Senior Design Project

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Solar Absorption Chiller

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I. Synopsis

Industry standard for commercial and residential cooling requires the use of vapor compression and electrical compressors in chillers. The proposed design is of a solar heat absorption chiller. There are countries worldwide that lack electrical power or sufficient HVAC systems. When clinics and camps are set up, they would benefit significantly from a mobile, packaged, self-powered a/c system. It would improve living conditions, and using renewable energy reduces harmful emissions, and promises encouraging futures.

The absorption chiller provides a low COP, due to the lack of power input. Minimal power is required to use water and solution pumps. The ultimate goal is to design a net-zero energy system that uses renewable energy to supply the necessary energy to operate this system. Due to the energy efficiency and reduction in consumption, the absorption chiller is an appropriate system to build on. Centrifugal chillers have the lowest power requirement, and their efficiency is improving. However, this design is proposed to require less power and improve system efficiency compared to the industry standard mechanical compression system. The heat-driven concentration and pressure difference, with improved heat transfer devices will allow for the addition of Stirling engine technology.

The purpose of using the Stirling engine is to generate mechanical energy using heat rejected and wasted by an HVAC system. The heat rejected by the water and refrigeration system can be collected and converted into mechanical energy, to power or reduce the consumption of standard pumps. The heat input required for this heat engine is large in comparison to the converted mechanical work it outputs. Considering warm climate regions along with the normally high discharge temperatures of the refrigeration system, the collection and usage of heat is essential. To increase the heat content and useful work for the system, the largest existing heat source, the sun, can significantly improve the efficiency of this system.

Renewable energy and their sources are being researched and invested in to allow for a sustainable future. This includes solar energy, and the utilization of waste heat to recycle this energy instead of rejecting it. The solar and waste heat provide enough heat energy to drive a simple, mobile packaged absorption chiller and provide cooling in temporary locations or places that lack electrical power. The use of thermal heat collection and the addition of the waste heat recovered from the system will allow the energy obtained to satisfy the energy required to operate the equipment. The ultimate goal is to design a system that requires less or no electrical power, and utilizes the several available heat sources. This design is proposed to run a net-zero energy efficient HVAC system, and improve on or replace the current existing technology, and promise a sustainable future.