Energy Saving Measures Implemented in Auxiliary Motors in a Medium Scale Foundry - A Case Study

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Abstract
Energy Efficiency Improvement in Auxiliary Motors in a medium scale foundry industry resulted energy savings in sand plant cooler and shot blast machine as below:
1. Sand Plant Cooler Motor
Existing Motor: 20 HP, Energy consumption = 11.6 kWh (hourly basis)
New Energy-Efficient Motor: 20 HP, Energy consumption = 10.0 kWh (hourly basis)
Daily Energy Savings for 20 hrs / day: 11.6 − 10.0 = 1.6 kWh x 20 = 32 kWh/day
Energy Savings Percentage: ≈ 14% through design modification and improved motor efficiency.
2. Shot Blast Machine – Impeller Motor
Existing Motor: 20 HP, Energy Consumption = 8.7 kWh
New Energy-Efficient Motor: 20 HP, Energy Consumption = 7.7 kWh.
Daily Energy Savings for 12 hr/ day : 8.7 − 7.7 = 1.0 kWh x 12 = 12 kWh/day
Energy Savings Percentage: ≈ 11.5% through design modification and improved motor efficiency. The combined replacement of these two motors results in 44 kWh/day savings. Over 300 operating days per year, this translates to 13,200 kWh/year, reducing both operating costs and carbon footprint. CO_2 reduction achieved per annum is 9.372 ton and its oil equivalent is 1.135 mtoe.

Introduction

Electric motors are the key drivers in foundry industries and they run auxiliary loads like air compressors, sand processing systems, cooling pumps. In all these systems motors account for a significant share of the energy consumption, as they often operate continuously. Many older motors installed in plants tend to have lower efficiency, leading to higher energy consumption. As part of energy efficiency improvement measures, the existing sand cooler motor and one impeller motor of the shot blast machine were replaced with high-efficiency motors, resulting in reduced energy usage and improved performance.

In a medium-scale foundry unit based near Coimbatore, energy-saving motors were replaced in the sand cooler and shot blast machine by older motors. This replacement led to notable energy savings, enhancing performance along with operating efficiency. Replacing the existing motors with high-efficiency motors helped the foundry minimize energy consumption and lower its ecological footprint. This case study delves into the specifics of the energy savings, cost advantages, and green benefits of these upgrades and how such similar actions can assist other foundries in optimal energy management and sustainability.

Factors Affecting Motor Efficiency and Associated Losses

- Motor efficiency is a factor of a variety of mechanical and electrical imperfections within the motor.
- Resistance (I2R) losses in the stator windings and rotor bars can constitute up to a 15 % loss in efficiency in three-phase motors.
- Magnetization losses in the stator and rotor cores cause about a 1%

to 7 % efficiency loss.

- Friction losses in the bearings and inefficiency in the cooling fans result in 0.5 % to 1.5 % percent loss in motor efficiency.

Performance Comparison and Energy Saving

A reputed medium scale foundry unit located near Coimbatore implemented this technology. The average liquid metal production is around 30 MT/day. After conducting a detailed energy audit, proposal was made to replace old inefficient (IE1) motors with new energy efficient (IE3) motors in Sand cooler and shot blast machine. The comparison of new and old motor I terms of energy efficient and energy use are presented in Table 1 & 2.

Table 1 Comparison of Old and New Motor Performance – Sand Cooler

Design Parameter	Existing	Present
Sand Plant cooler motor	20 hp	20 hp
Make	Siemens	Emerge Wagner
Motor efficiency	Old one (< 88%)	90.4% (IE1)
Average energy consumption per hour	11.6 kWh	8.7 kWh

Table 2 Comparison of Old and New Motor Performance – Shot Blast Machine

Design Parameter	Existing	Present
Shot Blast Impeller Motor	20 hp	20 hp
Make	Siemens	Bharat Bijilee
Motor efficiency	Old (<88%)	90.3% (IE3)
Average energy consumption per hour	8.7 kWh	7.7 kWh

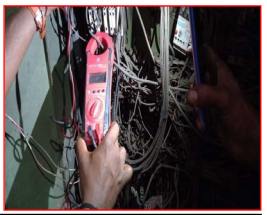
The typical economic analysis for Energy Efficient motor is presented in Table 3.

Table 3 Cost Benefit Analysis for Energy Efficient Motor

Parameter	Value	UoM
Energy savings per day	44	kWh
Energy savings per year @ 300 days	13200	kWh
Cost savings in Rs	1.06	Lakhs
Investment cost in Rs	1.3	Lakhs
Payback period	1.22	Year

Visuals of Implementation

Sand Blast Motor



Measuring Electrical parameters

Name Plate Details of New EE Motor – 20 HP Emerge Wagner Make

New Motor – 20HP Bharat Bijilee make

Conclusion

An energy study was conducted on both the sand plant cooler motor and the shot blast impeller motor. The findings show a total energy savings of approximately 44 kWh/day after replacing the existing motors with energy-efficient motors.

This improvement translates to 13,200 kWh of annual savings in electricity (based on 300 operating days per year). Overall, the intervention achieves around 12% electrical energy savings, enhancing operational efficiency while reducing electricity costs and carbon footprint.

Achievement in emission reduction in terms of CO_2 reduction per year is 9.372 ton which is equal to 1.135 mtoe.