Solar Heating in Industrial Processes (SHIP) Project

The project “Utilizing Solar Energy for Industrial Process Heat in Egyptian Industry” is financed by the GEF and implemented by UNIDO in partnership with the Egypt National Cleaner Production Centre ENCPC. The objective of the project is to develop the market environment for the diffusion and local manufacturing of solar energy systems for industrial process heat. The project results will increase the knowledge and strengthen the awareness among the major stakeholders on the penetration potential of solar technologies in the food, chemical and textiles sectors in the region. The project focuses on improving the energy efficiency of the industrial process heating systems and the introduction of solar thermal technologies mainly in industrial companies that have low and medium temperature heat demand in three industrial sectors, namely the food, chemical and textiles sectors.

Mediterranean Garden for Agribusiness (MGA) Case Study

Mediterranean Garden for Agribusiness (MGA) is a company specialized in olives products and pickled vegetables that was established in 2007. The company mainly serves both of the Egyptian local and export markets. According to the technician, the plant produces in normal and exporting seasons about 4,500 and 7,000 jars/day, respectively.

In Mediterranean factory, there is only one process that requires a thermal demand which is the pasteurization process. Pasteurization processes flow diagram exhibits the main steps that are performed for the table olives and pickled vegetables as it is not required for olive oil production.

Thermal energy system is supplied from three tanks in which water is heated through direct burners fitted under each tank. These burners are controlled manually and uses kerosene as a source of fuel. The calculated efficiency for the burner was around 25% for both the normal and the exporting seasons.

It is noted that the tanks are not insulated and heated to 98 °C despite the need of 90 °C only. If the optimization measures are applied, unnecessary losses will be eliminated and the system can operate at much lower cost.

- Optimization Opportunities -

- Thermal Insulation
- Boiler Optimization
- Waste Heat Utilization
- Solar Water Heating
Integration of Solar Thermal Heating System

Solar heating technologies collect thermal energy from the sun and this heat can be used for heating purposes. Solar collectors are selected based on the range of the operating temperature range and the type of the industrial sector. Heat in the lower temperature range (<100 °C) can easily be provided with systems commercially available, such as flat plate collectors (FPC) and evacuated tube collectors (ETC). Both of FPC and ETC were investigated for many different integration scenarios.

The most promising scenario envisioned for the factory is to preheat process water in hot water tanks after the implementation of the measures of tanks and filters insulation, the tunnel’s water filter covering and mass recovery of water in tunnel this will replace the existing burners load which will be the auxiliary. The system will be installed on the roof occupying 175 m² of area. The system is designed to heat 12 m³/day to 90 °C. The system cost is around USD 23,100 and the annual savings will be USD 6,100. With lifetime of 20 years, the total savings is USD 90,000. Other parameters are shown below.

**Lessons Learnt**

- Thermal insulation is a quick win. It saves energy with very low upfront costs and have high impact and low payback.
- Waste heat utilization is not a common measure, however highest energy saving can be achieved specially when integrated with SHIP.
- Solar thermal integration combines renewable energy resources utilization and energy savings measures.

The total proposed solutions summary:

- **Thermal Energy Savings:** up to 145,500 kWh/year, representing about 94.5% savings of the total thermal energy consumption (As the SHIP system with the optimization measures will replace the existing burners load),
- **Financial Savings:** 6,120 USD/year,
- **Capital Cost:** ~23,000 USD,
- **Overall Payback Period:** 3.8 years,
- **CO₂ Emissions Reduction:** 36 tCO₂ eq/year.

For more information:
UNIDO Project Management Unit in Egypt,
Email: info@shipprojectegypt.org
Phone: +20 102 895 1112
www.SHIPprojectEgypt.org

UNIDO Headquarters:
Mark Draek,
Email: m.draeck@unido.org
Phone: +43 (1) 26026 4356

---

**Adjust Air to Fuel Ratio in Burners**

Since the combustion inside the furnaces is controlled manually with no air to fuel ratio control settings. The proposed solution is to adjust the air to fuel ratio which can be poorly done manually using the current control schemes or better by installing a simple fuel regulator. This solution will help to increase the combustion efficiency, reduce the harmful gases in the exhaust and save about 18% of fuel consumption.

**Capex:** 1,500 USD  
Energy Savings: 25,000 kWh/year  
Payback: 1.5 years  
CO₂ Reduction: 6.3 tCO₂/year

**Thermal Insulation of Tanks And Filters**

Thermal insulation is a general principle that should be applied in all hot parts in the factories. The proposed solution is to insulate the hot water tanks and filters that is installed along the distribution line. The collective saving from proper insulation will help to reduce the burner load, CO₂ emissions, and operation costs. safety will be enhanced after reducing surface temperature.

**Capex:** 520 USD  
Energy Savings: 8,770 kWh/year  
Payback: 1.4 years  
CO₂ Reduction: 2.2 tCO₂/year

**Mass Recovery of Water Vapor and Drainage From The Tunnel**

The pasteurization tunnel wastes a big mass of warm water both as vapor stream and hot water drain stream. This can be considered a no-cost option. The proposed solution is to collect these mass flows and direct them back to the 3rd tank connections already exist but it is disconnected. This solution will help to reduce the burner load and reduce the required make-up water amount.

**Capex:** 1,750 USD  
Energy Savings: 1,935 kWh/year  
Payback: 0.18 years  
CO₂ Reduction: 115 tCO₂/year