



The National Reactor Innovation Center

The U.S. Department of Energy Office of Nuclear Energy established the National Reactor Innovation Center (NRIC) in 2019. Led by Idaho National Laboratory, NRIC's mission is to partner with the United States private sector, national laboratories, government agencies, and regulators to provide access to capabilities, facilities, subject matter experts and tools essential to demonstrate new reactor technologies and address key barriers to entry and success.

NRIC's goal is to accelerate the development and demonstration of advanced nuclear technology to reduce carbon emissions. To accomplish this, NRIC provides access to national laboratory assets and expertise, establishing four new experimental facility capabilities, two large reactor test beds for integrated technology demonstrations and

experimentation by 2028, and completing two advanced nuclear technology tests by 2030.

Industry Partnerships

NRIC partners with advanced nuclear energy technology

developers to bridge the gap between research and development and commercial demonstration. NRIC provides innovators with access to U.S. government resources, including the facilities and



Figure 1

The containment dome of the retired EBR-II reactor will host fueled experimental reactors up to 20 megawatts thermal for industry partners.

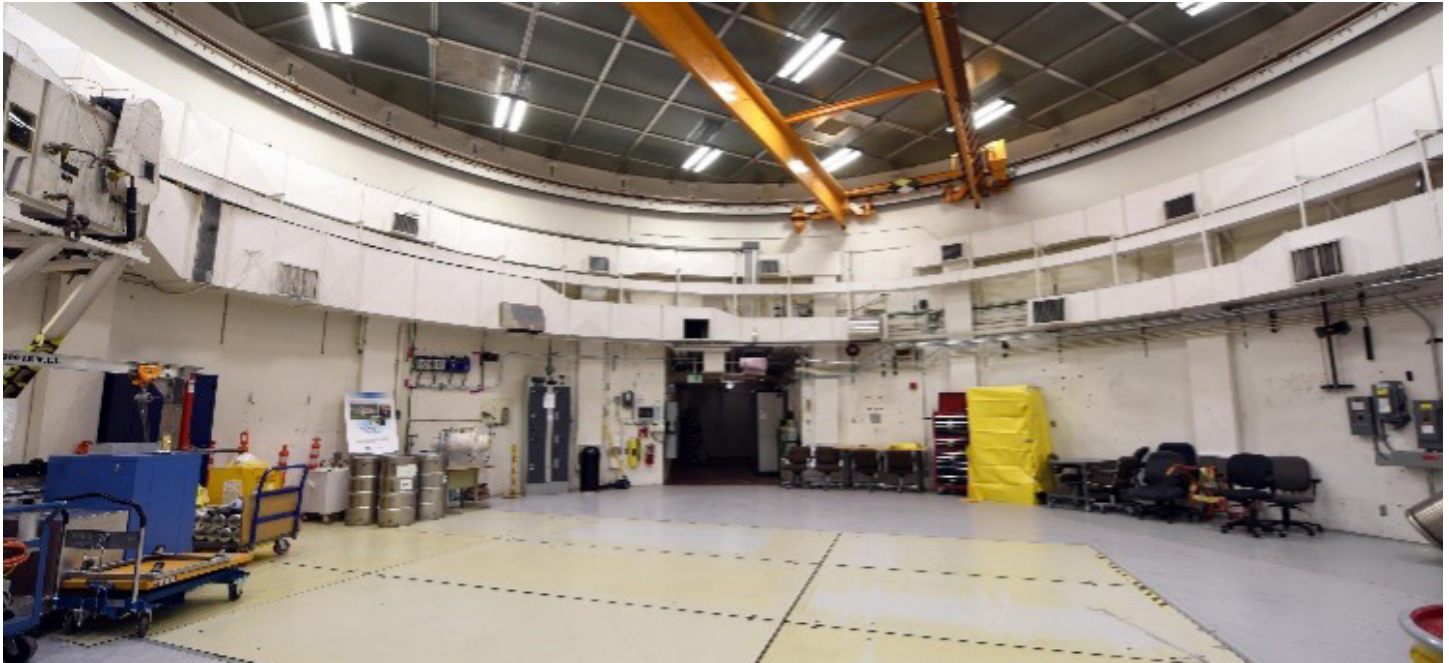


Figure 2

The repurposed Zero Power Physics Reactor facility will host projects including the Molten Chloride Reactor Experiment.

expertise to conduct technology demonstrations. NRIC also provides funding and oversight to developers and manages demonstration and test projects to success.

These capabilities will ultimately support a timely and cost-effective path to licensing and commercializing new nuclear energy systems. NRIC offers access to reactor test beds, materials and fuels testing, permitting and regulatory assistance, and contracting support to help innovators navigate the process.

Stakeholder Engagement

NRIC will work with relevant individuals, groups, and government and nongovernment entities with an interest in NRIC

programs and its private-public partnerships to facilitate testing and demonstrating advanced nuclear technology.

Test Beds

NRIC hosts a variety of experimental capabilities and demonstration infrastructure to help developers commercialize their technology. These include testing components operating in liquid metal environments, gas-cooled reactor designs and molten salt reactors. The Virtual Test Bed is a modeling/simulation environment supporting pilot demonstrations.

NRIC is also preparing two test beds to host advanced reactor experiments, providing a safe path for reactors to achieve initial

criticality: the Demonstration of Microreactor Experiments (DOME) and the Laboratory for Operation and Testing in the United States (LOTUS).

DOME will be located in INL's Experimental Breeder Reactor - II (EBR II) facility and will host tests of advanced experimental reactors up to 20 megawatts thermal fueled with high-assay low-enriched uranium (HALEU).

LOTUS will be located at INL's Zero Power Physics Reactor facility and will host tests of advanced experimental reactors up to 500 kilowatts thermal capable of using fuels with greater than 20% enrichment.

Experimental Infrastructure

To help industrial partners move technologies into test and demonstration, NRIC is developing and supporting experimental facilities that are key to testing fuels and components before full system demonstrations. The Helium Component Test Facility at INL allows industry developers to test components of gas-cooled reactor designs in a non-irradiated environment operating at temperatures, pressures and flow rates representative of actual reactor operating conditions.

The Molten Salt Thermal Examination Capability (MSTEC) is a shielded modular hot cell with an inert argon atmosphere housing characterization equipment for determining the thermophysical and thermochemical properties of high temperature liquids including highly irradiated fuel salts. MSTEC will provide users with characterization equipment, infrastructure and technical staff necessary to produce critical fuel property data needed to design, demonstrate, license and operate a molten salt reactor.

NRIC is developing three compact thermal creep frames to support materials development, qualification and licensing of advanced reactor materials. The compact design could be installed in a hot cell for the

concurrent testing of multiple irradiated subsize specimens. Creep frame installation is planned for fiscal year 2025 in the Sample Preparation Lab, which is under construction at INL.

NRIC supports the Mechanisms Engineering Test Loop (METL) at Argonne National Laboratory. METL tests small- to intermediate-scale advanced liquid metal components and instrumentation in sodium to generate performance data on fast reactor systems. This data helps reduce the risk of failures during reactor plant operations.

Risk Reduction

NRIC's Advanced Construction Technology initiative aims to reduce

cost overruns and scheduling delays that can impact nuclear plant construction. NRIC plans to support the demonstration of three high-impact technologies in a nuclear context:

- **Vertical Shaft Excavation:** this technique reduces excavation and backfill volumes and could save millions in project costs.
- **Modular walling systems:** modular construction using steel/concrete composite walling systems could significantly reduce costs and improve schedules.
- **Digital Twin:** embedded sensors provide developers with active plant monitoring during construction and throughout its lifetime.

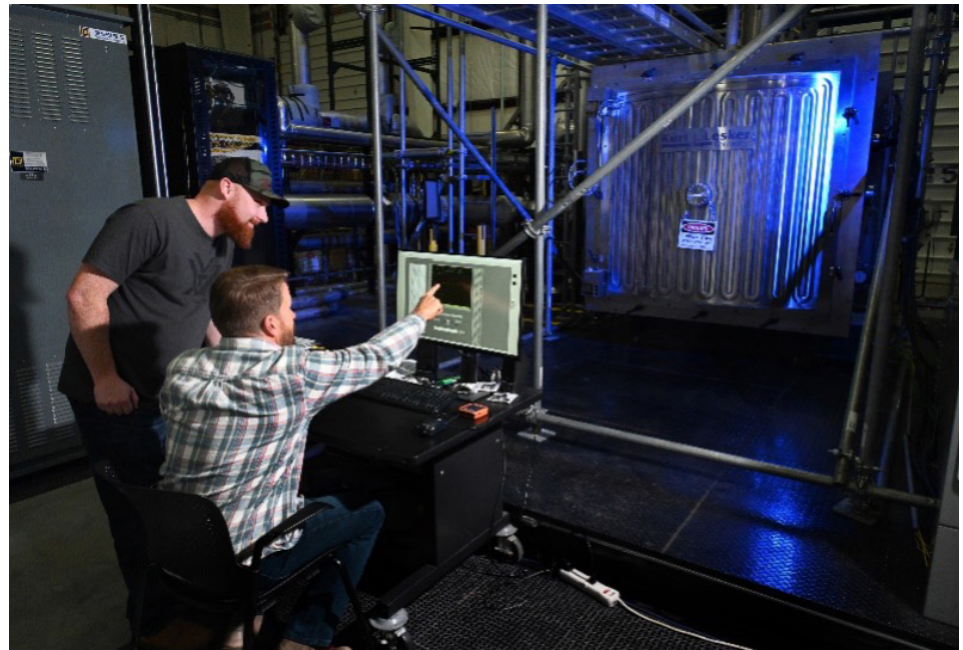


Figure 3

The Helium Component Test Facility helps developers test components for gas-cooled reactor designs in a non-nuclear environment.



Figure 4

Advanced construction techniques like vertical excavation can reduce costs and speed up timelines for reactor construction.

The Siting Tool for Advanced Nuclear Development is an online tool to help stakeholders identify and examine potentially feasible sites where communities might welcome advanced nuclear energy facilities. The tool is designed to explore and provide insight on socioeconomic, proximity and safety data; generate county reports; review regulatory data; and compare multiple sites.

NRIC has also developed the Demonstration Resource Network of publicly owned sites, facilities, expertise and capabilities suitable for performing key experiments, tests or fabrications

and for hosting advanced reactor demonstrations throughout the U.S.

NRIC is implementing enhancements of the digital engineering framework to enable fully digital engineering operations; integrating production P6 schedule data into the NRIC digital ecosystem; deploying and configuring a product lifecycle management tool for NRIC use; deploying and configuring a verification and validation tool for NRIC use; and sustaining the cloud production environment for the entire NRIC digital engineering ecosystem.

About Idaho National Laboratory

Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy. INL is the nation's center for nuclear energy research and development, celebrating 75 years of scientific innovations in 2024. The laboratory performs research in each of DOE's strategic goal areas: energy, national security, science and the environment.

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