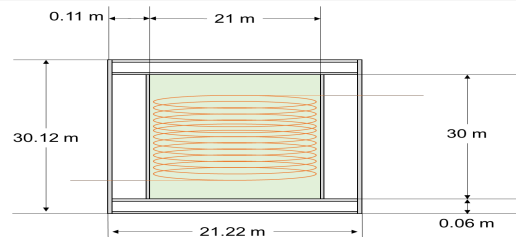


Project Overview

Overview

-Design a prototype model for a latent heat storage (LHS) tank in a fictitious heat recovery system.
-System will be based off of bottlenose dolphin blubber that helps retain body heat in cold water.



Design Schematic for Prototype LHS Tank.

Part Description	Material	Amount (kg)
PCM	Methyl Stearate	8,000,000
12" x 500 m OD Tubing	Copper	44,024
3/16" Plate	Stainless Steel	218,718
Insulation	Cellulose Fiber	232,013

Objectives

-Create realistic system based off biomimetic design principles.
-Evaluate max output of standard system.
-Analyze potential savings from recovered heat in home heating systems.

Analysis

-Needed to identify phase change material (PCM) for tank.
-Selected fatty acid ester for PCM based on dolphin blubber.
-Also need alternative to fossil fuel for heating and cooling processes.
-Options include some Triglyceride feedstocks such as yellow grease, vegetable oils, and animal fats.

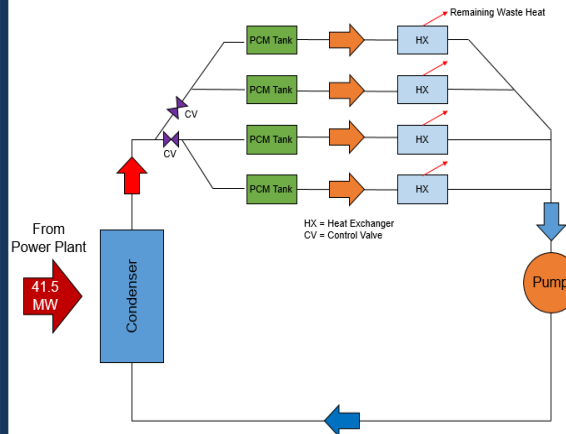


Diagram for the waste heat storage circuit:
- Flow of the cooling fluid is diverted into a storage branch, which in turn splits the flow into storage tanks containing the PCM.
-A storage branch will extract waste heat from the water and send it to a set of heat exchangers.
-Flow from the condenser will be diverted, while heat is extracted from the other branch for re-use.

Conclusions & Recommendation

Conclusions

- With implementation of the prototype, the tanks can store 547 MWh of waste heat with 85% reduction of emissions over 31-hour period.
- That is enough to support heat over 2,200 low income homes.

Further Study

- Improve design with more sustainable material selections.
- Perform LCA on fatty acid esters that quantifies water and energy consumption, as well as overall environmental and health-related impacts.