

Technical Assistance Request

Our hybrid desalination process combines robust evaporation technology with low-cost membrane distillation. While our Team has expertise in the design of the evaporator and distillation components, there are several additional pieces of conventional heat transfer equipment that must be designed to complete the process. This equipment includes a brine cooling tower, storage vessels, vacuum steam condensing vessel, and a thermocompressor. We are seeking the assistance of a private facility, and/or member of the American-Made Network to help us with the design of this equipment and an analysis of their performance under startup, steady-state, and shutdown conditions. In addition to designing the components to meet the process conditions, the designer must take into account the cost. Therefore, the preferred design engineer should have experience with materials and methods of construction, and fabricators.

Although the heat transfer equipment does not require research in their design, the process requirements present challenges that must be addressed through careful engineering. Our cooling tower is used to meet the temperature conditions required by the membrane distillation. To take advantage of cost and performance benefits from process intensification, direct cooling of the lower-concentration brine is used in lieu of an additional heat exchanger. As the liquid being cooled is brine, which will have elevated chloride levels. This elevated chloride level can present significant challenges with respect to the materials of construction due to stress chloride cracking of many conventional materials. The condenser is used to provide the thermal driving force for the membrane distillation. Care must be taken in the design of the condenser in order to handle the unique flow configuration and vacuum pressure used in the implementation of SCEPTRE for produced water, where the membrane distillate output joins the condensed steam on the shell side to be re-heated to liberate any volatile species that may have passed through the membrane. A thermocompressor is used in our system instead of the more common electrically-powered mechanical compressor. This is due to the fact that we are using motive steam from the solar thermal system to drive compression of the vaporized brine in the evaporator. Thermocompressors have a simple construction with no moving parts and are relatively insensitive to fouling. Nevertheless, the physical principles underlying the design require an understanding of the complex thermodynamics and fluid mechanics of compressible supersonic flow.

The private facility, and/or member of the American-Made Network would advantageously have access to, and proficiency with, the software required to design and model each type of equipment mentioned above. The industry-leading heat transfer equipment design software is HTRI.

Additional requirements for the entity providing Technical Assistance include having a history of success in producing, developing, testing, validating, prototyping, and manufacturing the equipment described above. Desirable specialized capabilities include thermal equipment and system design, fluid system design, as well as understanding for integration of these systems. As the heat transfer equipment described above is not unique to our system and find general use in thermal desalination, we expect that the engineering services we seek will find broad applicability to the American-Made Network.