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.

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 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.