Waste Heat Recovery



Latent Storage Tank Design EGR 7200 Biomimicry



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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.

30 m 21.22 m

Design Schematic for Prototype LHS Tank.

Part Description	Material	Amount (kg)
РСМ	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 flubber.
- -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.

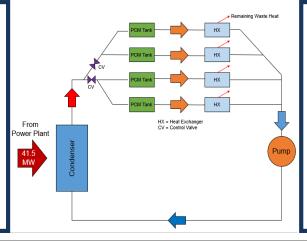


Diagram for the waste heat storage circuit:

- 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 suppport 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.