UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Industrial Energy Efficiency Project
Compressed Air System Optimization

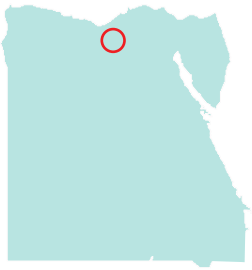
Typically over 75% of the lifetime costs of compressed air system are energy related. This case reviews the optimization of compressed air system at Sphinx Glass Company in order to address the potential energy consumption savings. This study reveals compressed air system opportunities assessed in this plant, 1,071,635 kWh (or EGP 590,120) per annum could be saved at an investment cost of EGP 12,500.

EGYPT

A Case Study of Sphinx Glass Company

Sphinx Glass Snapshot

Industry: Construction
Location: Sadat City, Menoufia, Egypt
Product: Float glass products



Implementation cost: 12,500 EGP
System: Compressed Air System
Annual energy savings: ~1,071 MWh
Financial savings: ~590,120 EGP/year
GHG reduction: ~1,040 tCO_2eq
Overall payback: Low

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 manufacturers 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 in glazing, automotive, silvering and coating quality

CASO at Sphinx Glass and the IEE 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 "promoting and accelerating inclusive and sustainable industrial development in developing countries and economies in transition."
The Compressed Air Systems Optimisation (CASO) 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.
Sphinx Glass has joined the IEE Project to implement an energy management system for its production facility in Sadat city. 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. Sphinx energy team started to build the energy optimization system since March 2016 and established the SEU according to the annual energy consumption kWh. it appears that the Compressed Air System represents 9 % from the total Annual Energy Consumption of the plant. This percentage made the company to focus on compressed air system improvements.

Summary of Optimization Strategies

Saving Opportunity	Energy Savings (kWh/year)	Financial Savings (EGP)	Capital Cost (EGP)	Payback (Year)
Fixing Air leakage	1,065,930	586,260	4,000	Immediately
Proper maintenance			---	
Modify pressure settings			---	
Replacing Air by N2			1,500	
Air policy	5,705	3,860	7,000	< month
Total:	1,071,635	590,120	12,500	< month

Case Description

Sphinx Glass has 3 cascaded Ingersoll Rand compressors driven by an electric Induction motor of 287.5 kW rated power. The compressor is a single stage screw type with capacity of 43.9 m3/min at pressure of 7.5 bar. The compressor will operate to maintain a set discharge line pressure and is provided with an auto restart system for use in plants where the air demand varies widely. The compressors have mode of operation as one of the compressor working as master in lead mode and the 2 others in lag mode at certain values of online and offline pressure. The lead compressor will be in operation as loaded till it reaches below the offline pressure by 0.3 bar (8 bar).

One of the other compressors will be on operation as unloaded (which consumes power without benefit) till the pressure value reaching to online pressure (6.9 bar) then it becomes loaded till reaching to the offline pressure 8.2 bar and then become unloaded again. The third compressor will be stopped on auto restart mode to be in operation in case of any sudden breakdown for any of the operated compressors. The lead compressor is always loaded 24 hours while the Lag compressor is loaded and unloaded several times per day according to the air consumption during the day.

The lead loaded compressor usually consumes Average 6,008 kWh per day as it is loaded 24 hours while the lag unloaded compressor consumes average 3,800 kWh per day according to the daily

Optimization Strategies

Reducing air consumption through the whole plant is the main issue in the assessment as it leads to power consumption reduction and therefore its costs. Five possible opportunities for energy saving in compressed air system, first one is finding out and fix existing leaking points, second one is emphasizing proper maintenance for filters and drains,

The third is adjusting and modifying compressed air pressure setting to be optimized according to required maximum pressure, fourth is replacing compressed air by nitrogen for cooling applications N2, fifth and the last one is Implementing air policy to increase the awareness of using compressed air.

Outcome

Applying these solutions will help the air compressor system to become optimized. The most highly recommended solutions are following up the air compressors path, pipes and regulators periodically to keep our savings within limits, and applying compressed air usage policy which will help a lot in increasing savings and keep the current savings within limits which could be the close opportunity to apply.

Lessons Learnt

- Small component could introduce huge saving in the compressed air system
- Importance of air policy exists during normal operation of the plant to insure sustainability.

Sphinx Glass Company now realizes the potential savings as it has other compressed air system 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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