Sorption-based Solar Desalination for High-efficiency Modular ZLD Treatment

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Phase 2: American-Made Challenges - Solar Desalination

Technology Summary:

The proposed technology offers an innovative sorption-based solar-thermal desalination concept enabling an energy-efficient, modular, and cost-competitive ZLD treatment for a verity of small-scale mobile or semi-mobile applications including inland and oil and gas extraction applications.

The technology is enabled by maximizing the temperature difference between the hot and cold sides of the proposed thermodynamic cycle. Here, a MED unit is uniquely embedded at the heart of a absorption-desorption system (cf. Fig. 1).

Proposed Project Goals:

- The goal is to design, model, and demonstrate a modular, plate-and-frame sorption-based ZLD system with a thermal energy consumption of 67 kWh_{th}/m^3.
- The prototype system desalts low-to-high salinity water (i.e., 20,000-200,000 ppm input water quality) for small-scale, mobile applications.
- The new system is mainly made of low-cost and readily available materials, and is compact.

Key Participant Information:

MTU + Rackam + ORNL + Artic Solar Inc.

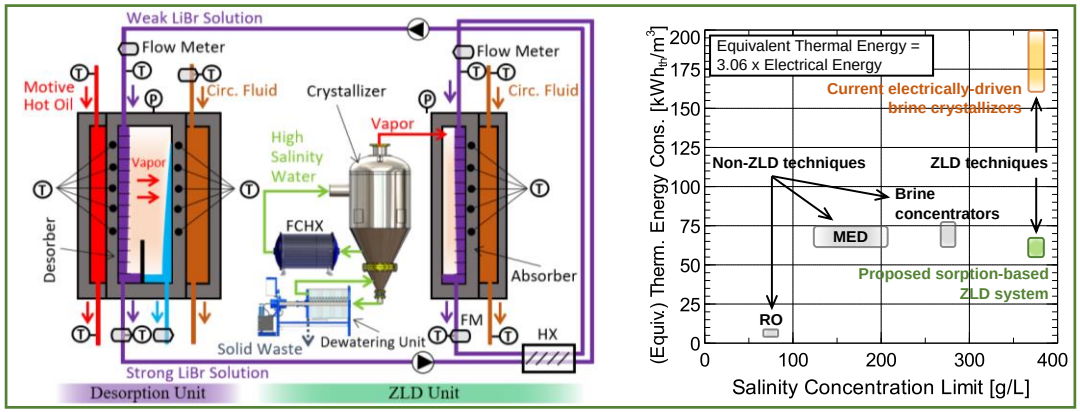

Fig. 1: Sorption-based Solar ZLD Technology

Technology's Impact:

- The sorption-based ZLD technology reduces the thermal energy consumption from 160-200 kWh_{th}/m^3 in existing brine crystallizers to 67 kWh_{th}/m^3 at a LCOW of \$2.59/m^3.
- The core technology offers a promising pathway to lower energy consumption of ZLD systems achievable through existing concentrating solar collector systems.

Project's Key Idea:

- The **high-temperature desorption process** enables a high solar-to-desalination efficiency through existing concentrating solar collectors.
- The **low-temperature crystallization process** allows a cost-effective ZLD approach eliminating the need for high-nickel/molybdenum alloy construction materials.

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