UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Industrial Energy Efficiency Project
Motor Systems Optimization

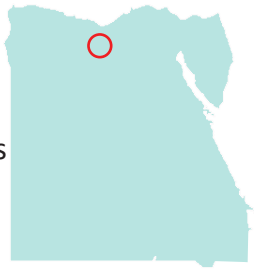
Electric motor driven systems globally consume approximately 70% of the industrial sector electrical consumption. This case reviews the optimization of a compressed air motor system within a large industrial plant in the glass manufacturing sector. The study revealed that for the compressed air system motors optimization 1,860,000 kWh (equivalent to EGP 970,000) that represent 4.7% of the company's total electricity consumption could be saved per annum without the need of any significant capital costs. This project is implemented by the UNIDO in partnership with the Egyptian Environmental Affairs Agency, Ministry of Industry, Trade and SMEs and the Federation of Egyptian Industries.

EGYPT

A Case Study of Sphinx Glass Company

Sphinx Company Snapshot

Industry: Glass
Location: Sadat City, Monufia, Egypt
Products: Float Glass



Implementation cost: 9,000 EGP
System: Compressed Air System
Annual energy savings: ~1.86 GWh
Financial savings: ~970k EGP /year
GHG reduction: ~10 ktCO_2eq (10 y)
Overall payback: Immediate

About Sphinx Glass Company

Sphinx Glass is a float glass plant established in Egypt in 2008, and majorly owned by Construction Products holding Company "CPC", one of the region's largest manufacturer and supplier of full range of building materials. Located in Sadat City over 220,000 square meters, the plant works at an annual capacity of 200,000 tones. Sphinx Glass has licensed the technology of PPG Industries Inc. - USA to ensure producing the highest quality.

MSO at Sphinx and the Industrial Energy Efficiency Project

The Industrial Energy Efficiency Project (IEE) is a programme 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 Optimisation (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.

The appointment of new senior management personnel in Sphinx has prompted a shift towards energy awareness. Management have since made a commitment to realize savings through energy efficiency.

Key personnel were identified to attend the MSO course presented via the IEE Project in Egypt.

Summary of Optimization Strategies

System	Saving Opportunity	Annual Energy Savings [kWh p.a.]	Financial Savings [EGP p.a.]	Investment [EGP]	Payback [Years]
Compressed Air System	1. Voltage Unbalance Correction	75,000	39,000	0	Immediate
	2. Fixing Leaks	1,240,000	645,000	2000	Immediate
	3. Scheduled Maintenance	73,000	38,000	0	Immediate
	4. Optimization of Operational Set Points	110,000	57,000	0	Immediate
	5. Air Usage Policy Development and Implementation	365,000	190,000	7000	Immediate

The Case

The compressed air system was chosen as a pilot MSO case. Sphinx were having problems with the supply of compressed air around the plant and were in the process of purchasing a new compressor to increase available air supply.

Sphinx has three cascaded single stage screw type compressors. Each compressor is driven by a 287.5kW induction electric motor. The compressed air system represents 9% of the total annual electricity consumption.

The required system pressure is 7.5 bar. The compressors control approach is designed to have one compressor working at full load, with the other 2 switching on as the load increased. Existing operation showed that all three compressors were operating all the time.

Optimization Strategies

Using this systems approach a number of optimization strategies were identified.

The system was assessed first by estimating the motors loading and voltage unbalance in the three motor systems.

After the initial assessment, Sphinx Glass have carried out an audit to identify air leaks, review maintenance records and existing procedures.

Furthermore, Sphinx have reviewed all end uses of compressed air and assessed their “actual demand” compared to the current “perceived demand”.
Finally, the installation of new VSDs to drive the motors’ compressors was assessed for technical and financial feasibility.

Outcomes

Sphinx have decided to implement Options 1 to 4 of the possible solutions identified, since each addresses a different aspect of the motor system. Voltage unbalance correction was carried out through the replacement of damaged capacitors.

Several leaks were identified during the assessment with some of them being major leaks exceeding 20 mm hole diameters. Fixing leaks have resulted in the biggest savings the company was able to achieve in the system.

Due to these combined measures, Sphinx were able to switch off one of the three compressors and operate it as a stand-by unit. Furthermore, the company has also identified improper uses of compressed air and were able to reduce the system pressure without affecting production operations.

Lessons Learnt

Using a systematic approach to motor systems optimization, Sphinx were able to identify low cost savings and were able to reduce their compressed air system consumption by approximately 45%. This corresponds to a 4.7% savings of the total annual electricity consumption of the whole plant.

In addition, Sphinx have saved the potential purchase of a new compressor and its associated life cycle energy cost.

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