UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

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

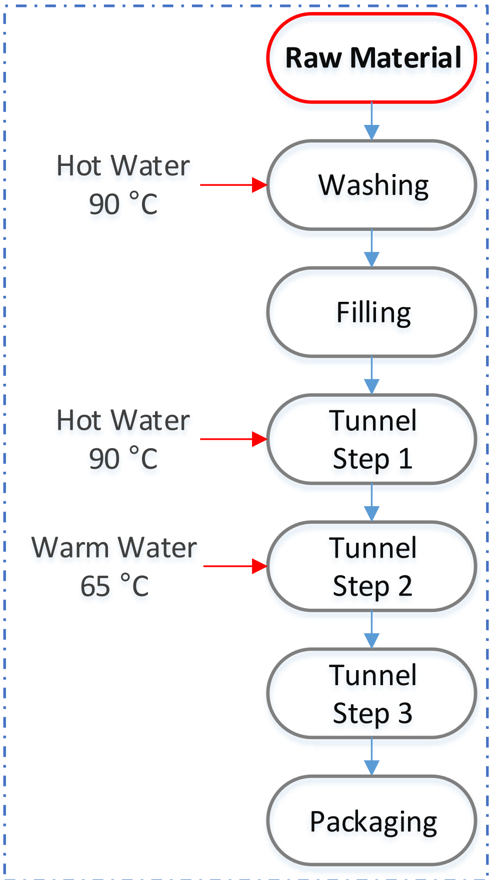
10th of Ramadan City, Egypt

Food Sector

Olives Products and Pickled Vegetables

154,000 kWh/year thermal energy consumed

Pasteurization Processes Flow Diagram



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**

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**
CO_2 Reduction: 6.3 **tCO_2/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**, **CO_2 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**
CO_2 Reduction: 2.2 **tCO_2/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**
CO_2 Reduction: 115 **tCO_2/year**

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 m^2** of area. The system is designed to **heat 12 m^3/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.

175 m^2 using FPC — System Design Area

145,000 kWh/year — Energy Savings

23,100 USD — Capex

USD 6,000 — Annual Savings

4 years — Payback

35 tCO_2/year — CO_2 Reduction

12 m^3/day — Water Flow Rate

90 °C — Design Temperature

20 Years — Lifetime

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**,
- **CO_2 Emissions Reduction:** **36 tCO_2eq/year**.

For more information:

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