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Energy Conservation Opportunity In Forging Plant With A Practice Of Energy Audit

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Abstract:

It is vital to conserve energy for evolution, growth, and survival as it is a component of day-to-day life as well as increase in demand. India as a nation developing country and require focusing on energy. Energy conservation with proper methodology like energy audit can be proper solution. The paper focuses on the importance of energy conservation by considering the loads of a forging plant having a contract demand of 450 kVA with HT1 connection considering the energy consumed by the present loads and recommending energy efficient technology.

Keywords: Energy, Forging

1. INTRODUCTION

1.1. Current Market Overview

Forging industry is a basic industry and such industries tend to grow in a country in relation to the rate of growth of its GDP. The Indian forging industry has emerged as a major contributor to the manufacturing sector of the Indian economy.

1.2 Technical Features of Forging Industry

The typical production process involves heating of MS blanks in a reheating furnace up to a temperature range of 1050^0 – 1150^0 C. The heated material is then passed on to forging press, better known as hammer. Other than heating and forging, there are also several other process, both upstream and downstream side all these processes also require energy. Thus, it can well be concluded that forging is one the most energy intensive process in the manufacturing industry. Drop forging hammer are the second most high energy consumer, use pneumatic power and electrical motor for the operation.

2. ELECTRICITY BILL ANALYSIS

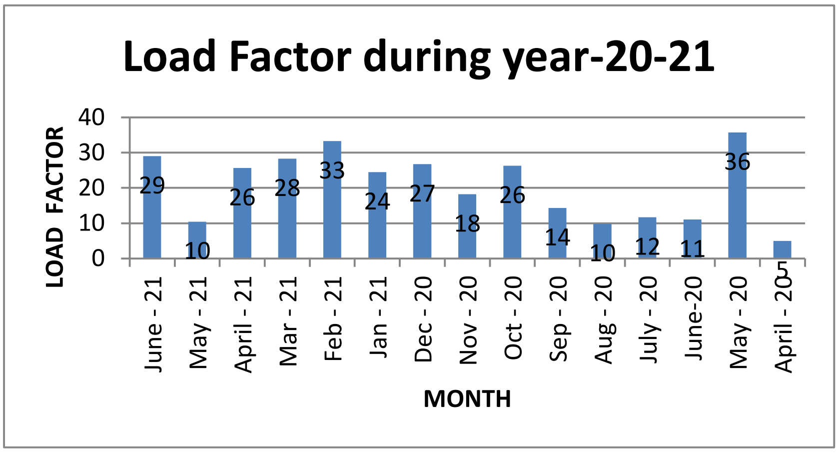


Table 1: Load Factor (LF) during year 2020-21

From the above graph it is observed that maximum load factor consumption is observed in month May-2020 (36 LF) and minimum load factor consumption is observed in Apil-2020 (5 LF).

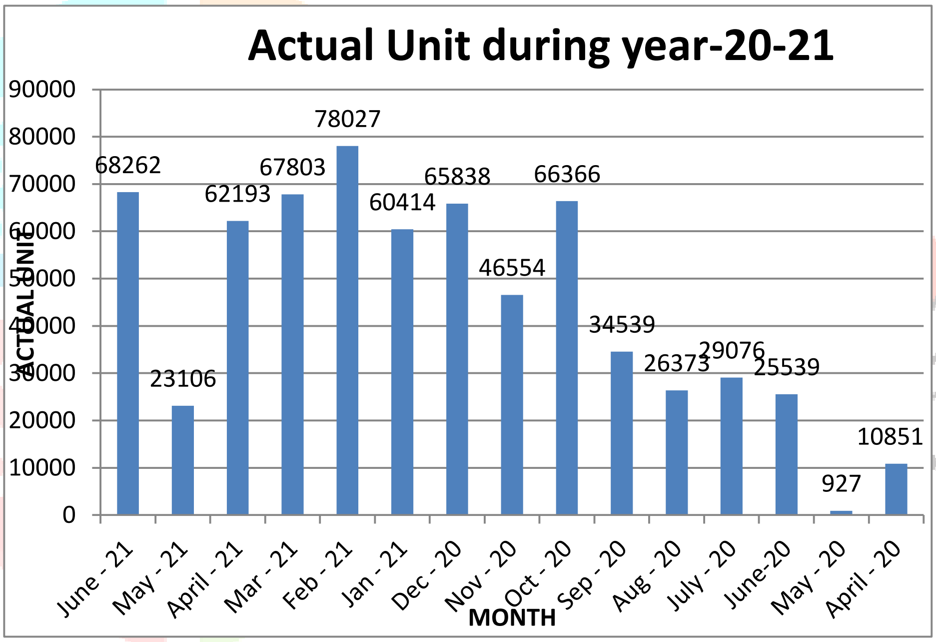


Table 2: Actual unit consumption during 2020-21

From the above graph it is observed that maximum Actual Unit consumption is observed in month Feb-2021 (78027) and minimum Actual unit consumption is observed in May-2020 (927).

Table 3: Actual unit consumption during 2020-21

Power consumption from Forging Hammer motor considered per year	=	2,49,600 kWh
Considering power saving with the installation of Energy Efficient Electric Motors		
Amount that can be saved @ Rs. 7.9 /kWh	=	Rs. 2,15,709
Approximate Investment	=	Rs. 460000
Simple Payback	=	2.13 Year

3. ENERGY CONSERVATION OPPORTUNITIES

3.1 Energy conservation opportunity in forging Hammer Motors with the replacement of Energy Efficient Motors

Considering the annual power consumption of one of the Forging Hammer as follows:

= 20 kW x 10 hrs x 26 days x 12 months x 4 Electric Motors =2,49,600 kWh

For proposed Energy Efficient Electric Motor of same capacity

3.2 Energy conservation opportunity in reciprocating compressor motor with the replacement of energy efficient motor

Considering the annual power consumption of one of the Reciprocating Compressor as follows: 0.75 kW x 6 hrs x 26 days x 12 months x 1 compressor =1,404 kWh

For proposed EEM Compressor Motor of same capacity i.e.

Power consumption of 1 Compressor considered per year	=	1404 kWh
Considering power saving after installing EEM in Reciprocating Compressor		
Amount that can be saved @ Rs. 7.9 /kWh	=	Rs. 1,544
Approximate Investment	=	Rs. 6,000
Simple Payback	=	3.88 Year

3.3 Energy conservation opportunity by improving insulation to reduce radiation heat losses from furnace

Average skin temperature of	=	84°C
(All Forging and Heat Treatment Furnaces 7 nos)		
Identified area Ts Total surface area for insulation	=	50.0 m^2
Ambient Temperature Ta	=	40°C
Surface Heat Loss saved from furnace	=	[10+ (Ts-Ta)/20] X (Ts-Ta) X Area Kcal/hr [10 + (84-50)/20] X (84-50) X 50 Kcal/hr = 26840 kCal/hr
KW saved	=	26840/859.84 = 31.21
Annual Saving	=	2000 hrs/yr X 31.21 = 62,430 KWh
Annual saving	=	62430 x Rs. 7.9 Rs/KWh = Rs. 4.93 Lakhs
Investment (Forging Furnace insulation blanket)	=	50,000 Rs
Payback Period	=	2 months

3.4 Energy conservation through installation of eco ventilator in place of electric exhaust fans

Number of Eco ventilator can be installed = 10 nos

Needed Number of Exhaust Fan Stopped = 8 nos

Consider Rating of one Exhaust fan = 0.75 kW

Savings in KW = 8 x 0.75 kW	=	6 kW
Approx. no. of operational hours in year = 3000 hrs		
Savings in kWh = 6 x 3000 kWh	=	18000 kWh
Amount that can be saved @ Rs. 7.9 /kWh		
Annual Savings = Rs. 18000 x 7.9	=	1.42 Lakhs
Investment Required	=	50,000 Rs
Simple Payback	=	4 months

3.5 Energy conservation opportunity by installation of solar power plant

A 100 KW solar system is best suitable for large manufacturing unit or business with high energy usage. This solar system generates 400 units/ day and 12000 units/month as an average over the year. Its average payback time is 3 to 5 years. For installing such a big solar system 600 sq. meter area is required.

Solar System	100 kW
Solar Panel Capacity	335 watt
Solar Panel Qty	300 Nos.
On Grid Solar Inverter	100 kW
Solar Structure	100 kW GI
ACDB/DCDB Box	2 Nos.
Wires AC/DC	1400 Meter
Earthing	1 Set.
Lighting Arrestor	1 Set
MC4 Connector,	100 Nos.
Other Fitting	1 Set.
Space required	600 Sq. Mt
System Generation	144000 Units / Year
Govt. Subsidy on Solar	30% or Rs. 20,000/kW
System Warranty	5 Years
Solar Panel Warranty	25 Years
Price Range Approx.	Rs.40,00,000

3.6 Other Energy Conservation Opportunities

3.6.1: Cooling Towers: Control of tower air flow can be done by varying methods: starting and stopping (On-off) of fans, use of two- or three-speed fan motors, use of automatically adjustable pitch fans, use of variable speed fans. On-off fan operation of single speed fans provides the least effective control. Two-speed fans provide better control with further improvement shown with three speed fans.

Automatic adjustable pitch fans and variable-speed fans can provide even closer control of tower cold water temperature. In multi-cell towers, fans in adjacent cells may be running at different speeds or some may be on and others off depending upon the tower load and required water temperature. Depending upon the method of air volume control selected, control strategies can be determined to minimise fan energy while achieving the desired control of the Cold water temperature.

- Follow manufacturer's recommended clearances around cooling towers and relocate or modify structures that interfere with the air intake or exhaust.
- Optimise cooling tower fan blade angle on a seasonal and/or load basis.
- Correct excessive and/or uneven fan blade tip clearance and poor fan balance.
- On old counter-flow cooling towers, replace old spray type nozzles with new square spray ABS practically non-clogging nozzles.
- Replace splash bars with self-extinguishing PVC cellular film fill.
- Install new nozzles to obtain a more uniform water pattern
- Periodically clean plugged cooling tower distribution nozzles.
- Balance flow to cooling tower hot water basins.
- Cover hot water basins to minimise algae growth that contributes to fouling.
- Optimise blow down flow rate, as per COC limit.
- Replace slat type drift eliminators with low pressure drop, self extinguishing, PVC cellular units.
- Restrict flows through large loads to design values.

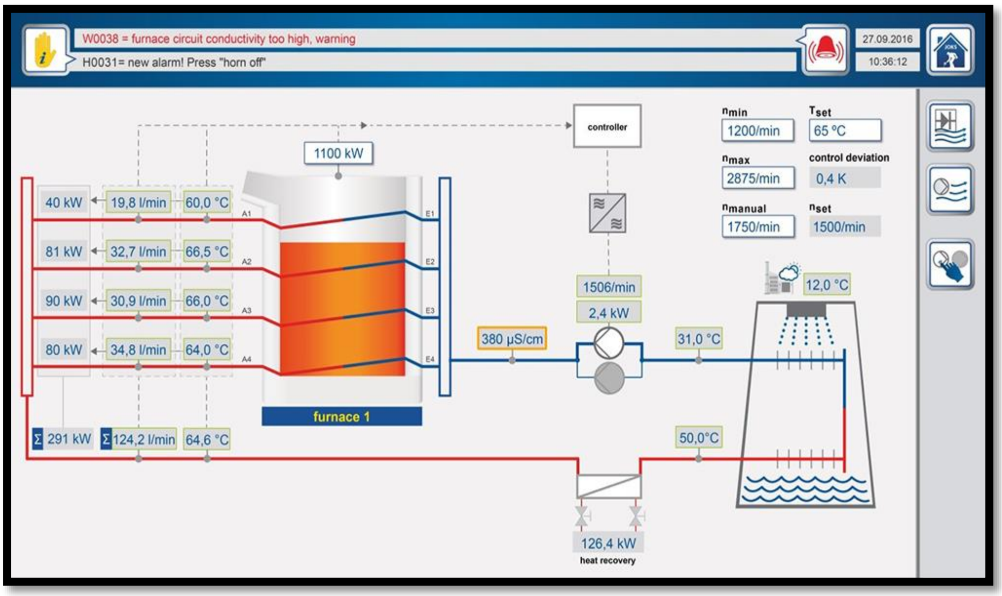
3.6.2: Heat Exchangers: Head duty, pressure drop, Temperature range, Heat Transfer Coefficient,

Physical Properties should be carefully monitored.

3.6.3: SMART ENERGY-EFFICIENT WATER RECOOLING SYSTEM:

It is observed that for an induction melting furnace to operate safely, a powerful water-cooling system must be in place to prevent overheating of the induction coil, the frequency converter and the capacitors.

In this context, particular importance is attached to a low energy consumption of the cooling water pumps and fans of the air cooler or evaporative cooler as well as to the capability of recovering a large amount of heat from the cooling water.



6. Conclusion:

The existing system, existing devices replaced with energy efficient devices. It can be seen that considering all the energy saving opportunities, there will be a huge amount of saving in electricity i.e. 1,07,930 kWh leads to 8.52 Lakhs of savings in a year. It requires the total investment of 5.66 lakhs with attractive payback of 1.5 years. These are very few basic steps that anyone can follow and conserve energy and thus reduce the bill amount and also contribute to fight against pollution, global warming and promise a better world to live.

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