Icarus RT: Organic Rankine Cycle (ORC) Power Conversion System

Project Overview

The goal of this project is to develop an ORC that serves as a proof-of-concept for generating power from waste heat extracted and recovered from Icarus RT's solar array.

The stored heat energy is converted to additional electricity by heating a cool organic fluid via a heat exchanger. During this exchange, the organic fluid is vaporized and pressurized due to its low boiling temperature (< 0 °C). The vapor expands in a turbine-generator to produce electricity. Upon exit, the organic vapor is cooled and depressurized, ready to repeat the cycle.

Requirements & Criteria

- ORC must be able to generate electricity
  - Select components that are low cost
- ORC must use DR-14A as the working fluid
  - The working fluid should have low environmental impact and be non-toxic
- ORC must be compact and able to size up for utility scale installations

Main Components

- The team leased an Air-end compressor by TamRotor to operate in reverse and serve as an expander
- An exhaust adaptation was manufactured to fit the plumbing schematics for the ORC

- The evaporator boils the liquid DR-14A into superheated
- Designed to use the recovered heat from the PV array

- The condenser cools the DR-14A from vapor phase to liquid phase

- A HydraCell P200 Metering Pump was provided by Icarus RT
- This pump is certified to operate with DR-14A

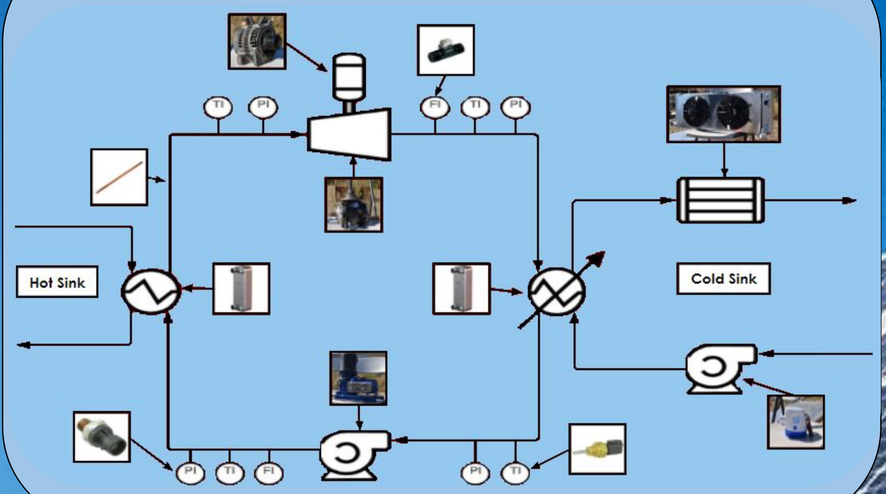
Project Display

ORC Assembly

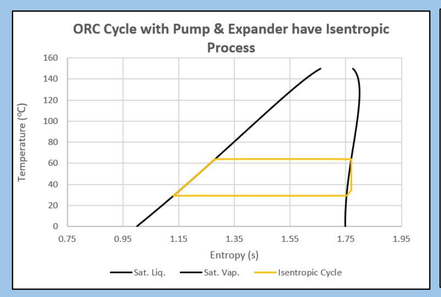
Hot Sink

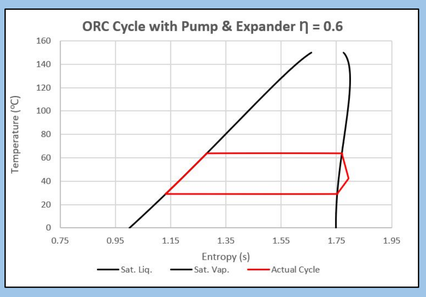
Cold Sink

System Level Diagram



Thermodynamic Analysis





- Parameters and initial conditions were used to size both heat exchangers and to determine inlet and outlet temperatures
- T-s diagrams indicate an isentropic process (left) and the actual process (right)

Acknowledgements

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