

Terrestrial Energy USA  
partnered with  
Argonne National Laboratory

GA-16AN020102, Verification of Molten-Salt Properties at High Temperatures  
RFA-17-14615, Integral Molten Salt Reactor Fuel Salt Property Confirmation: Thermal Conductivity and Viscosity

**YEARS AWARDED:** 2016, 2017

**TOTAL COMBINED PROJECT VALUE:** \$688K (DOE funding, \$560K; awardee cost share, \$128K)

2016: \$300K (DOE funding, \$250K; awardee cost share, \$50K)

2017, \$388K (DOE funding, \$310K; awardee cost share, \$78K)

**STATUS:** Completed

**PRINCIPAL LAB INVESTIGATOR:** Mark Williamson (williamson@anl.gov)

**DESCRIPTION:** At the outset of this collaboration, made possible by the Gateway for Accelerated Innovation in Nuclear (GAIN), Terrestrial Energy USA, Inc. (TEUSA) asked Argonne National Laboratory (ANL) to procure, prepare, and characterize fluoride salt compositions relevant to the company's Integral Molten Salt Reactor (IMSR®) design. After demonstrating the suitability of the fluoride salt compositions, voucher work was focused on the measurement and assessment of the salts' heat capacity. This voucher pilot program allowed TEUSA to obtain actual thermophysical properties of fuel salts using modern experimental methods rather than close approximations based on historical data. Under the second voucher, ANL and TEUSA worked together to investigate the fuel salts' thermal conductivities, viscosities, and densities. ANL procured a laser flash analysis system using cost share funds provided by TEUSA for thermal diffusivity property measurements, which provided additional value to the laboratory in support of its broader mission.

**BENEFIT:** In addition to the technical data and measurements that were collected, which will be essential to the licensing and commercialization of TEUSA's IMSR®, the working relationship developed between ANL and TEUSA allowed for both parties to pioneer novel collaborative research.

**IMPACT:** The collaborative work funded by GAIN offers a case study on how GAIN vouchers advance nuclear technology toward commercialization. TEUSA's two separate GAIN awards catalyzed work that evolved into a full-scale commercial partnership with ANL, announced in November 2020.

**LESSONS LEARNED:** Rather than building its own in-house testing capabilities, TEUSA determined that it would be more efficient to procure fuel salt testing services through national laboratories that possess the necessary expertise.

**SIGNIFICANT CONCLUSIONS:** The fuel salt testing program is part of a broader ongoing confirmatory testing program for fuel, components, and systems used in the IMSR® power plant. The results of these tests will support licensing applications for the first commercial deployment of IMSR® power plants.

**NEXT STEPS:** ANL will continue to use an extensive array of characterization techniques and advanced laboratory equipment to determine the thermophysical properties of the IMSR® fuel salt in accordance regulatory quality standards.