vishvesvaraya iron & steel plant.

Case study- 1

Adopting VVVFD in overhead cranes

In VISL material handling i.e. movement of material from one place to another within the plant is required. Overhead cranes are used for the above purpose. Depending upon the weight of the material to be handled various capacity cranes are used in all the departments. The capacity of the crane is indicated in tons i.e., the max load which can lift. In VISL cranes of 50 tons to 2 ton are used.

The details of crane

- Capacity: 40 T
- Crane no: 321
- Usage for handling hot steel

TABLE I: Motor details

	Slip ring I.M. capacity in KW	Rotor voltage in Volts	Rotor current in A	Rotor resistance in ohm	Speed in RPM
MH	50	200	156	0.77	725
AH	24	220	85	1.50	965
TROLLEY	10.5	190	36	3	965
BRIDGE	32	300	67	2.60	970

Duty cycle is 60% and 24 hours working per day

TABLE II: Energy Analysis

Average power dissipated in KW	MH	AH	Bridge	Trolley
3*I*I*R	56.21	32.51	35.01	11.664
Total load in KW	135.4			
Energy dissipated in external resistances per day considering 60% duty cycle	(0.6*24*135.406) = 1949.8 KWh			
Annual wastage of energy	7,11,693.93 KWh			
Cost of energy at 6 Rs per unit	42,70,163 Rs			
Total annual saving including spare charge in Rs	46,00,000(42+4)			

From the above analysis it is found that approximately700000 KWh energy is wasted in the external resistance connected to the rotor winding.

Case study- 2

Replacing the conventional sodium vapour lamps by LED lamps

It comprises of high bay lighting and side lantern type. Sodium vapour lamps of 70 W, 150 W, 250 W, and 400 W are used. In VISL connected load of sodium vapour lamp is 0.7 MVA, approximately and the artificial illumination is required for 12 hours i.e., from 6 p.m. to 6 a.m.

TABLE III: ENERGY SAVING FOR 0.7 MVA ILLUMINATION LOAD

	Sodium vapour lamp	LED lamp
Electrical load in KW	700	294
Daily energy consumption in KWh	8400	3528
Annual energy consumption in KWh	30,66,000	12,87,720
Energy cost in Rs	1,83,96,000	77,26,320

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- By using LED lamps saving in energy consumption per year = 17, 78,280 KWh
- In terms of Rs = 106, 69,680
- % Energy Saving = 58%
- Payback period = 2 years 8 months

Case study-3

Automatic illumination system provide at track hopper, screen house and B.F.top area.

High power illumination is provided at various locations of Blast furnace. Various luminaries of 70 W, 150 W, 250 W sodium vapour, and mercury vapour lamps are provided.

Light sensing device can be mounted in the area and when the illumination falls below the set value the luminaries will automatically switch on in the similar way luminaries will switch off when the maximum illumination occurs. Experiments are conducted and nearly 2 hours of luminous could be saved.

- Earlier duration of switching – 14 hours
- Revised duration of switching – 12 hours
- Saving – 2 hours
- % saving – 14.3 %
- Lighting load – 30 KW
- Annual saving – 30*2*365 = 21,900 units

V. CONCLUSION

The study at Visvesvaraya iron and steel plant gave me an insight into the old and new technology. VISL is an energy intensive industry, coke and electrical energy is a basic need. The availability of commercial sources of energy such as oil, coke and gas within our country are rapidly depleting and the supply of them has to be supplemented by imports. The cost of importing them is very high so it is necessary to conserve the energy as much as possible by its efficient use. Energy saving opportunities has been identified in the various areas like Blast furnace, SMS etc. VVVF drive can be adopted in many areas; improvement in illumination can be implemented.

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BIOGRAPHIES

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