UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

وزارة الصناعة والتجارة الخارجية

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.

SOLARheating for Industrial Process
Together Toward Efficient Production

Al-Arabia for Carton Case Study

1st Industrial Zone, Al Kawthar, Sohag

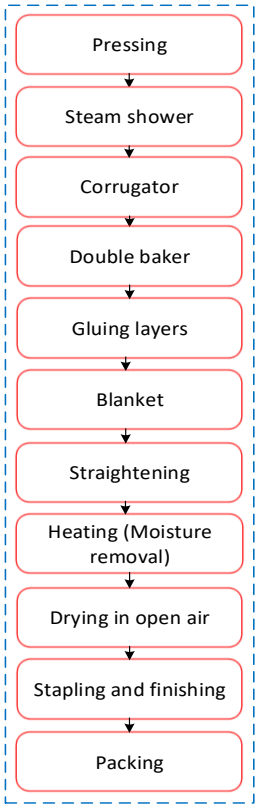
Chemical sector **Paper**

5,400 Tons/year

2,729,256 kWh/year energy consumed

Production Processe Flow Diagram

Al-Arabia for Carton Factory



General analysis on the electrical and thermal energy consumption shows that electrical consumption represents 3% from the total energy consumption while diesel fuel consumption represents 97% from the total energy consumption.

The existing thermal energy system in Al-Arabia for Carton factory is supplied through two steam boilers of 2 TPH at 12 Bar (one main and one standby boiler). The steam is used both directly and indirectly for manufacturing processes. The boiler is fire tube using diesel as fuel source. The boiler has single burner.

- Optimization Opportunities -

Thermal Insulation

Switching from diesel to natural gas

Waste Heat Utilization

Solar Water Heating

Fuel switching from diesel to natural gas

The current fuel used for thermal energy production is diesel in the steam boiler. The average diesel price is EGP 6.82 per liter for 2020 while the unit price of the natural gas is USD 5 per MBTU for 2019/2020. A calculation was done to study the possibility of switching from diesel to natural gas**Error! Reference source not found.**. The cost of energy generation using natural gas is lower than that of diesel.

Capex: 1,750 USD
Energy Savings: 257,802 kWh/year
Payback: 0.03 years
CO₂ Reduction: 234 tCO₂/year

Optimizing the flow rate of blow down in boiler

Using a fixed rate of blow down does not take into account changes in makeup and feed water conditions, variations in steam demand or condensate return or the actual concentration of dissolved solids in the boiler water. An automatic blow down-control system optimizes blow down rates by regulating the volume of water discharged from the boiler in relation to the actual current concentration of dissolved solids. Within the acceptable limits.

Capex: 7,000 USD
Energy Savings: 314,635 kWh/year
Payback: 0.78 years
CO_2 Reduction: 84 tCO_2/year

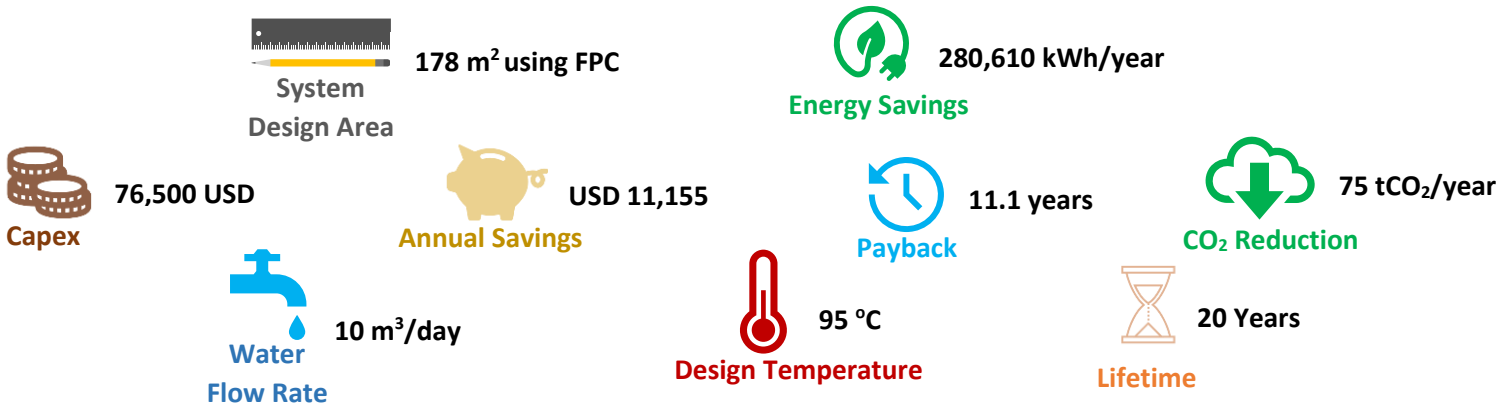
Optimizing steam losses of condensate return tanks

Since all of the steam condensate return tanks are at atmospheric pressure therefore, a high amount of flash steam losses is generated because of high pressure of the condensate generated from the processes. it is recommended to replace the condensate return tanks with one pressurized tank. Will reduce steam losses and save thermal energy.

Capex: 7,000 USD
Energy Savings: 206,155kWh/year
Payback: 1.2 years
CO_2 Reduction: 55 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 (<80 °C) can easily be provided with systems commercially available, such as flat plate collectors (FPC) and evacuated tube collectors (ETC). The **scenario envisioned** for the factory is to **preheat boiler feed water** which will decrease the energy consumed by the boiler. The system will be **installed on the roof** occupying **278m²** of area. The system is designed to **heat 10 m³/day to 95 °C**. The **system cost** is around **USD 76,500** and the **annual savings** will be **USD 11,000**. With lifetime of **20 years**, the **total savings is USD 220,000**. 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 a low payback**
- **Boiler fuel switch requires low efforts but have high impact on CO_2 reduction**
- **Solar thermal integration combines renewable energy resources utilization and energy savings measures**

The **total proposed solutions** summary:
Thermal Energy Savings: up to **719,100 kWh/year**, representing about **44.62% savings of the total diesel consumption** (For **10.61%** savings due to integration of solar heating systems).

- **Financial Savings: 85,500 USD/year,**
- **Av Capital Cost: 104,600 USD,**
- **Overall Payback Period: 11.1 years,**
- **CO_2 Emissions Reduction: 354 tCO_2eq/year.**

SCAN ME

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