UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

# Industrial Energy Efficiency Project
# Motor System Optimization

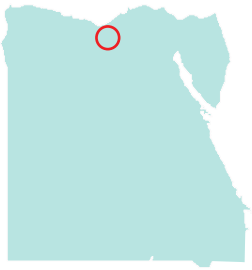
**Electric motor driven systems globally consume approximately 70% of the electrical consumption in industrial sector. This case reviews the optimisation of motor systems regarding the pumping water system within a large industrial plant in the food sector in order to identify opportunities for saving the energy efficiency, use and consumption by that system. The study revealed that for the major motor system savings assessed in this plant save 1,467,550 kWh (or 37,695 EGP) per annum at an investment cost about EGP 34,380.**

EGYPT

## A Case Study of Beyti Company

### Beyti Snapshot

**Industry**: Dairy and juices
**Location**: Nubaria, Egypt
**Product**: Milk, juice and yoghurt



**Implementation cost**: 34,380 EGP
**System:** Water Pumping System
**Annual energy savings**: ~1,468 MWh
**Financial savings**: ~37,695 EGP/year
**GHG reduction**: ~797 $tCO_2eq$ (10 y)
**Overall payback**: < 1 year

Beyti is one of the largest producers of milk, juice and yoghurt in Egypt, targeting a market of 86 million consumers and catering to different consumer profiles. Beyti was established in 1998 with the acquisition of the largest commercial dairy farm in Egypt from the Saudi Group Dallah Al-Baraka. Today Beyti holds strong market positions in all the categories it operates in, and employs over 3,000 people, producing approximately one million units per month of 4 main product categories.


### MSO at Beyti 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.

Beyti Company is considered as a pilot plant for the IEEP in the MSO as well as other components. The company is one of the pioneer companies in Egypt, working on the food sector. They are in the process of developing an Energy Management System (EnMS) with the assistance from the IEEP, and the MSO serves pretty well in developing saving opportunities for the company.

## Summary of Optimization Strategies

| Saving Opportunity | Energy Savings (kWh/year) | Financial Savings (EGP) | Capital Cost (EGP) | Payback (Year) |
|---|---|---|---|---|
| Install VSD's for 3 Chilled Water Pumps | 543,600 | 13,590 | 25,000 | 1.8 |
| Stop One Chilled Water Pump | 270,900 | 7,015 | --- | Immediately |
| Upgrade Motors to IE3 | 43,510 | 1,125 | 3,880 | 0.8 |
| System Retrofit Savings for (1 motor + 1 pump) | 81,310 | 2,105 | 5,500 | 2.6 |
| Installing VFD on 3 Cooling Tower Fans | 528,230 | 13,860 | N.A. | 1.5 |
| Total: | 1,467,550 | 37,695 | 34,380 | < 1 year |

## Case Description

Only four 75 kW water pumps systems, have uncovered quite a few opportunities for energy usage reduction with exceptional return on investment RO. The plant makes use of the latest and best food processing techniques and innovative layout that maximizes efficiency. It employs high-speed processing machinery, and is capable of producing a diverse variety of dairy, juice and dairy-based products to the highest standards of hygiene and safety.

The main BEYTI loads are the refrigeration A300 which represent 30 % of total BEYTI consumption and 13 % for Refrigeration B12.

Refrigeration station (A300) divided into two chilled water circles. First circle (1$^{o}$C) for cooling manufacturing process. Second circle (5 $^{o}$C) for air conditioning system, that have 3 old pump each one has a 75 kW induction motor and 1 new pump with 75 kW rated power.

So, Significant potential for improvement founded in First circle (5 $^{o}$C) for HVAC system, regarding unstable and unmonitored control system, high failure rate. The pump system is working as chilled water pump, serving about 35 air handling units (AHUs) that are responsible for air-conditioning the production halls.

## Optimization Strategies

Based on measurements and analysis of the data obtained from the system, we have identified the five possible opportunities.

First Install VSD's for three chilled water pumps with low payback. Second stop one of chilled water pumps with immediately payback .Third, install high efficient IE3 that is planned to be used in case of replacement of the current one.

Fourth, chilled water pumps – system retrofit which requires an updated maintenance strategy policy. Fifth, Installing VFD on the cooling tower fan.

## Outcome

Motor and System Optimization for BEYTI 5 $^{o}$C Chilled water system circle include great opportunities to reduce its energy consumption with high attractive investment returnees. It is highly recommended to implement Install VSD's for three chilled water pumps and Stop one with investment cost is 25,000 EGP and payback period is 1.8 year with total annual energy saving 543,600 kWh, carbon dioxide reduction is 295 ton and total annual saving 13,590 EGP.

## Lessons Learnt

Applying a structured approach to MSO can often realize with no or low cost requirements.

Beyti has Energy management system for continuous energy improvement and sustainability along all plant systems.

Energy cost can be reduced significantly some may not require financial investment. A systematic approach as demonstrated in this study will lay the foundations for significant and sustainable cost reduction in energy use for organizations of all sizes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