Transforming to Carbon Neutrality: One Industry at a Time

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Self

- Undergraduate student at Yale University, USA
- Majoring in Physics
- Particle physics research at CERN, Genève, Switzerland in June–July 2015
- Biophysics research in the O'Hern Lab at Yale University between September 2015 –July 2016

HIMA^Verte Sustainability Incubator

Dear Alizeh:

Thank you for approaching HIMAˆVerte. We take your expression of interest seriously.

Starting this year, we are commencing the **HIMAˆVerte Sustainability Incubator**, and would be pleased to consider you as a candidate for this initiative.

- The HIMA^Verte Sustainability Incubator aims at matching real-life needs to solutions derived from guided research through a well-designed and managed program

Problem: The Current Scenario at Zephyr

- Electricity from the grid used to burn rice husk to generate steam
  - Daily rice husk usage ~ 13,000 kg ~ $ 850
  - Daily electricity usage ~ 400 kW ~ $ 66
  - Total costs ~ $ 1,150
- Compliance with environmental protocols demanded by consumers: EU Ecolabel
- Detailed analysis ~ 6 months

Textile Industry: Overview

- Cotton-based textiles make for 60% of the total exports, 46% of the total manufacturing, and provide employment to 38% of the workforce. (Tahir, 2013)
- Currently, fossil fuels are used to meet energy needs in the textile industry (Mahmood and Harijan)
- Overall, fossil fuels are used to meet 85% of the commercial energy needs in the country (Mahmood and Harijan)
- The Pakistan Agricultural Research Council has warned the textile industry of an unpromising future. (Dawn)

Pakistani women pick cotton (samaa)

Consumer's Demand: EU Ecolabel

- Energy requirements stipulated in EU Ecolabel: "manufactured using resources and energy more efficiently" (2014/350/EU)
- In specific, according to Criterion 15 of 2014/350/EU, when
  - Average production < 10 tonnes/day ➔ 2 energy management techniques
  - Average production > 10 tonnes/day ➔ 3 en management techniques

(aonauk)

Objectives

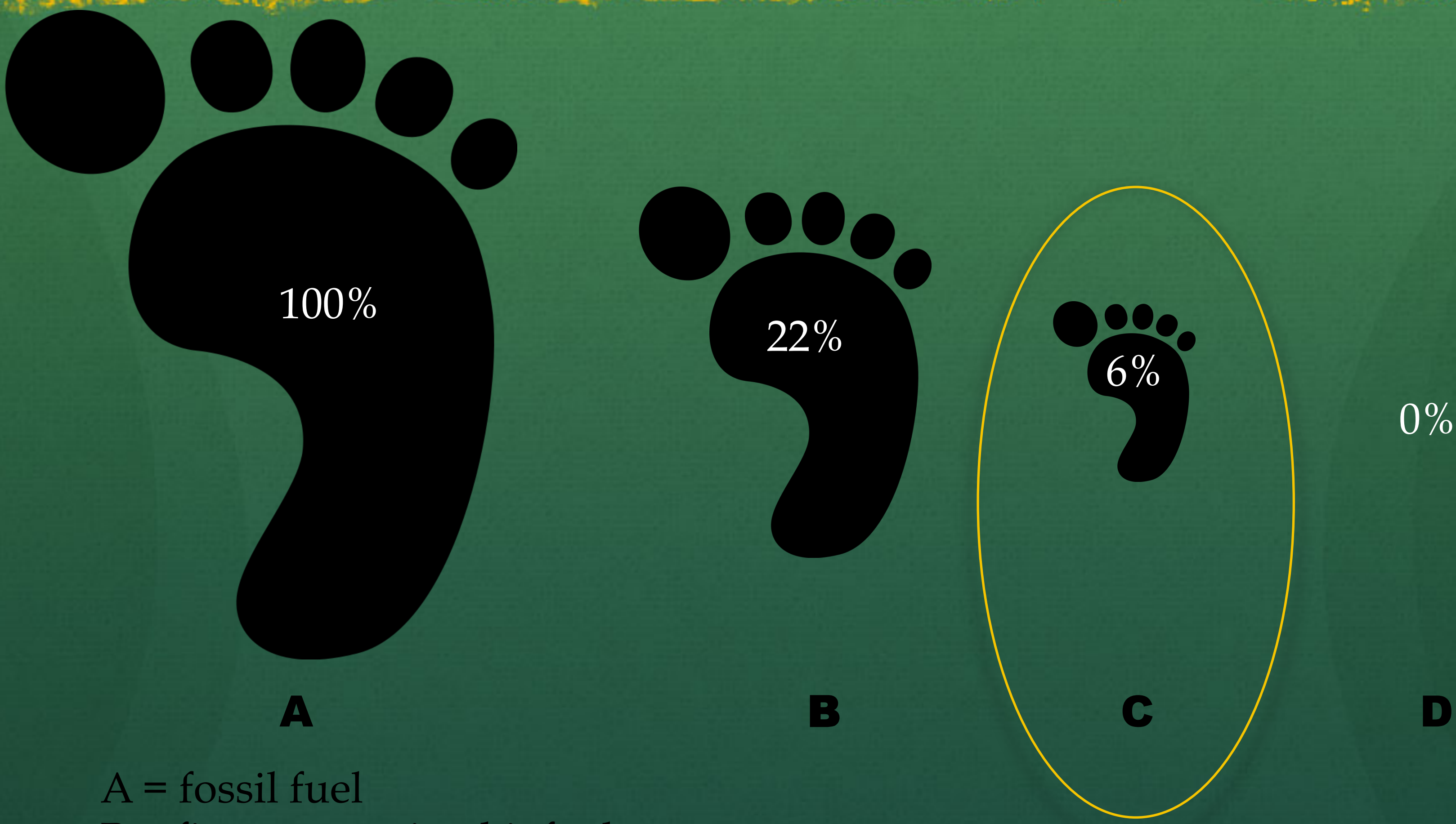
- Implement a solar water heating solution at Zephyr Textiles
- Compare the environmental impact of solar heating with existing machinery
- Compare the economic feasibility of existing machinery with the solar solution

A Bird's Eyeview

Hybrid car greenliving4live

- Two different sources of power
- Cars: diesel engines and electric motors
- Textile industry: grid electricity and solar solution

Relative Carbon Footprints



A = fossil fuel
B = first-generation biofuel
C = second-generation biofuel
D = solar solutions

(Highina, Bugaje & Umar)

Solar Energy in Textile Industry

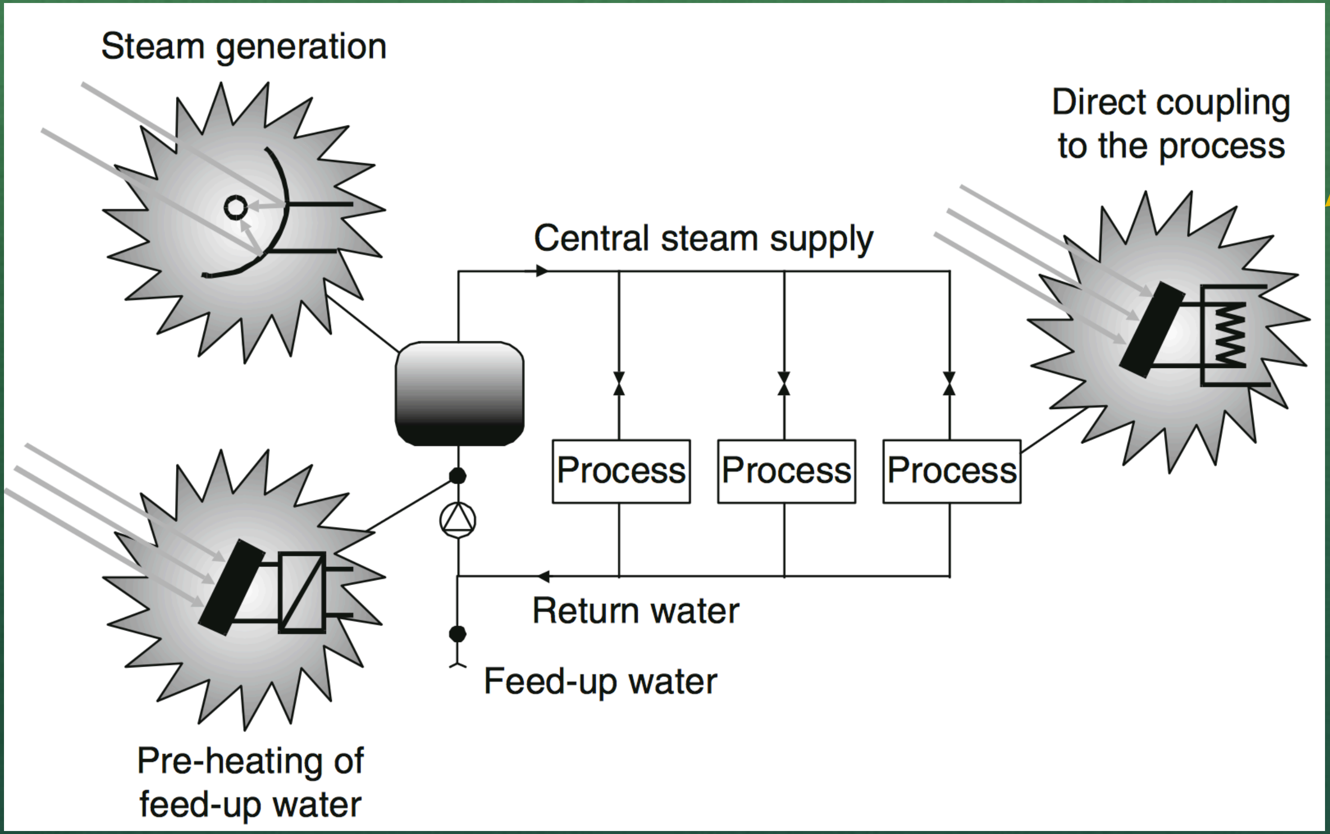


Fig. 2: Different ways of deploying solar energy in textile processing units (Mahmood and Harijan)

Solar Energy at Zephyr

- Hypothesis 1: Generating steam from solar energy
  - Large temperature increase means process is less time efficient
- Hypothesis 2: Preheating input stream to boiler tank
  - Extra steam being generated in the boilers at Zephyr textiles means wastage of resources
- Hypothesis 3: Preheating input stream to the dyeing process unit
  - Less steam required to heat the input water
  - Only required amount of water is heated

Dyeing Unit at Zephyr

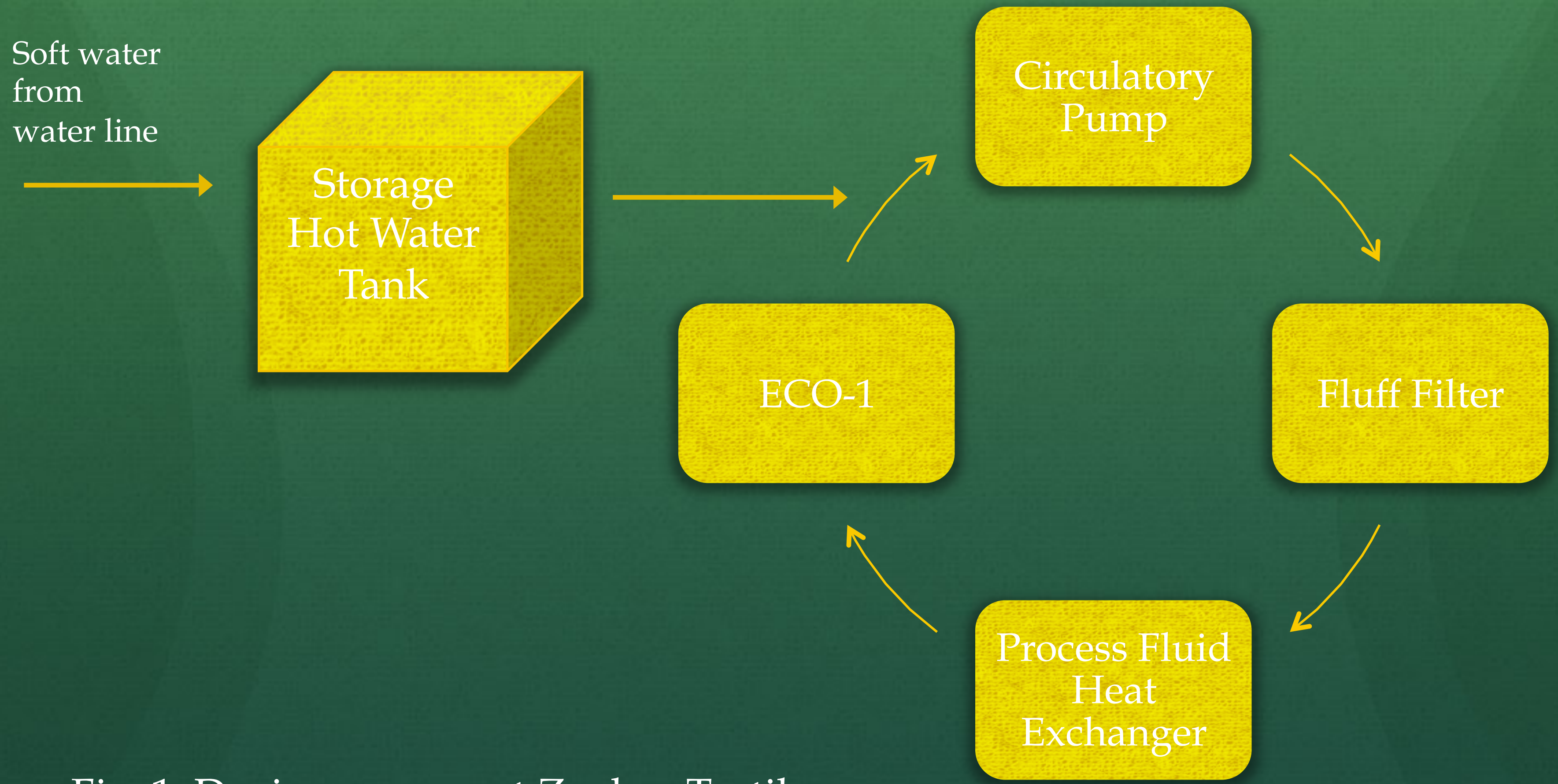


Fig. 1: Dyeing process at Zephyr Textiles

Motivation

- Water is input to the storage tank at ~ 35 °C
- Steam in the tank is used to heat this water to the required temperature (~80°C)
- Preheating the initial input water stream leads to the consumption of a smaller volume of steam in the heating process

Reduced steam consumption → Reduced demand for electricity → Reduced costs

Design

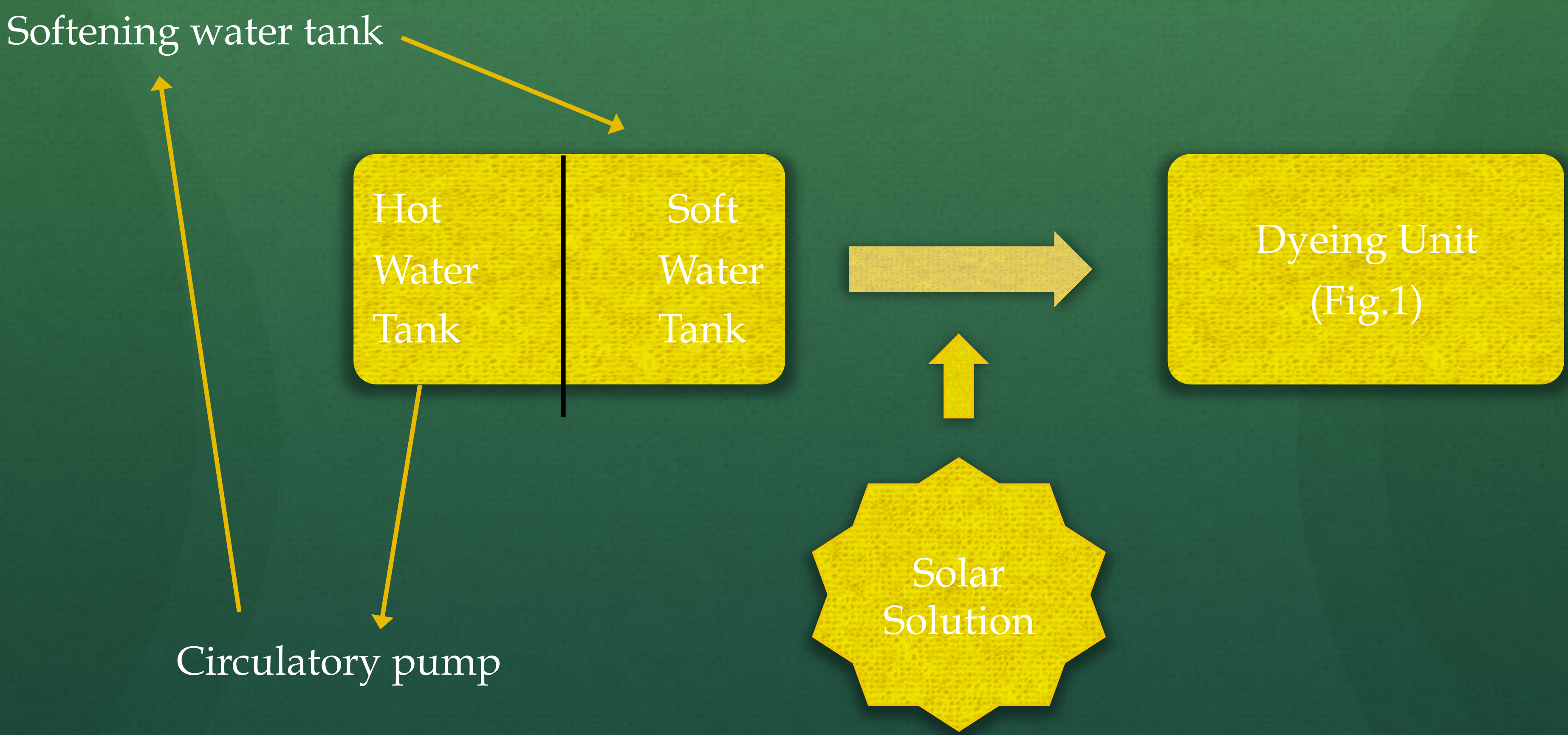


Fig. 3: Implementation of solar solution

Flat Plate Collectors

- Cost-effective
- More efficient for a temperature rise of up to 30 °C
- Readily available

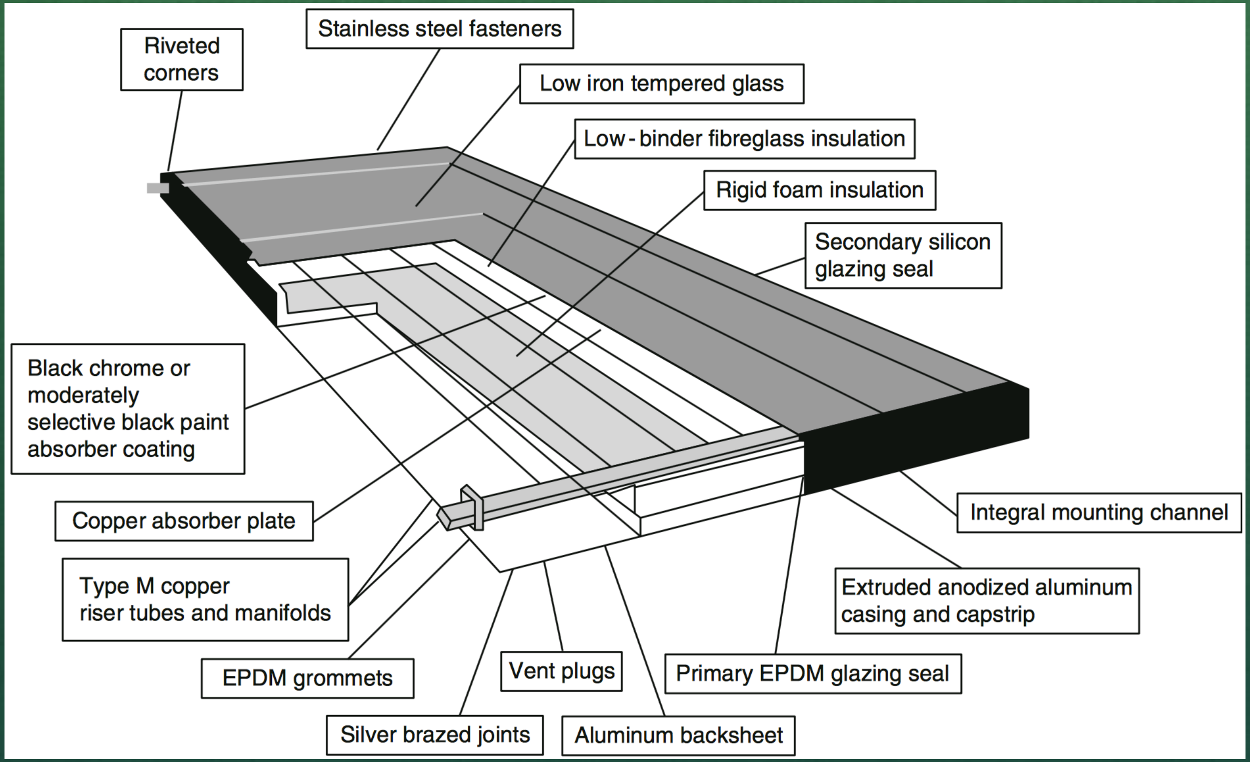


Fig. 5: Mahmood and Harijan

Proposal: A Work in Progress

- Vendor: ICEBERG INDUSTRIES
  - Worked on similar-scaled projects in the past
  - Outsource equipment from USA and China
- Flat plate collector
  - Desired temperature rise = 10°C (from 35°C -> 45°C)
  - LT rooftop ~ 1500 sq ft.
- Heat Exchanger to transmit heat to soft water
  - Indirect heating system used to prevent overheating
  - Use ETP treated wastewater as heat exchanger fluid

The Economic Question

- Money saved/month = $ 1,380
  - Savings from rice husk ~ 19,700 kg ~ $ 1,280
  - Savings from reduced boiler operation ~ $ 100
- Total cost ~ $60,000
  - Heating technology + heat exchanger ~ $ 55,000
  - Installation, temp controls, pressure valves ~ $ 5,000
- Return on investment time ~ 3.75 years

Disclaimer: For calculation purposes, cost of solar thermal used is based on an indoor swimming pool project

SHAMA

Solar Energy for Cleaner Living

Client Ref:	LH-006-A

Indoor swimming pool

Colour code:

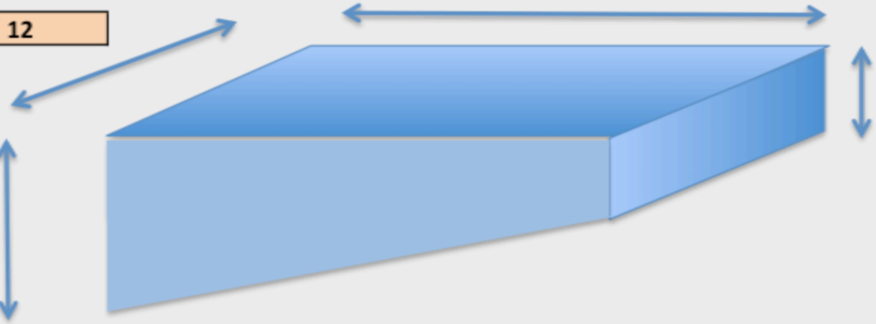
Data entry	(orange)
Calculated result	(green)

LENGTH = 22

WIDTH = 12

DEPTH 1 = 4

DEPTH 2 = 6



	ft	meters
		0.3048
Length	22	6.71
Width	12	3.66
Depth 1	4	1.22
Depth 2	6	1.83

Pool water temperature range in Deg C:

Winter	22
Summer	30

	Meter-Cubed	US Gallons
Estimated Water Volume	37.38	**9,875**

Summary

- More environmentally friendly industrial practices
  - Pioneer for environmentally friendly practices in the textile industry
  - 2 energy management techniques
  - Wastewater reused instead of directly being disposed off
- Economic feasibility in the long-term
  - ROI period of 3.75 years

The Way Forward?

- Engagement with vendor to implement solar thermal solution
- Improving environmental standards for compliance with EU Ecolabel
- Publicity of environmentally friendly industrial practices to the market
  - Consumers are more aware of industrial practices
  - Other industries follow suit in implementing similar standards

What Did I Learn?

- Academic research and industrial progress meet at an exciting cross-section
- Communication with different tiers of workforce in the industry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- Dr. Munir Ghazanfar, Professor of Environmental Studies, LSE

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