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.

Solar Heating for Industrial Process
Together Toward Efficient Production

Lotus Garments – Fresh Tex 1 Plant Case Study

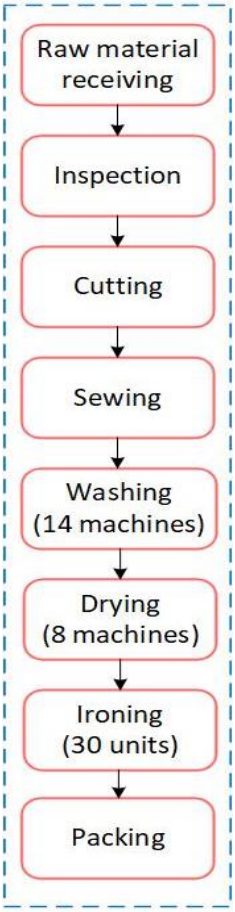
Public Investment Free Zone, Port Said, Egypt

Textile Sector **Garments**

9,204,600 Pieces/year

38,032,920 kWh/year energy consumed

Production Processes Flow Diagram



Lotus Group is part of textile sector for manufacturing supportive consultation and production services from raw fiber to finished garments through about 8,000 employees, operating since 1994. The production of Lotus Group is assigned for export to different markets including the top brands in European and US chain stores.

Fresh Tex 1 factory is one of the Lotus factories that its processes flow diagram exhibits the main processes performed on the raw material to produce the finished ready-to-wear garments. General analysis on the electrical and thermal energy consumption shows that **electricity consumption** represents **37.8%** while **natural gas consumption** represents **62.2%** from the total energy consumption.

Thermal energy system is supplied through **three steam boilers**, two boilers are 1.5 Ton/hr capacity and one is 1.6 Ton/hr. Boilers supply steam at **3 barg** and use natural gas as fuel source. It was found that the thermal loads can be covered by only the two 1.5 TPH boilers and the other 1.6 TPH boiler can be a standby. If the suggested optimization measures were applied, unnecessary losses will be eliminated and the system can operate at lower cost.

- Optimization Opportunities -

Thermal Insulation

Boiler Optimization

Waste Heat Utilization

Solar Water Heating

Proper Thermal Insulation of Hot Steam Surfaces

Insulation of pipes, fittings, and tanks is a general principle that should be applied in all steam consuming processes in the factories. **The proposed solution** is to **fix the insulation** for all steam pipes and fittings. The collective saving from proper insulation is usually enormous. This solution can **reduce energy consumption**, **CO_2 emission**, and **operation costs**. **safety will be enhanced** after **reducing** surface temperature from **140 °C to 40 °C**.

Capex: 1,350 **USD**
Energy Savings: 294,000 **kWh/year**
Payback: 0.27 **years**
CO_2 Reduction: 59 **tCO_2/year**

Improvement in Burner Efficiency with an Oxygen Analyzer

The excess air is not automatically controlled in the boiler, thus the air to fuel ratio is not optimal and leads to an increased fuel bill. The flue gas O_2 content was found to be 12.65%. **The proposed solution** is to **install an online combustion gas analyzer** and manual adjustment of the air damper to improve burner efficiency. This **solution** requires **low capital cost** and results in huge **CO_2 emissions reduction**.

Capex: 1,750 **USD**
Energy Savings: 914,860 **kWh/year**
Payback: 0.1 **years**
CO_2 Reduction: 185 **tCO_2/year**

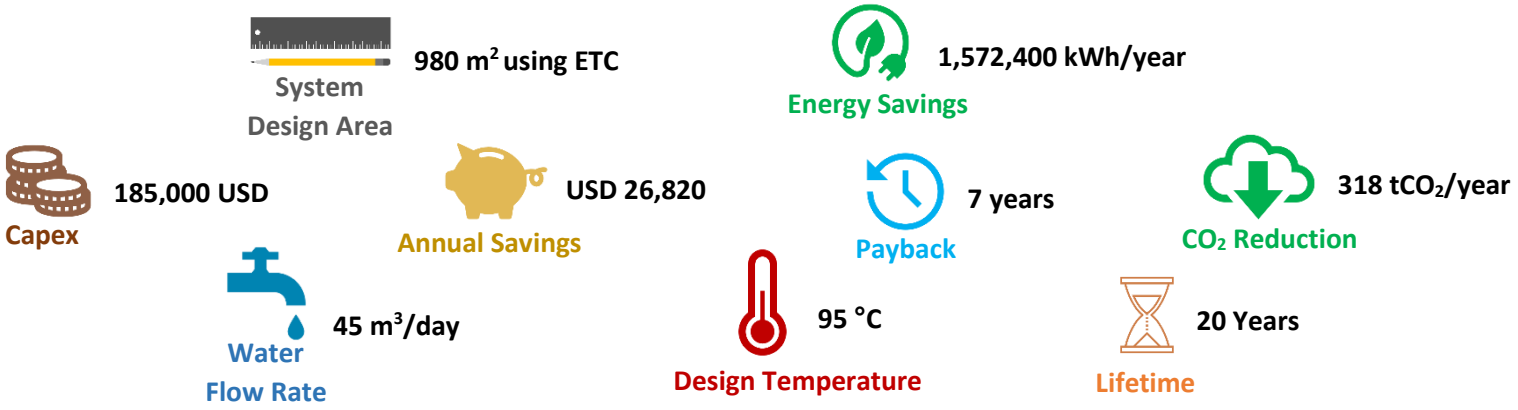
Optimizing The Flow Rate Of Blowdown In The Boiler

Using a fixed rate of blowdown does not take into account changes in makeup and feed water conditions, variations in steam demand or the actual concentration of dissolved solids in the boiler's water. **The proposed solution** is **to install an automatic control system** for optimizing blowdown rates. This solution can **reduce energy consumption, treatment**, **CO_2 emissions**, and **operation costs**.

Capex: 7,000 **USD**
Energy Savings: 849,470 **kWh/year**
Payback: 0.47 **years**
CO_2 Reduction: 172 **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). The **scenario envisioned** for the factory is to **preheat boiler feed water** by **recovering energy from exhaust gases and blowdown water followed by heating using solar system** which will decrease the energy consumed by the boiler. The system will be **installed on the roof** occupying **980 m^2** of area. The system is designed to **heat 45 m^3/day to 95 °C**. The **system cost** is around **USD 185,000** and the **annual savings** will be **USD 26,820**. 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.**
- **Boiler optimization requires low efforts but have high impact on energy consumption and CO_2 emissions reduction.**
- **Solar thermal integration combines renewable energy resources utilization and energy savings measures.**
- **Waste heat utilization is not a common measure, however highest energy saving can be achieved by this measure.**
- **Feasibility of a SWH system is improved when integrated with waste heat recovery measure.**

The **total proposed solutions** summary:

- **Thermal Energy Savings:** up to **3,630,780 kWh/year**, representing about **9.5%** savings of the total energy consumption (where **4%** is due to the integration of SWH systems),
- **Financial Savings:** **62,350 USD/year,**
- **Capital Cost**: **~195,100 USD**,
- **Overall Payback Period:** **3.1 years**,
- **CO_2 Emissions Reduction:** **734 tCO_2eq/year**.

SCAN ME

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