

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 El-Marwa of Juhayna Group focusing, in order to identify opportunities for saving the energy consumption by the system. The study reveals compressed air system opportunities assessed in this plant 79,210 kWh (or EGP 51,000) per annum could be saved at a low investment cost.

EGYPT

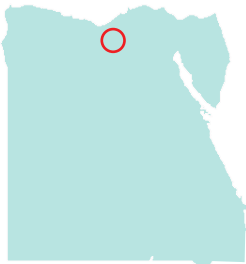
A Case Study of El-Marwa Company

El-Marwa Juhayna Snapshot

Industry: food

Location: 6th of October City, Giza Governorate, Egypt

Product: Tropical fruit pulp, Citrus fruit concentrates



Implementation cost: 4,000 EGP

System: Air Compressor System

Annual energy savings: ~79,210 kWh

Financial savings: ~51,000 EGP /year

Overall payback: Immediately

El -Marwa Food Industries is a member of the leading industrial group Juhayna s.a.e, the largest dairy and juice product company in Egypt, it was found in 1997 with invested capital up to 20 million Egyptian pounds. In 2001, due to their large and tremendous expansion in the marketplace the paid up capital was raised from 20 million Egyptian pounds to 60 million Egyptian pounds. Moreover, to fulfill their customers need, a new production line for apples and oranges was built. Also new products were launched in the market like pomegranate concentrate.



CASO at El-Marwa 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.

El Marwa Food Industries 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. The breakdown of the electricity among different consumers was made through the EnMS using sub meters data. It appears that the compressor accounts for around 19% of the total electricity consumption of the plant, and thus any savings made to that user would greatly impact the total electricity invoice of the company.

Summary of Optimization Strategies

Saving Opportunity	Energy Savings (kWh/year)	Financial Savings (EGP)	Capital Cost (EGP)	Payback (Year)
Minimizing Air Leaks	52,800	34,000	---	Immediately
Reduce Pressure Settings	1,885	1,210	---	Immediately
Increase Storage Capacity	24,525	15,795	4,000	0.4
Total:	79,210	51,005	4,000	Immediately

Case Description

The electricity consumption of the compressor at El-Marwa Company is monitored on a daily basis using an electricity sub-meter. Based on the hour meter readings, the compressor is loaded for 40.5 % of the time. It is clear from the measurement that the compressor undergoes rapid cycling, which prevents the complete separation of the oil before the compressor reloads. The loading duration is approximately 20 seconds, while the unload duration is around 30 seconds, resulting in a 40% load. The 40% load is an indicator of an oversized compressor, while the rapid cycling is an indicator of small storage volume. The air leak test detection was conducted in the plant with the ultrasonic leak detector to identify the leak points.

Optimization Strategies

The compressed air system at El-Marwa Company could be optimized with several low cost actions. The saving achieved from implementing the low cost actions reached over 25% of the compressor energy consumption without any impact to the productivity or quality of the production.

Some solutions for reducing and optimizing the plant air consumption are investigated first, eliminating/minimizing the air leaks by walking through the production line, in a non-operating, silent condition, and having the compressor running resulting a reduction in the compressor consumption from the baseline consumption by about 25%, second, reduce the pressure setting for the compressor which could reduce 1.2% saving in the compressor energy, third increasing the storage volume by installing 1 m3 tank after the compressor and before the drier, and switch the existing 2m3 tank to be after the drier, the expected saving would be 5% saving in power, fourth, Increase the pipe diameter in the main header,

The recommendation is to attempt to measure the pressure drop through the existing pipe, and estimate the pressure drop in case of replacing the pipe, then investigate this option.

Outcome

Applying these solutions will help the air compressor system to become optimized. The annual energy savings amount is estimated to be 79,210 kWh and financial savings to be around 51,000 EGP at total investment cost of 4,000 EGP. The most highly recommended solutions are eliminate/minimize the air leaks, reduce the pressure setting for the compressor and increase the storage volume.

The option to Increase the pipe diameter in the main header is not accepted by the company team, especially due to the connection to the compressor, which was built in from the manufacturer for the 1.5" pipe while, the other option to connect the compressor network between EL-Marwa and Modern appeared to be non-practical for the following reasons: 1) the pipe line connecting the two plants will result in an increase in pressure drop. 2) The two plants don't operate simultaneously except for approximately one month per year.

Lessons Learnt

- Most of the compressor consumption is for leakage and inappropriate use
- Housekeeping solutions could introduce savings about 20%

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