Report as of FY2007 for 2006NM51B: "Sustainable Recovery of Potable Water from Saline Waters (Khandan)"

Publications

- Articles in Refereed Scientific Journals:
  - Veera Gnaneswar Gude and NirmalaKhandan. Desalination Using Low Grade Heat Sources. Submitted to ASCE Journal of Energy Engineering.

Report Follows

Problem and Research Objectives

Due to increasing energy costs and declining energy sources, interest in the use of low grade heat sources and recovery of waste heat is growing. The goal of this study is to evaluate the feasibility of utilizing low grade heat to run a new desalination process. Traditional desalination processes such as reverse osmosis, electrodialysis, mechanical vapor compression, and multi-effect flash distillation require electrical energy derived from nonrenewable sources the cost of which has increased by 10 times over the past 20 years. Recently, a new desalination process has been proposed by Al-Kharabsheh & Goswami (2004) that has the potential to run solely on low grade heat at around 50^{o}C. We propose a modification to that process, whereby it can be run round the clock, using a thermal energy storage (TES) system. The TES system can be maintained at the desired temperature using waste heat from any available source. In this study, we evaluated the feasibility of utilizing the heat rejected by a solar-powered absorption refrigeration system (ARS) to provide the energy for the TES.

Methodology

An integrated process model has been developed using Extend® and EES® software to simulate the desalination-absorption refrigeration system (ARS) process. Process parameters have been established to evaluate process performance and economical feasibility of the combined desalination/air conditioning system. Operating parameters have been identified. Design values of solar panels and TES volumes have been calculated for different desalination/air-conditioning rates.

Principal Findings

The integrated process model has been completed. Complete analysis of the process and design specifications have been completed. We have utilized other resources to build a near-full scale prototype system. This system is fully operational now and is being readied for experiments. It is planned to conduct a range of experiments over the summer to generate experimental data to validate the model developed during the first year.