A proprietary Ocean Thermal Energy Conversion (OTEC) modeling tool, the Makai OTEC Thermodynamic and Economic Model (MOTEM), is leveraged to evaluate the accuracy of finite-time thermodynamic OTEC optimization methods. MOTEM is a full OTEC system simulator capable of evaluating the effects of variation in heat exchanger operating temperatures and seawater flow rates. The evaluation is based on comparison of the net power output of an OTEC plant with a fixed configuration. Select optimization methods from the literature are shown to produce between 93% and 99% of the maximum possible amount of power, depending on the selection of heat exchanger performance curves. OTEC optimization is found to be dependent on the performance characteristics of the evaporator and condenser used in the plant. Optimization algorithms in the literature do not take heat exchanger performance variation into account, and this is the source of the discrepancy between their predictions and those calculated with MOTEM.

A new characteristic metric of OTEC optimization, the ratio of evaporator and condenser overall heat transfer coefficients, is found. The heat transfer ratio is constant for all plant configurations in which the seawater flow rate is optimized for any particular evaporator and condenser operating temperatures. The existence of this ratio implies that an exact solution of the ideal ratio could be computed based on the ratio of heat exchanger performance curves, and additional research is recommended.

Major: Mechanical Engineering

Educational Career:
Bachelor's of Mechanical Engineering, BS, 2006, University of Florida

Committee in Charge:
Dr. Marcel Ilie, Chair, MMAE
Dr. Yuanli Bai, MMAE
Dr. Subith Vasu, MMAE

Approved for distribution by Dr. Marcel Ilie, Committee Chair, on June 20, 2012.

The public is welcome to attend.