Technical Assistance Request

STREED – Resonance Energy Exchange Desalination

Our Solar Thermal Resonance Energy Exchange Desalination – STREED- based water treatment system consists of a properly interconnected array of STREED modules that efficiently absorb sunlight and store thermal energy to provide a continuous freshwater output and concentrated brine.

One of the key features of STREED is that each module can be described as a heat oscillator that cyclically transfers heat across countercurrent water flows, as we have recently demonstrated experimentally (Energy Environ. Sci.,1**3**, 968-976, 2020) and explained theoretically (Phys. Rev. Applied, 14, 034045, 2020).

Single or few STREED modules can be studied numerically through detailed Finite Element Method based simulations that capture all the essential elements of each module, allowing manipulating its thermophysical properties, input quantities and geometry.

However, the practical implementation of a scaled-up water desalination system requires the coupling of tens to potentially thousands of modules, depending on target desalination capacity and module size. Each module performance depends on many potentially time-dependent factors, including illumination intensity, ambient temperature, input feedwater salinity content, materials thermophysical properties and flow rates.

1. STREED Team @Rice, in partnership with Localized Water Solutions Inc, seeks computational assistance for the multi-parameter optimization of large networks of thermal oscillators. Computational methods may include Reduced Order Models (ROMs) based on FEM simulations or other customized algorithms.

Additionally, critical elements that may affect water treatment systems performance and maintenance costs are fouling, scaling and corrosion. While we propose a membrane-free technology that should minimize modules maintenance, treating high salinity water for prolonged times would almost certainly require addressing minerals buildup and potential damage to the piping system.

2. STREED Team @Rice, in partnership with Localized Water Solutions Inc, seeks expertise regarding the treatment and maintenance of high salinity water treatment systems. Solutions may include ad-hoc materials or the use of water-compatible chemicals.

To ensure the successful realization of a pilot-scale and eventually commercial-scale systems, the proposed solution's performance and desalination efficacy must be carefully monitored during different stages of its development. Independent validations are needed to confirm system energy performance and robustness.

3. STREED Team @Rice, in partnership with Localized Water Solutions Inc, STREED Team @Rice seeks third-party validation entities to verify and provide feedback over STREED desalination performance, including advice on quality monitoring methods.