UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

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 optimization of a vacuum pumps system within a large industrial plant in the Textile manufacturing sector. The study revealed that for the vacuum pump system assessed in this plant about 55,345 kWh per annum could be saved (or EGP 48,100) at an investment cost of EGP 3,000.

EGYPT

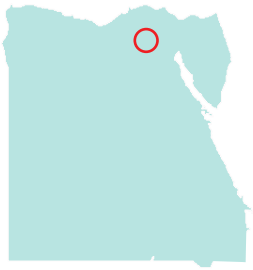
A Case Study of Arafa Group Company

Arafa Group Snapshot

Industry: Textile

Location: 10th of Ramadan, Sharqia, Egypt

Product: ready-made garments



Implementation cost: 3,000 EGP
System: Vacuum Pump System
Annual energy savings: ~55,345 kWh
Financial savings: ~48,100 EGP/year
GHG reduction: ~29 tCO_2eq
Overall payback: Immediately

Arafa Holding is a leading global textiles and apparel manufacturer and retailer based in Egypt, with a network reaching more than 70 countries worldwide. The group serves a diverse global audience, including top international brands and global retailers. Joint ventures have seen the company gain ownership of prestigious leading brands and partner with leading fashion houses.
Today, Arafa Holding is a leading fashion and apparel manufacturer and retailer accounting for 10% of Egypt's garments exports.

MSO at Arafa Group 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.

Egypt Tailoring Company (ETC), one of the Arafa Group of companies, is considered as a pilot plant for the IEE in the MSO as well as other components. The company is one of the pioneer companies in Egypt, working on the manufacturing of ready-made garments. They are in the process of developing an Energy Management System (EnMS) with the assistance from the IEE, and the MSO serves pretty well in developing saving opportunities for the company.

Summary of Optimization Strategies

Saving Opportunity	Energy Savings (kWh/year)	Financial Savings (EGP)	Capital Cost (EGP)	Payback (Year)
Load sharing between vacuum pumps	19,800	12,270	Low	< month
Pulleys alignment of the transmission system	13,400	8,750	---	Immediately
Using synchronous belts instead of V-belts	13,400	21,400	3,000	2 months
Switch off vacuum pumps during break	8,745	5,680	---	Immediately
Total:	55,345	48,100	3,000	Immediately

Case Description

The factory is divided into three standalone production facilities; ETC1, ETC2, & ETC3. The focus of this study is relevant to ETC1, which is subdivided into three main subsections termed Jacket 1, Jacket 2, & Trousers 1.

The vacuum pumps system from the Utilities department was selected for this case study to be analyzed. The reason of selecting the vacuum pumps system is that the utilities department accounts for around 27% of the electric consumption of ETC1, and thus this department is considered as a SEU for ETC company. Any savings proposed for the users of the utilities section should highly impact the overall electric invoice of the company.

Optimization Strategies

Through the site survey conducted in the vacuum pump system seven opportunities, three of them are not studied yet which are eliminating and minimizing the leaks, Waste heat recovery and introducing better control strategy and the rest have high potential saving will be explained below in details.

The other opportunities showed a great energy saving potential with low cost and payback so that it can be implemented easily. Two of them which are aligning the pulleys of the transmission system and Switching off vacuum pumps during break have no CAPEX and immediate payback.

The other opportunities which are Load sharing between vacuum pumps and Using synchronous belts have low cost and low payback.

Outcome

The outcomes of the assessment have shown that annual energy saving is representing around 6% overall saving from the vacuum pumps baseline consumption in load sharing between vacuum pump opportunity. In addition to the elimination of the high replacement frequency of the belts, This option may also save around 3% of the transmission efficiency assuming that with the current conditions the belts are loosely tight.

It's highly recommended by the consultants to use synchronous belts as they are a highly efficient alternative for the currently used V-belts. This replacement will result in an energy saving for each pump by 6.4%.

Lessons Learnt

In conducting this case study, the main challenges experienced were:

- Selecting the suitable and proper system for the case study. The company is extremely large, with many small motors.
- Unavailability of all needed technical data. The data sheets and manuals from the manufacturers didn't include all the required data related to the vacuum requirements. Moreover, few manuals for some equipment were not available to the consultants.
- The actual vacuum load requirements for each equipment were not available. Hence it is difficult to define the actual required vacuum load
- The installed pressure gauge (company property) following the vacuum pump A was not functioning properly, leading to an indication that the pressure of vacuum pump A is higher than the other two pumps.

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