UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

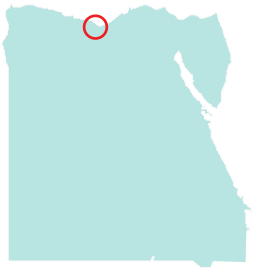
Industrial Energy Efficiency Project
Motor System Optimization

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 cooling water system, intake system and makeup water 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 30,579,280 kWh (or 17,150,020 EGP) per annum at an investment cost about EGP 23,880,000.

EGYPT

A Case Study of SIDPEC Company

SIDPEC Snapshot



Industry: Petrochemicals
Location: Alexandria, Egypt
Product: Ethylene, polyethylene, LPG, and Butene-1
Implementation cost: 23,880,000 EGP
System: water cooling tower System intake and makeup water systems
Annual energy savings: ~30.58 GWh
Financial savings: ~17.2Million EGP/year
GHG reduction: ~ 16,512 tCO_2eq (10 y)
Overall payback: 1.4 years

SIDPEC is an Egyptian joint stock company established on 16 November 1997. SIDPEC area is 180.3 acres located in El-Nahda territory, El Amreya, Alexandria. The trade name of SIDPEC polymers is named "EGYPTENE®" polymer portfolio. SIDPEC has a production of 225,000 Ton/Year of Poly-Ethylene, Ethylene (285,000 Ton/Year), LPG (50,000 Ton/Year) and Butene-1 (10,000 Ton/Year). SIDPEC has its continuous operation through two shifts per day in seven days per week.

MSO at SIDPEC 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.

SIDPEC has joined the IEE Project to implement an energy management system for its production facility in Alexandria. 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, SIDPEC has focussed on motor system improvements.

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. Utilities consumption represents 38 % of the total electricity consumed by the company.

Summary of Optimization Strategies

Saving Opportunity	Energy Savings (kWh/year)	Financial Savings (EGP)	Capital Cost (EGP)	Payback (Year)
Cooling fans: Install VSD's	1,040,000	590,000	300,000	0.5
Cooling fans: Switching off "unused " fans	770,000	440,000	---	Immediately
Cooling pumps: Downsize by smaller pumps (exist)	1,200,000	680,000	---	Immediately
Cooling pumps: Install VSD's	22,690,000	12,880,000	21,100,000	1.7
Intake pumps: Downsize by smaller pumps	1,016,160	532,465	1,080,000	2.0
Intake pumps: Install VSD's	2,000,000	1,048,000	1,000,000	0.9
Make-up pumps: Replace two 150 kW pumps with two 55 kW potable pumps (existing)	543,120	284,595	100,000	0.35
Make-up pumps: Install VSD's	1,320,000	694,960	300,000	0.43
Total:	30,579,280	17,150,020	23,880,000	1.4

The 4 major motor systems (cooling pumps, cooling fans, Intake pumps and make-up pumps) were identified as significant energy users consuming 50%, 10%, 4.5% and 3% of the utilities plant electrical consumption respectively.

Optimization Strategies

There are eight 110 kW cooling water fans. However, the process requirements do not dictate the operation of all eight fans at the same time most of the year. Three possible opportunities for energy saving were identified. Two of them involved operating parallel fans at reduced speeds to get more reduction in power.

There are seven 1100 kW cooling water pumps, of which 2 are switched off 8 months of the year. Outcome Review of process requirements showed the flow rate could be reduced without any negative effects on production. Three opportunities were identified. The first was to replace larger pumps with readily available smaller pumps (750 kW), the second was by installing VSDs on the newly installed smaller pumps and the third was to add VSDs to all larger pumps.

The intake cooling water system consists of two parallel 315 kW pumps feed two clarifying tanks. Three opportunities were identified. The first was to change the pump with smaller one. The second is using VSD and the third one is cleaning the pipe line, however the last opportunity can be proceed with one of the other two.

There are two 150 kW makeup pumps, work alternately, each pump should cover the maximum make-up demand for the cooling towers. Three opportunities were identified.

Outcome

it was recommended to implement all options that don't include VSD option as they have a lot of potential to be applied without any harmful effects on the system. For the pumps the company has decided to implement Option 1 (replacement of pumps) and use the savings generated to review implementation of the other options. For the fans Options 1 has also been chosen. Total savings amount of 2,056,160 kWh (or EGP 1,122,465) per annum at an investment cost about EGP 1,380,000.

Lessons Learnt

Applying a structured approach to MSO can often realise with low cost requirements. This case only realises around 1.3% of total energy consumption.
SIDPEC now realize the total potential savings as it has many other large motors systems at the plant that could also be epitomized.

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