UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Industrial Energy Efficiency Project
Motor System Optimization

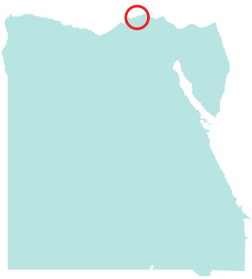
Electric motor driven systems globally consume approximately 70% of the electrical consumption in industrial sector. This case reviews the optimisation of motor systems regarding the Ammonia cooling tower system in order to identify opportunities for saving the energy efficiency, use and consumption by that system. The study revealed that for the major motor system savings assessed in this plant save 1,500,760 kWh (or 38,865 EGP) per annum at an investment cost about EGP 25,880.

EGYPT

A Case Study of MOPCO Company

MOPCO Snapshot

Industry: Chemical
Location:Damietta, Egypt
Product: Liquid ammonia and Urea



Implementation cost: 25,880 EGP
System: Ammonia Cooling System
Annual energy savings: ~1,5 GWh
Financial savings: ~38,865 EGP/year
GHG reduction: ~814 tCO_2eq (10 y)
Overall payback: 9 months

MOPCO is one of the petroleum sector companies established over 400.000 meters square. MOPCO produces Urea as a main product and liquid ammonia. MOPCO is producing approximately 1200 metric tons per day (mtd) of Ammonia (UHDE technology), 1925 mtd urea Granulation (Stamicarbon technology).

MSO at MOPCO 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.

MOPCO has joined the IEE Project to implement an energy management system for its production facility in Damietta. 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, MOPCO has focused on motor system improvements.

Summary of Optimization Strategies

Saving Opportunity	Energy Savings (kWh/year)	Financial Savings (EGP)	Capital Cost (EGP)	Payback (Year)
Motor upgrading	35,000	910	690	0.7
Install VSD with the existing motors	625,000	16,185	8,500	0.5
Upgrading motor and installing VSD	660,000	17,090	16,690	1.0
Change blade angle	65,560	1,700	---	Immediately
Stop fan at no demand	115,200	2,980	---	Immediately
Total:	1,500,760	38,865	25,880	0.7

Case Description

The plant have around 450 motors, the biggest 27 motors are considered the electrical SEUs where they consumed 78 % of total electrical consumption. The selected motors system is the Ammonia cooling tower which represents 22.1% of total motors electrical consumption and represents 28.2 % of the significant motors consumption. Currently there is no control strategy for the cooling tower and the fans are running at 100 % load, regardless of the water temperature.

Optimization Strategies

The cooling tower system fans are 6 fans driven by 6 motors with rated capacity of 160 KW. One of the most effective opportunities is applying variable speed drive control systems for pumps and fans, but due to design restriction to change the flow velocity through the heat exchanger and the capacity of a cooling tower depends strongly on airflow rates. The Implementation of variable speed drive control systems will be applied only for fans. Five possible opportunities for energy saving in cooling fans system were identified. First opportunity involved using high efficient motor as a stand by motor in case of failure of old motor and calculations are based on the different in prices between the two motors. Second opportunity involved installing variable speed drive to control the fans speed. The third opportunity is a combination between the two mentioned above opportunities. The fourth opportunity is to stop one of the ammonia cooling tower fan during winter season and night shift under certain circumstance and the last opportunity is to decrease the blade angle of fan from 10.1 to 9.5 degree during winter session due to the ambient temperature decrease and the temperature difference decreases as well.

Outcome

After the comparison between the opportunities mentioned above, it is recommended to start with the optimization with the no cost opportunity which is to stop one fan at low ambient temperature and to be caution not to destroy the sprayers .

Then we can go forward after showing improvement and saving to install a VSD to control fan speed with temperature difference change.

And in case of the existing motor fail, we recommend to purchase the new one with the specification of efficient motor.

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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