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Project: **Molten Salt Pump Development for Solar and Nuclear Power Systems**
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Sponsor: NEUP, SETO, DOE

SCL

THL Thermal Hydraulics Laboratory

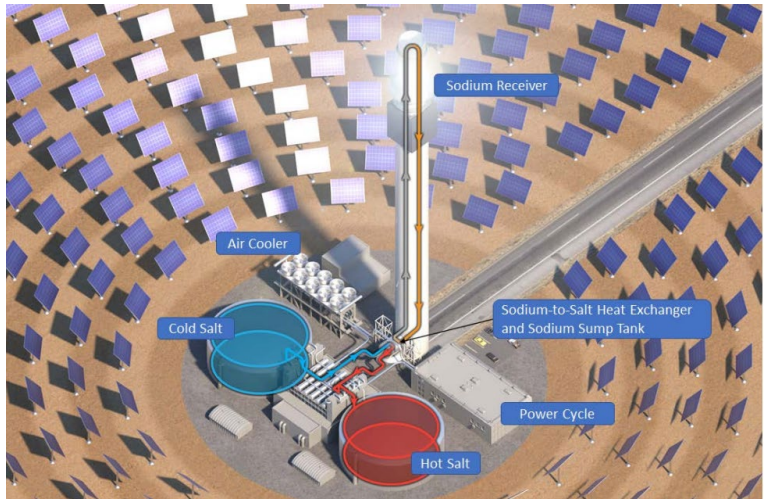
# Background

The need to further develop alternative energy systems to reduce the carbon footprint has led to the Department of Energy's new initiatives which include:

- Exploring the next generation of CSP systems (CSP Gen3) which aim to achieve 50% efficiency from heat to electricity.
- Developing advanced nuclear molten salt reactors (MSR) concepts for improved safety and economics.

**To withstand the high temperatures (750°C) and corrosive molten salt environment, pumps need to be hermetic, robust, serviceable, and economical. This introduces engineering challenges that incorporate innovative designs and ultra tough materials.**


*Sulzer VEY Pump design cross section*




*CSP Gen3 System Design*

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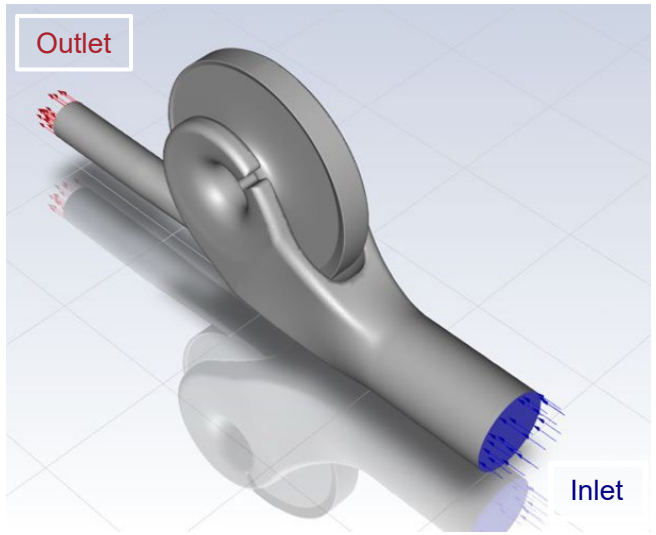
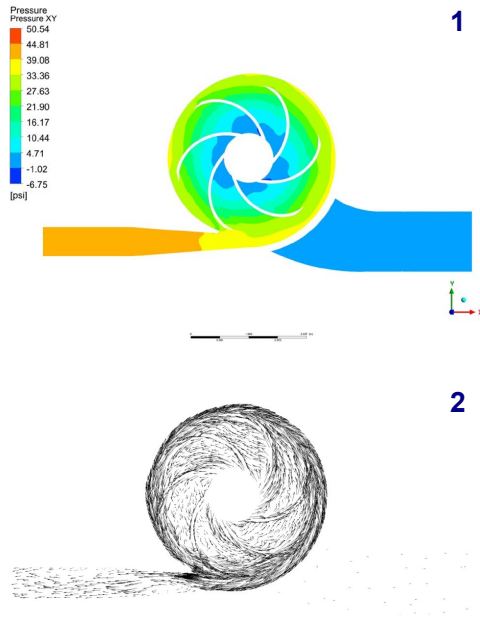
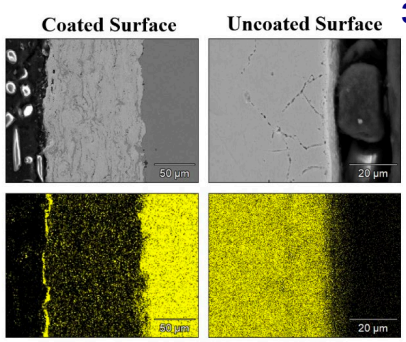
# Project Goals

1. Identify new candidate materials that are suitable for salt-wetted pump bearings by characterizing the tribology and corrosion properties in molten salt.
2. Benchmark the candidate materials by measuring: friction factors, wear rates, material compatibility, and corrosion resistance.
3. Manufacture and test wetted bearing materials in different salts of interest over a range of temperatures, speeds and loads.
4. Develop an advanced pump design concept that utilizes salt wetted bearings, advanced materials, and advanced manufacturing techniques (e.g. additive manufacturing) for non-conventional integral casing geometries.
5. Construct and test laboratory-scale salt pump prototypes suitable for advanced MSR and CSP applications.




CFD overview of molten salt magnetic bearing double suction pump impeller-volute section
1). Pressure contours. 2). Velocity vector field 3). Cross-sectional SEM image and EDS maps of Cr (bottom yellow) distributions in the cermet coating deposited on the surface of superalloy after exposure to molten chloride salt at 750C for 250 hours.

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