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# Energy Management in an Energy Intensive Industry

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1. Abstract: The gap between supply and demand of energy is continuously increasing despite huge outlay for energy sector since independence. The gap between supply and demand of energy can be bridged with the help of energy conservation which may be considered as a new source of energy which is environment friendly. Energy conservation has now become a necessity. Considerable energy saving is possible through proper choice of equipments, and their effective use. The only feasible way to handle energy crisis, apart from capacity addition, is the efficient use of available energy. For this there is a need of optimizing energy, using standard systems and procedures so as to reduce energy requirements per unit of output. The energy conservation is cost effective with a short payback period and modest investment. There is a good scope of energy conservation in various sectors, viz. , industry, agriculture, transport and domestic.

2. Introduction: The energy audit can unearth huge profits to the industry. The industrial sector has failed to take full advantage of many financial incentives provided by the government to encourage energy conservation strategies. The energy Audit is considered as one of the comprehensive methods in checking the energy usage and wastage in industry hence helps in energy management.[1-3]

   Energy audit is an important commercial tool to save energy and to improve financial state of an organization. Almost all the large scaled and many small scaled organizations i.e industries as well as non-industrial sectors are conducting energy audit to save energy and to minimize the electricity cost.[4]

   Common types/levels of energy audits are distinguished below**:**

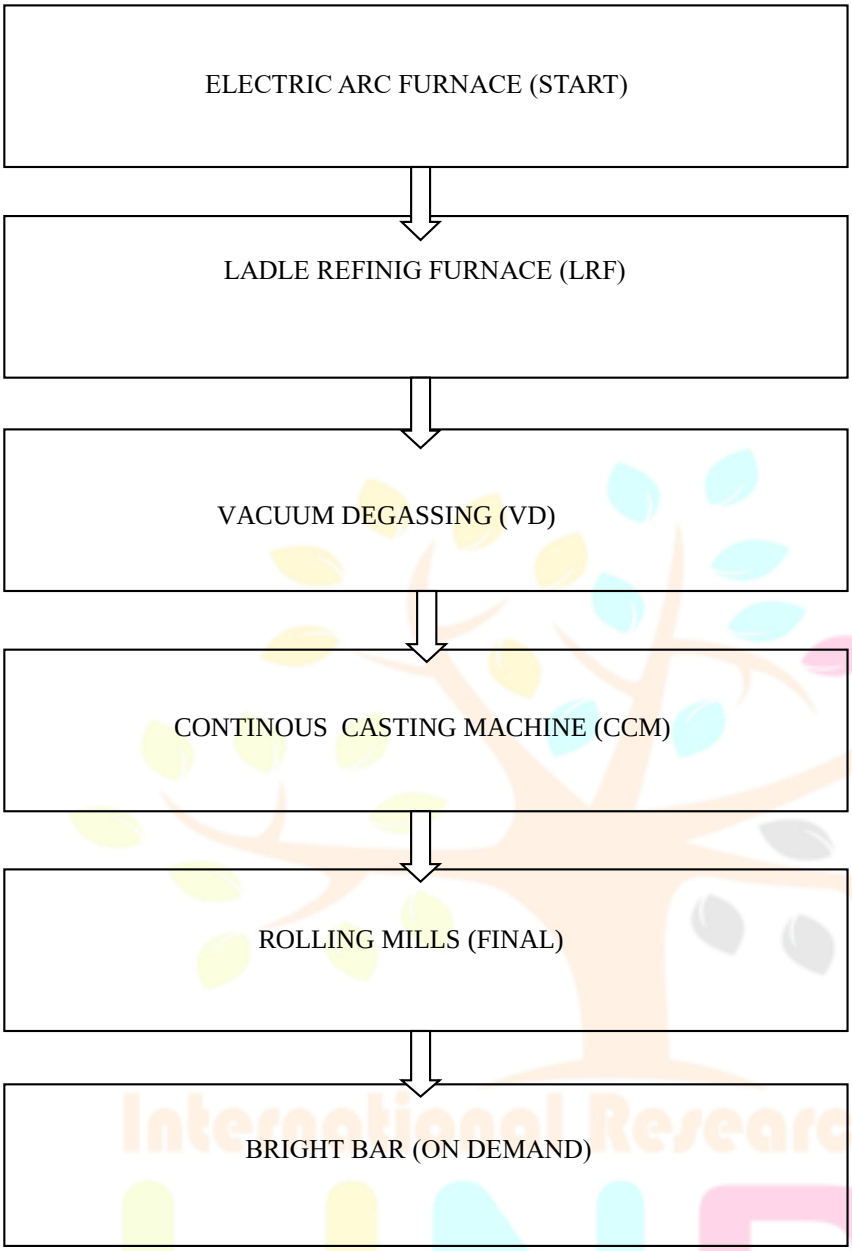
   Level 0 – Benchmarking: This first analysis consists of a preliminary Whole Building Energy Use (WBEU) analysis based on the analysis of the historic utility use and cost and the comparison of the performances of the building to those of similar building. This benchmarking of the studied installation allows determining if further analysis is required or not.[5-7]

   Level 1 – Walk-through audit: Preliminary analysis is made to assess building energy efficiency to identify simple and low-cost improvements, but makes a list of energy conservation measures (ECMs), or energy conservation opportunities (ECOs) to orient the future detailed audit. This inspection is based on visual verifications, study of installed equipment, operating data and detailed analysis of recorded energy consumption collected during the benchmarking phase.[8-10]

   Level 2 – Detailed/General energy audit: Based on the result of the pre-audit. This type of energy audit consists of survey of energy usage in order to provide a comprehensive analysis of the studied installation, a more detailed analysis of the facility, a breakdown of the energy use and a first quantitative evaluation of the ECOs/ECMs selected to correct the defects or improve the existing installation. This level of analysis can involve advanced on-site measurements and sophisticated computer based simulation tools to evaluate precisely the selected energy retrofits.[11]

   Level 3 – Investment-Grade audit: Detailed analysis of Capital-Intensive Modifications focus on potential costly ECOs, requiring rigorous engineering study.[12-13]

3. Proposed Work: Process of a Steel Industry**:**




Scope of Work: Energy Audit has been done in the following areas:-

Power System: Study of optimum improvement of power factor for Punjab State Power Corporation Ltd. supply and self generation, monitoring of voltage, current, active/reactive power demand and peak hour power demand and rationalization of power demand from state electricity board and self generation to minimize energy bills.

Motors: Motor load analyses for all big and medium size motors (greater than 10 HP) motor burn out rates and causes, motors swapping/replacement to maximize drive efficiency.

Diesel Generator Set: Determination of specific generation factor for individual DG set and comparison with the performance guaranteed for establishment of margin for improvement.

Lighting: Study of existing lighting system in the plant and township improvement of the existing lighting efficiency, suitable replacement of the lamps with energy efficient lamps, replacement of insufficient luminaries, latest controls in lighting (i.e. voltage controls, levels controls, occupancy sensors etc.) to reduce lighting energy conservations

4. Results And Discussion: Based upon the analysis done, following recommendations ( with pay-back Period) are made for the energy management in a typical energy intensive industry:-

Installation Of Additional Capacitor Banks On The Main Incoming Power Supply HT Side

Total saving per annum by improving power factor from 0.94 to 0.99 at 11 KV

= distribution loss saving + KVA demand reduction ( Except rebate from PSPCL)

= Rs. 91.2 lacs/annum

Total Estimated Investment for providing 2000 KVAR CAPACITOR BANK consisting of four steps of 500 KVAR, 11KV APFC panel (for one 11 KV 400 Amps 350 MVA vacuum Circuit breaker and a Bus coupler VCB based along with HT capacitors)

= Rs. 50 lacs

Simple payback period = 6 months

Replacement of under loaded motors with appropriate/ smaller capacity ENERGY EFFICIENT motors

Total Saving after Implementation = Rs. 32.5 lacs / annum

Total Estimated Investment = Rs. 10.78 lacs

Simple Payback Period = 4 months

Replacement of Conventional Tube Lights of 40 W with Energy Efficient Tube Lights of 28 W

| | |
|---|---|
| Energy Savings per annum | Rs. 1.01 Lacs (20,440 KWH) |
| Estimated Investments @ Rs. 450 /lamp | Rs. 0.98 Lacs |
| Simple Payback Period | 10 - 15 Months |

Replacement of HPSV 250 W lamps by 150 W MH lamps:

| | |
|---|---|
| Energy Savings per annum | Rs. 1.64 Lacs (33215 KWH) |
| Estimated Investments @Rs. 5000/lamp | Rs. 4.7 Lacs |
| Simple Payback Period | 36 – 37 Months |

Replacement of HPSV 150 W & HPMV 150 W both lamps by 70 W MH lamps:

| | |
|---|---|
| Energy Savings per annum | Rs. 0.43 Lacs (8689.92 KWH) |
| Estimated Investments @ Rs. 3500 /lamp | Rs. 17.71 Lacs |
| Simple Payback Period | 30 Onths |

Conclusion: Electrical energy is the most flexible type of energy since it can be converted to any form and can be transferred with equal ease. With every passing year the demand of electrical energy rises much higher than its supply. And therefore the only way to plug this gap is ti identify the places where it can be conserved.

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