UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Industrial Energy Efficiency Project
Motor System Optimization

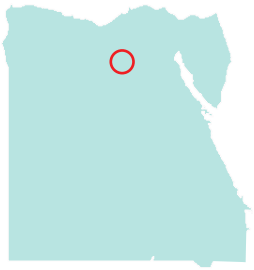
Electric motor driven systems globally consume approximately 70% of the electrical consumption in industrial sector. This case reviews the optimisation of motor systems in The Egyptian Salts and Minerals Company (EMISAL) regarding the cooling tower system in order to identify opportunities for saving the energy efficiency and consumption by the system. The study revealed that for the major motor system savings assessed in this plant save 854,400 kWh (or 655,325 EGP) per annum at an investment cost about EGP 664,465 for the selected scenario.

EGYPT

A Case Study of EMISAL Company

EMISAL Snapshot

ndustry: Salts and Minerals
Location: Fayoum, Egypt
Product: Na2SO4, NaCl



Implementation cost: 664,465 EGP
System: Cooling tower pumps and fans
Annual energy savings: ~854,400 kWh
Financial savings: ~655,325 EGP/year
GHG reduction: ~ 494.7 tCO_2eq (10 y)
Overall payback: 1.8 years

The Egyptian Salts and Minerals - EMISAL Company factories are located directly on the southern shore ofLake Qarun, Fayoum Governorate where the company has established its factories and facilities on 1,750 acres. EMISAL company extract salts from Lake Qarun as Anhydrous sodium sulphate (Na2SO4), with a production capacity of 120,000 ton/year, Sodium Chloride (NaCl) with a production capacity of 150,000 ton/year, and Magnesium Sulphate (Mg2SO4.7H2O) with a production capacity of 27,000 ton/year.

MSO at EMISAL 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.

EMISAL has joined the IEE Project to implement an energy management system for its production facility for addressing the potential energy measures in its motor system. 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, EMISAL has focussed on motor system improvements.

Summary of Optimization Strategies

Saving Opportunity	Energy Savings (kWh/year)	Financial Savings (EGP)	Capital Cost (EGP)	Payback (Year)
Shading the outdoor pumps to eliminate Derating	4,050	3,105	1,500	0.48
Installing VSD for pump C	338,300	259,475	309,960	1.2
Installing VSD's for pumps C and B	429,500	329,460	619,920	1.88
Replace fans' blades	158,850	121,840	105,415	0.86
Controlling three fans with One VSD	691,500	530,380	557,550	1.05
Replacing Fans' motors with IE3 motors	12,300	9,435	717,565	> Lifetime
Total:	1,634,500	1,253,695	2,311,910	1.80

Case Description

The company includes four plants that produce several types of salt products where 15 Million m3/y of water is pumped from the Lake into a number of concentration ponds to be concentrated by solar energy; the concentrated brine from the 4th pond is pumped into the facility plants for processing.

The Sodium sulphate plant two cooling towers (main cooling tower and small cooling tower); where the main cooling tower consists of three IE3 pumps 200 kW each and three fans 55 kW each. The cooling tower feed the electricity generation plant and the refrigeration unit.

The assessment involved reviewing process requirements, reviewing historical data, taking system measurements and developing optimisation solutions. This approach requires the engineers to develop a strong understanding of the system efficiency, operation and control conditions, as well as maintenance practices impact.

Optimization Strategies

The study identifies six possible opportunities for energy saving in The Sodium sulphate plant. The first one is to Shade the outdoor pumps for Derating elimination. The second one is to Install VSD for pump C to improve motor efficiency which represents good opportunity to save costs. The third one is to Install 2 VSD for Pump C and B.

The fourth one is to Replace fans' metallic blades by efficient hollow FRP blades that will result fan energy savings of minimum 15% (also increases the life of the gear box, motor and allows for easy handling and maintenance).

The fifth one is to Control three fans with One VSD. The sixth one is to Replace Fans' motors with premium efficiency motors (IE3) (with high initial calculated payback).

Outcome

There are three developed scenarios:

Scenario 1 opportunities 1, 2, and 4 which will lead to 1.9% of the total electric energy consumed by sodium sulphate plant.

Scenario 2 opportunities 1, 3, and 4 which will lead to 2.26% of the total electric energy consumed by sodium sulphate plant.

Scenario 3 opportunities 1, 4, and 5 which will lead to 3.26% of the total electric energy consumed by sodium sulphate plant.

As conclusion scenario 3 shows the best main indicators and awarded highest score (9.63 of 10 points) and ranked in the first place. The total savings amount of 854,400 kWh (or EGP 655,325) per annum could be saved at an investment cost of about EGP 664,465.

Lessons Learnt

Applying a structured approach to MSO can often realise with low cost requirements. This case only realises around 1.72% of total energy consumption of The Egyptian Salts and Minerals Company.

EMISAL now realize the total potential savings as it has many other large motors systems at the plant that could also be epitomized. Using a continuous improvement approach it intends to realize these savings in future projects.

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