UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

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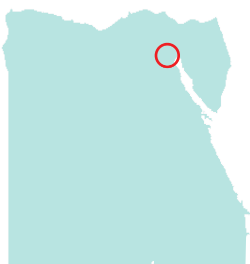
Industrial Energy Efficiency Project Motor System Optimization

Electric motor driven systems globally consume approximately 70% of the electrical consumption in industrial sector. This case reviews the optimisation of motor systems regarding the laminar flow system and ladle refining furnace booster systems in order to identify opportunities for saving the energy efficiency, use and consumption by that system. The study revealed that for the major motor system savings assessed in this plant save 27,936,110 kWh (or 15,640,220 EGP) per annum at an investment cost about EGP 22,154,000.

EGYPT

A Case Study of EFS Company

Ezz Flat Steel Snapshot



ndustry: Steel
Location: Suez, Egypt
Product: Steel HRC, Billet and Rebar
Implementation cost: 22,154,000 EGP
System: Laminar Flow and Ladle Refining Furnace (LFR) booster fan systems
Annual energy savings: ~27.94 GWh
Financial savings: ~15.64 Million EGP/year
GHG reduction: ~ 14,990 tCO_2eq (10 y)
Overall payback: 1.4 years

The Ezz flat steel (EFS) is located in Ain Al Sokhna, 4th industrial zone, Suez, Egypt with a short distance from the port and local market and at the canter of international consumer market. Ezz flat steel is considered the largest producer of steel in the Middle East and is the market leader in Egypt holding more than 10,000 employees. The company production capacity riches 1,345,123 ton of molten steel, 1.175.000 ton of HRC, 1,316,902 ton of Billet and 1,020,824 ton of rebar.

MSO at EFS and the IEE Project

The Industrial Energy Efficiency Project (IEE) is a program developed and initiated by UNIDO to promote energy efficiency in industry as part of its primary objective of “promoting and accelerating inclusive and sustainable industrial development in developing countries and economies in transition.”

The Motor Systems Optimization (MSO) Project forms part of the IEE Project and has the specific objectives of developing local personnel to become competent in the application of energy efficiency in industry in order to unlock the potential for energy savings within their respective local industries.

EFS has joined the IEE Project to implement an energy management system for its production facility in Ain Al Sokhna. It needs to reduce operating costs to remain competitive in the global market. The mandated electricity tariff increases have also contributed to this need to improve energy efficiency. Since motors consume a large proportion of electrical energy, EFS has focused on motor system improvements.

Summary of Optimization Strategies

Saving Opportunity	Energy Savings (kWh/year)	Financial Savings (EGP)	Capital Cost (EGP)	Payback (Year)
LFS: Motors upgrade for two pumps	813,440	408,890	1,054,000	2.5
LFS: Minimization of over supply	900,000	450,000	This Opportunity is achieved by using benefits of Opportunity 4	
LFS: Stop system 4 hours per day	1,562,670	781,330	---	Immediately
LFS: Reducing consumption during inter-gap time	770,000	440,000	---	Immediately
LRF: Downsizing pumps (Already exists)	1,200,000	680,000	---	Immediately
LRF:Installation of VSD's	4,950,000	2,810,000	3,600,000	1.3
LRF: Installation of Additional VSD's	17,740,000	10,070,000	17,500,000	1.7
Total:	27,936,110	15,640,220	22,154,000	1.4

Case Description

Large motor systems within the utility plants were identified as a pilot project. The utility plant was perceived to have a low production and business risk. Successful implementation could realize energy savings but also serve as a stepping stone to realize more energy savings in other areas of production.

The motor system has been selected based on the available opportunities of reducing electricity consumption of two systems; the laminar flow system (LFS) and the Ladle Refining Furnace booster fan (LRF).

Optimization Strategies

The laminar flow pump consists of 5 pump motors with 280 kW for each pump motor. One standby pump motor and 4 motors are running continuously in full speed to pump the laminar flow water regardless the true process requirements where during inter gap time, all cooling water headers are closed and all pumped cooling water returns back to the main tank without actual utilization.

The LRF booster fan system which is part of the fume treatment plant in the melt shop area is selected because it is part of the fume treatment plant which is responsible for dust and fume disposal. Another reason is that this system is under the boundaries of my responsibility and it will be easier to collect all the required data. 4 possible opportunities for energy saving in LRF booster fan system were identified. First one installing new efficient motor instead of the standard one, second reduce the size of the spare motor and purchase efficient one, installing VSDs as a control strategy and the last one is replacing the V belt with synchronous belt and install a higher efficiency fan.

Outcome

As an outstanding result from the laminar flow system assessment is the calculation done in the first opportunity that convinced the decision makers in the company to provide the investment required to purchase the original component of the system after they confirm the financial benefits of this investment.

For the LRF booster fan the company top management agreed to start the implementation of the first opportunity to purchase the spare motor of the LRF booster fan with the specification of high efficient motor. Then they will think about installing the VSD as a control strategy. But regarding the reduction in motor size, maintenance and operation departments will consider to investigate the applicability of this option.

Lessons Learnt

- Upgrading the spare motor is more promising than replacing the existing motor with efficient one,
- At no production time, it is crucial to stop the motor system,
- Installing VSD could be an attractive option if the environment is good

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