Capstone II Design
ENGR4951U

DESIGN AND DEVELPOMENT OF A SOLAR AND NATURAL GAS HYBRID SYSTEM FOR SPACE HEATING APPLICATIONS

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INTRODUCTION

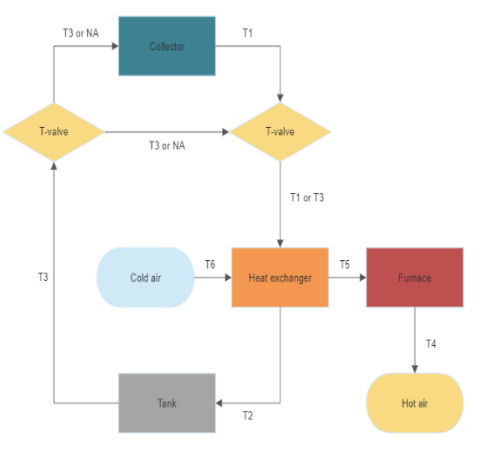
Renewable sources such as solar, wind and geothermal energy are used to heat homes and buildings. The goal of this project is to design and develop a solar and natural gas hybrid system for space heating applications which would effectively lower carbon emissions and cost.

PROJECT SCOPE AND BACKGROUND

- Design and development of a hybrid heating system
- Design layout (solar collectors, heat exchanger)
- Simulations, prototyping and test plans
- Risk management plan (failure modes and effects analysis)

DESIGN GOALS

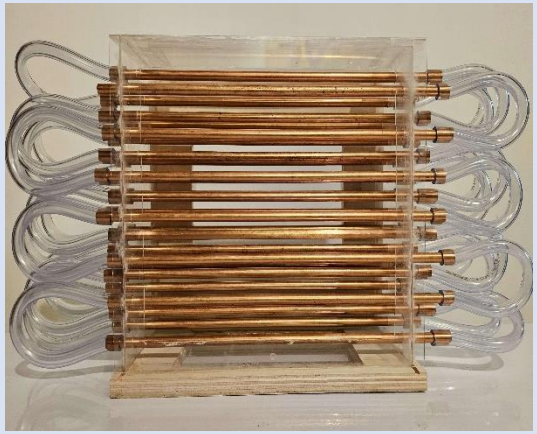
- Reduce carbon emissions
- Reduce carbon heating costs



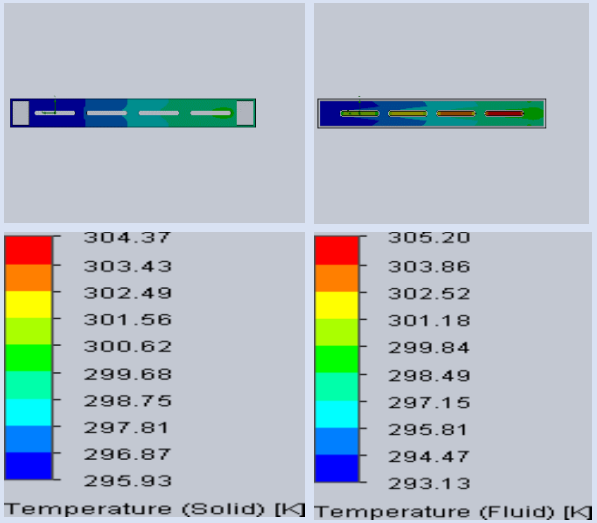
Sketch of layout implemented in the system

ENGINEERING REQUIREMENT/ANALYSIS

Circulating fluid: 50% mixture of water (H_2O) and propylene glycol
Dimension of flat plate collector= 4' * 7'



DESIGN SIMULATION RESULTS



TEST ANALYSIS AND RESULTS

Flow simulation: Using Solid works flow simulation to determine the properties of the configuration by varying the fin geometry attached to the tubes. Temperature, pressure and flow rate were analyzed. The results showed that flat fins allow for more heat to be transferred to the air and increasing the number of fins used would lead to more heat being transferred.

NEXT STEPS

- Feasibility of thermal energy storage
- Further optimization of heat exchanger design
- Exploring integration with solar water heating
- Further carbon saving analysis