

## Case Study: EA-251

### Energy Audit in Engineering Unit (Manufacturing - Refrigeration & Air Conditioning Compressors)

Total Savings in Energy Cost (Identified & Recommended) is INR 15.17 Million, which is 23.64% of Annual Energy Bill and GHG reduction of 1860 TCO<sub>2</sub>-e per annum

#### About The Installation

The plant, manufacturing Refrigeration & Air-Conditioning Compressors, has annual electricity consumption of about 3,164,000 KWh/year for main plant and 48,54,400 KWh/year for Ancillary plant. Annual HSD consumption is about 45.75 KL/Annum, annual furnace oil consumption is about 493.62 KL/Annum & annual LPG consumption is about 107 MT/Annum. Annual production of compressors is 2,50,000 nos. Total energy bill is Rs. 64.17 Million.

#### About The Assignment

Detail Energy Audit has been carried out in order to identify and recommend energy cost saving measures. This includes detail mass and energy balance of major energy consuming equipments like Decarb Furnace, Thermic Fluid Heater including its distribution & consumption points, Compressed air generation distribution & consumption and performance evaluation of Transformers, Motors, Air-conditioning units, Cooling towers, Lighting & others with the objective of identifying energy losses, quantifying various energy flows and comparing with benchmarks.

#### How did we Approach?

Energy audit has been carried out in 2 phases (Preliminary Energy Audit (PEA) and Detail Energy Audit (DEA)). Focus during PEA & DEA has been as follows:

##### 1. Preliminary Audit:

- ✓ Identifying quantity & cost of energy used in various form and total energy bill
- ✓ Departmental/Section/Process/Equipment wise energy consumption
- ✓ Correlating every energy input to production.

##### 2. Detail Audit:

In this portion "Scope of Audit" is focused and pursued in detail. Various measurements have been carried out to facilitate mass & energy balance and performance evaluation of all the energy guzzlers listed above. This Energy Balance has been studied and energy conservation measures are identified for optimizing end use energy efficiency and/or cost. Finally, based on the findings, recommendations for implementation of energy conservation measures are made based on technical feasibility, saving potential in energy cost, investment required and likely payback period.



Thermic Fluid Heater



Waste Heat Recovery System In Decarb Furnace

## Findings & Recommendations

1. Maximum demand can be controlled within the contract demand by installation of Maximum Demand (MD) Controller, which automatically trips the equipments for about 10 to 15 min without affecting the production. Savings achieved from this measure are about 8% in MD charges.
2. In Thermic Fluid Heater (TFH), It is observed that fresh atmospheric air is entering into it even when TFH is in OFF condition from opening of the blower due to natural convection because of the chimney, which itself is acting as one of the major load on TFH. This air is taking around 4.7 % of total available heat in TF. So it is recommended to make damper arrangement in the blower pipeline, which will avoid air passage through the TFH when it is OFF and will thus avoid air infiltration. Savings achieved from this measure are about 5% of FO consumption and corresponding reduction in GHG.
3. In Decarb Furnace, for Exo-gas generation LPG is used. HSD is also used in the furnace in "Burning-Zone" as a support fuel. Now with gasification technology, it is possible to "gasify" agricultural waste based briquettes. The product from this gasification is also "exo-gas" (rich in CO) which can substitute costly and GHG emitting fuel LPG & HSD. Gasification is conversion of solid fuel (Wood, Briquette, Coal etc.) into a combustible gas mixture normally called producer gas. This process involves partial combustion of such biomass. Partial combustion process occurs when air supply (O<sub>2</sub>) is less than adequate for complete combustion of biomass. Achievable savings are about 60% of LPG & HSD cost.
4. In TFH, further savings are possible by converting to briquette fired TFH. This means 50% savings in FO cost and corresponding GHG reduction.
5. In the paint shop paint temperature is to be maintained within a range 26 to 28 °C. For this the paint is first heated through hot water (of about 52 °C), which is heated by TF. The paint is then cooled by chilled water (of about 17 °C). In this continuous heating and cooling process significant amount of energy is wasted. This complete heating and cooling cycle can be replaced with only cooling process for more than 90% of the time. Energy required in will be 3% of total energy required earlier.
6. In Decarb furnace, moisture free Exo gas is required to avoid oxidation of "stator". For reducing moisture in Exo-gas, it is cooled to 11°C. In present situation, Exo-gas at 11°C is passed through furnace due to which there is significant cooling effect in the furnace and furnace requires more electrical heating to attain 800 °C (which is furnace inside temperature). It is proposed to preheat Exo-gas to a temperature of around 300 °C, so that it will reduce electrical heating required for raising the temperature of Exo-gas from 11 °C to 300 °C. Achievable savings are more than 15% of KWh consumption in the furnace.
7. In Exo-gas generation, the Exo-gas temperature is reduced by preheating the air, which in turns is used in burning zone of the furnace. Its present temperature is not sufficient to attain the required temperature in the burning zone. Therefore HSD firing is necessary. At present last stage of Heat Recovery Unit (HRU) is unused. It is recommended to use the last stage too so that the required temperature can be attained and thus HSD fired burners can be completely eliminated. For this present air blower is required to be replace with new "roots-blower" to increase the head. This will eliminate use of 8.2 KL of HSD per annum.
8. Cooling water requirement of compressor & decarb furnace is presently being served by three different Cooling Towers, which can be served by only one cooling tower. It is recommended to shift present cooling tower of decarb in between decarb section and the compressor room sheds, which will also reduce the head loss. This head loss is presently very high due to the elevation. This will also reduce pumping power requirement and result in 70 % saving in present cooling tower energy consumption.
9. By reducing leakage level in compressed air system to 5 % (which is 30% now). The energy consumption reduction will be about 30% of present compressed air consumption.



### SEE-Tech Solutions Pvt Ltd

(Consultants & solution providers for Industrial Safety, Energy Conservation, Environment Protection & Application Software)

"Lets Conserve", 11/5, MIDC Infotech Park, Near VRCE Telephone Exchange, South Ambazari Road, Nagpur-440022 (India)

Ph. No. +91-712-2222177, Fax No. +91-712-2225293

E-mail: [seemil\\_ngp@sancharnet.in](mailto:seemil_ngp@sancharnet.in) Web: [www.letsconserve.org](http://www.letsconserve.org)