UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

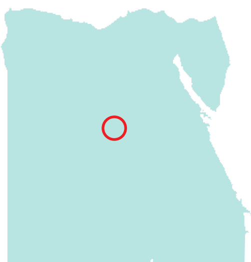
Industrial Energy Efficiency Project Motor Systems Optimization

Electric motor driven systems globally consume approximately 70% of the electrical consumption in industrial sector. This case reviews the optimization of some different motor systems within a large industrial plant in the petroleum sector. The study revealed that for the systems assessed in this plant 730,000 kWh per annum could be saved (or EGP 510,000) at an investment cost of EGP150,000.

EGYPT

A Case Study of Assuit Oil Refining Company (ASORC)

ASORC Snapshot



Industry:
Oil Refinery
Location:
Assuit, Egypt
Product:
Petroleum Products (Gasoline, Kerosene, Gasoil, Fuel Oil and LPG)

Implementation cost: ~150,000 EGP
System: Air Coolers & Cooling Water Systems
Annual energy savings: ~0.73 GWh
Financial savings: ~510,000 EGP p.a.
GHG reduction: ~3980 tCO2eq (10 y)
Overall payback: 4 months

About ASORC

ASORC is a refinery established in 1984, to meet upper Egypt needs of petroleum products.
AASORC started production with One Crude Distillation Unit (CDU) with Production capacity of 2.5 million tons per year (MT/Y), Vacuum Distillation Unit (VRU), Utility and storage tanks.
In 2002, ASORC started up a new CDU to increase the production capacity to 4.5 MT/Year. In 2016, a new VRU was added to accommodate the growing demand

MSO at ASORC 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.

ASORC joined the IEE project as a part of the cooperation with Egyptian Ministry of Petroleum represented by Oil and Gas Sector Modernization project (Group 4B). ASORC is committed to improve energy efficiency where it was investigated that there is a good opportunity for MSO in existing plant and in new plant that is still under construction.

The company consumes about 41,300,000 kWh of electrical energy annually where the tariff was EGP0.709 (in 2017/2018) . Therefore, ASORC has focused on improvements related to electric motor driven systems.

Summary of Optimization Strategies

System	Saving Opportunity	Annual Energy Savings [kWh p.a.]	Financial Savings [EGP p.a.]	Investment [EGP]	Payback [years]
Fuel Oil Air Cooler Fans	1. Switching off the fans in winter	75,000	53,000	0	0
	2. VSD Installation	31,000	22,000	30,000	1.35
Fractionator Condenser Air Cooler Fans	1. Maintenance for Tow low Performance Motors	137,000	97,000	0	0
	2. Replacing Tow low Performance Motors with new IE2 Motors	158,000	111,000	120,000	1.1
Cooling Water System	1. Operational Control for Cooling Tower	73,000	51,000	0	0
	2. Operational Control for Circulation Pumps	240,000	170,000	0	0
	3. Operational Control for Cooling Fans	155,000	110,000	0	0

The Case

ASORC Energy Team has identified three systems for starting MSO implementation. First, fuel oil air cooler fans including two fans driven by 18.5 kW motors (one fan in operation 24/7). Second, fractionator overhead condenser air cooler fans including eight fans driven by 22 kW motors (six fans in operation 24/7). Third, cooling water system including cooling tower, five circulating pumps (two new pumps and three old pumps with less discharge pressure), and three cooling fans.

The assessment involved reviewing process requirements, reviewing historical data, taking system measurements and developing optimization solutions.

Optimization Strategies

For the fuel oil cooler, it was investigated that the fuel oil after passing the cooler entering the storage tank which includes a steam heating coil to keep constant temperature at the tank. Hence, the idea was to switch off the fan and stop the heating coil by isolating the steam inlet valve. This action has already been taken without any effect on operation. It is expected to be effective at least during 8 months of the year. For summer 4 months, a VSD can be installed so that a fan can be running according to weather conditions.

For the fractionator condenser, two fans were identified with lower performance as their motors consumes higher current than the motors for other fans operating in similar conditions. Replacing those two low performance motors with another existing one or performing maintenance to them resulted in decreasing their consumed current to reach the normal value. This no cost temporary action was taken while replacing the two lower performance motors by new IE2 motors is in progress that can increase the annual savings.

Three optimization strategies for cooling water system were addressed including (i) maintenance and cleaning of the cooling tower, (ii) operating three smaller pumps for at least six months of cool weather conditions instead of two small pumps and one large pump all over the year, and (iii) apply new operating philosophy such that three fans to be in operation at lower speed during winter instead of two fans in operation at higher speed along the year.

Outcome

For the fuel oil air cooler, option 1 (switching off the fans) was implemented while option 2 is still under study. For fractionator condenser, option 1 was temporary implemented till receiving the new motors as per option 2. For cooling water system, the three options are in progress. Total savings amount to 732,000 kWh (or EGP510,000) per annum at an investment cost of EGP150,000.

Lessons Learned

Focusing on MSO affects energy efficiency issues in company new project (under construction) where all ordered motors are IE2 or IE3.

Energy efficiency work has a significant effect on identifying some existing drawbacks in design.

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