UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

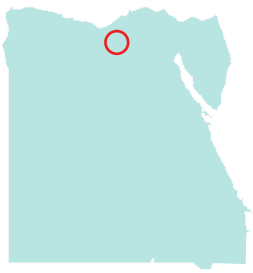
Industrial Energy Efficiency Project
Compressed Air System Optimization

Typically over 75% of the lifetime costs of compressed air system are energy related. This case develops an in-depth understanding leading to the compressed air system optimization at Quessna Industrial Complex of ElAraby Group focusing in Foam factory, in order to identify opportunities for saving the energy consumption by the system. The study revealed that for compressed air system opportunities assessed in this plant 2,697,840 kWh (or EGP 2,069,235) per annum could be saved at an investment cost 451,500 EGP.

EGYPT

A Case Study of ElAraby Group Company

ElAraby Group Snapshot



Industry: Engineering
Location: Quessna, Manofia, Egypt
Product: home appliances and air conditioning units
Implementation cost: 451,500 EGP
System: Air Compressors
Annual energy savings: ~2,697 MWh
Financial savings: ~2,069,235 EGP/year
GHG reduction: ~720 tCO_2eq (10 y)
Overall payback: Immediately

ElAraby Industrial Group in 1982 was transformed from a trading agent to an industrial group of companies. The group produces home appliances and air conditioning units. More than 330 different products (in more than 4000 models) are included in the product range. All products are produced in 17 manufacturing plants spread over two main industrial complexes; one is near Banha city the other near Quessna City. Quessna industrial complex includes 21 industrial buildings and facilities that are fed by compressed air from 5 compressed air stations.

CASO at ElAraby Group 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.
ElAraby group is considered to be one of the industry leaders in developing Energy Management System (EMS) with the assistance from the IEEP; by mid-2016, six companies of the group were ISO 50001 certified. As the CASO serves well in developing saving opportunities for the group, the UNIDO consultants, within agreement of the company and the IEEP, developed this case study on one of the compressed air systems of Quessna complex. 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.

Summary of Optimization Strategies

Saving Opportunity	Energy Savings (kWh/year)	Financial Savings (EGP)	Capital Cost (EGP)	Payback (Year)
Supply the demand side with the optimum pressure	371,900	285,245	---	Immediately
Minimize leakage	478,295	366,850	---	Immediately
Fixing unload Over consumption	394,200	302,350	Maintenance	Immediately
Switching the control from Load/Unload to VSD	1,453,445	1,114,790	451,500	0.4
Total:	2,697,840	2,069,235	451,500	Immediately

Case Description

The compressed air demand of foam plant and the other facilities is supplied through five screw compressors installed in the compressor room. The main header of the compressed air is connected to the central compressed air network via a shut off valve; which was always open. Each compressor has one 6 m3receiving tank in which automatic drains are installed at the bottom.

The major consumer of compressed air among all facilities of Quessna is the foam plant; consuming 21.6% total compressed air consumption with 50.8% of the total electrical consumption. Therefore, it has been decided to apply this study on the foam plant compressed air system station. Successful implementation could realize energy savings but also serve as a stepping stone to realize more energy savings in other areas of production.

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

Quessna Foam factory compressed air system is supplied through five 160 kW INGERSOLL RAND screw compressors where four possible opportunities for energy saving were identified. First, is to minimize air leakage through the system. Second, is to supply the demand side with the optimum necessary pressure (separate three compressors out of the main five to be the main compressed air suppliers, two to supply the low pressure demand and one to supply the high pressure demand). Third, is to Fix unload over consumption. The last one, is to switching the compressor control from Load/Unload mode to VSD.

Outcome

The three major compressed air savings opportunities represent about 13.8% of the total electrical energy consumed by Quessna complex. This is obtained from Minimizing leakage; Supplying the demand side with the optimum necessary pressure and Fixing unload over consumption. These opportunities are consuming about 10.4 %, 8.6% and 8% of the total electrical energy consumed by Foam factory respectively.

For the air compressor system, No cost opportunities can be easily done specially the opportunity of minimizing the air leakage. However, the implementation for these opportunities will lead to reduce the energy consumption in the compressed air system with total savings amount of 1,244,395 kWh (or 954,445 EGP) per annum could be saved at a low investment cost.

Lessons Learnt

Applying a structured approach to CASO can often realise large amount of energy savings with low cost requirements. This case realises about 58.6% of Foam factory electricity consumption (or 29.7% of total Quessna electricity consumption).

Quessna Foam factory now realize the potential savings that could be epitomized. Using a continuous improvement approach it intends to realize these savings in future projects.

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