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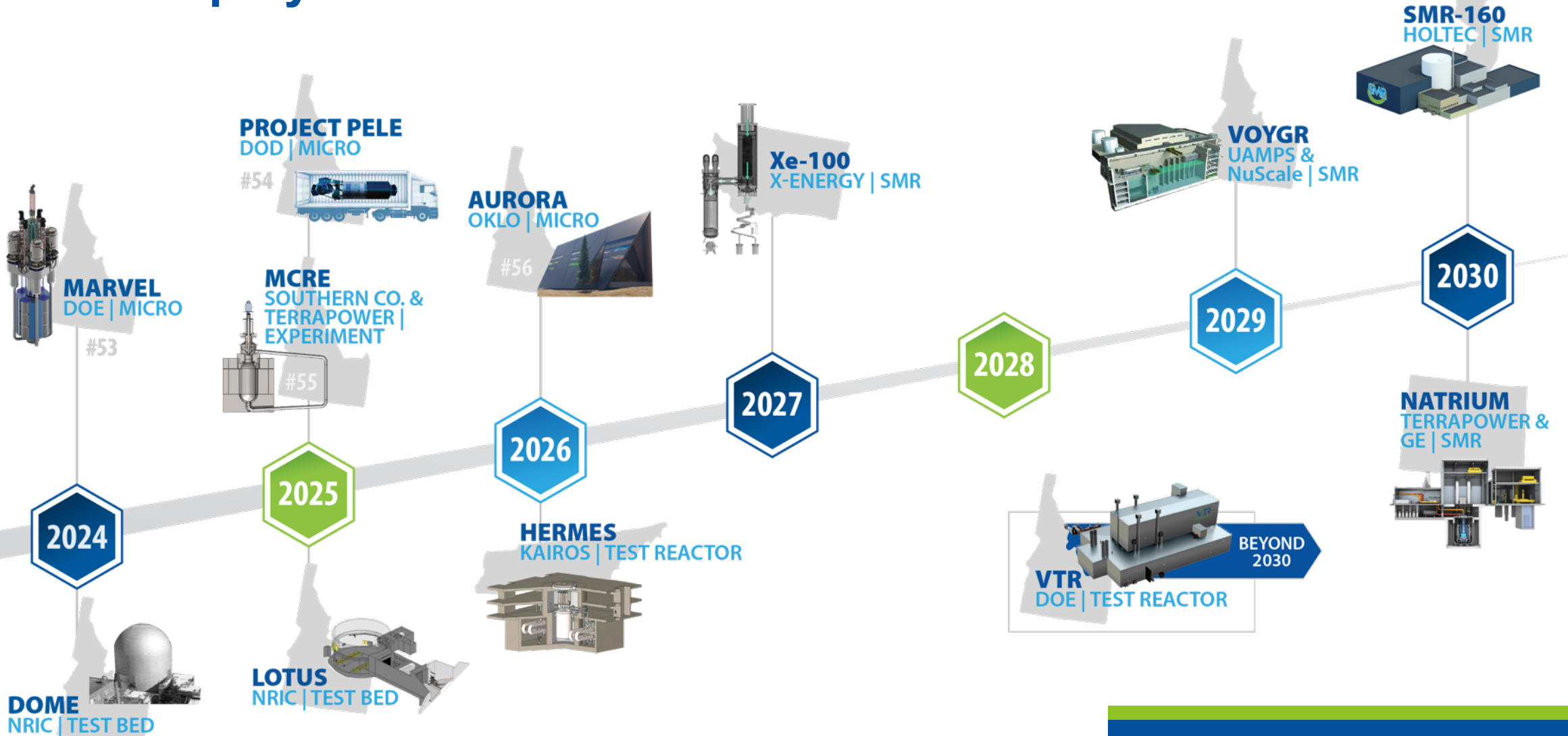
National Laboratory Role for Developing and Deploying Advanced Reactors

Battelle Energy Alliance manages INL for the
U.S. Department of Energy's Office of Nuclear Energy



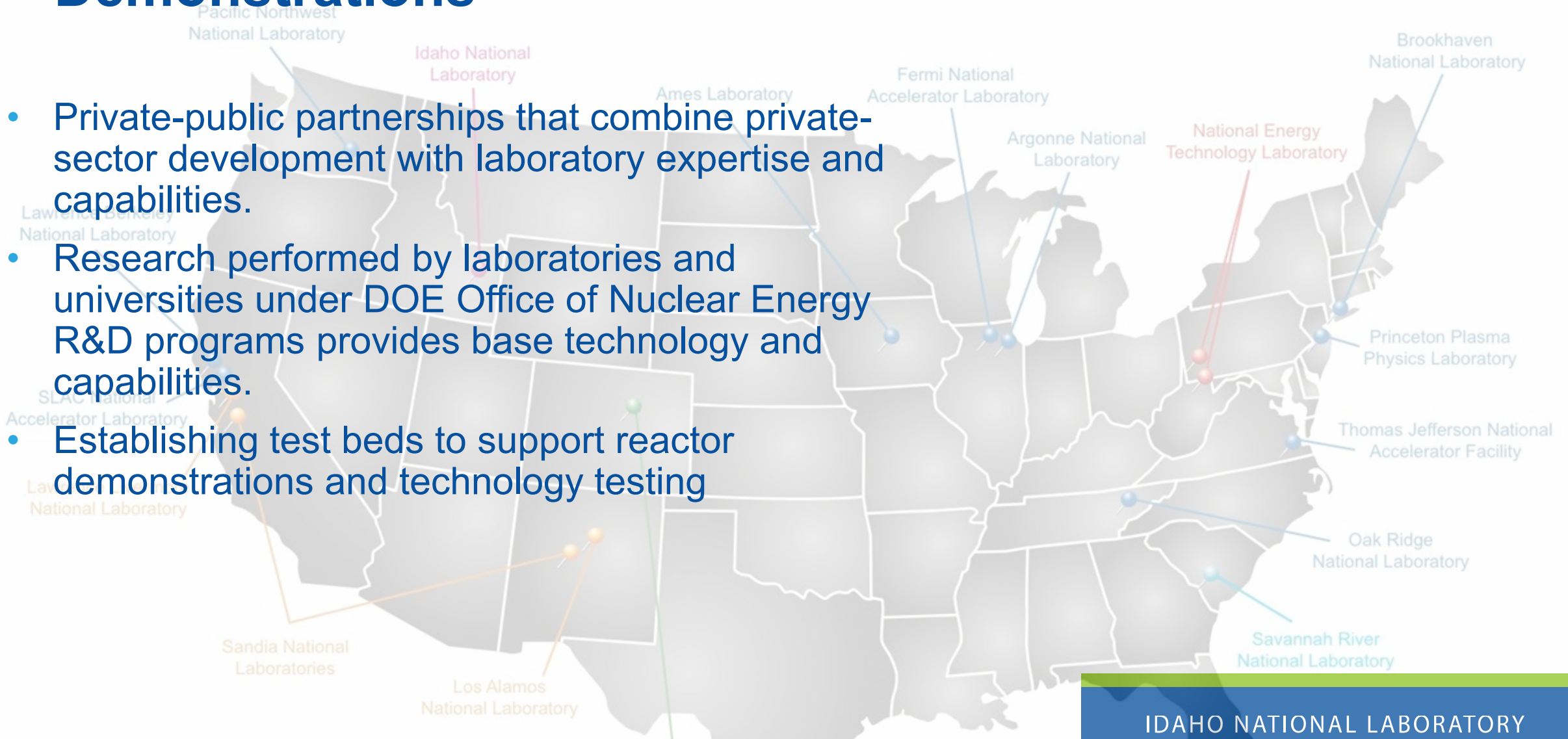
Idaho National Laboratory

Setting the Stage: Notable Advanced Reactor Demonstrations and Deployments Over the Next Decade in the United States



National Laboratories Support Advanced Reactor Demonstrations

- Private-public partnerships that combine private-sector development with laboratory expertise and capabilities.
- Research performed by laboratories and universities under DOE Office of Nuclear Energy R&D programs provides base technology and capabilities.
- Establishing test beds to support reactor demonstrations and technology testing



Research and Development through DOE-NE R&D Programs Are Enabling Advanced Reactors

- **Research and development through DOE R&D programs provide the fundamental technologies needed to support advanced reactor development**
 - Reactor technology development, Fuels, Materials, Modeling and Simulation, Sensors and Instrumentation
- **National Laboratory facilities and capabilities are supporting technology development and qualification**
 - Fuel fabrication capabilities
 - Fuels and materials irradiation
 - Post-irradiation examination
 - Component and system testing
- **National Reactor Innovation Center – enabling reactor demonstrations**

Advanced Reactor Technologies Research and Development

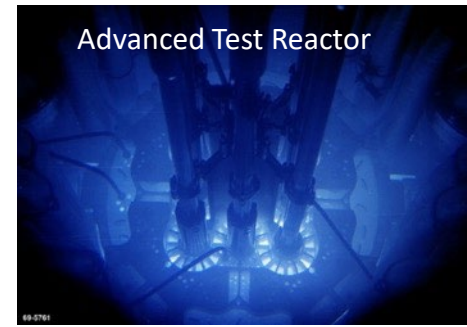
- **Targeted R&D on advanced reactor technologies**
 - Fast reactors
 - Molten Salt Reactors
 - High-temperature gas-cooled reactors
 - Microreactors
- **Research focuses on:**
 - Fundamental technologies and design methods
 - Interactions of diverse reactor coolants with materials and components
 - Advanced energy conversion
 - Research to enhance safety and reduce regulatory risk
 - Experimental validation of models



MARVEL Microreactor

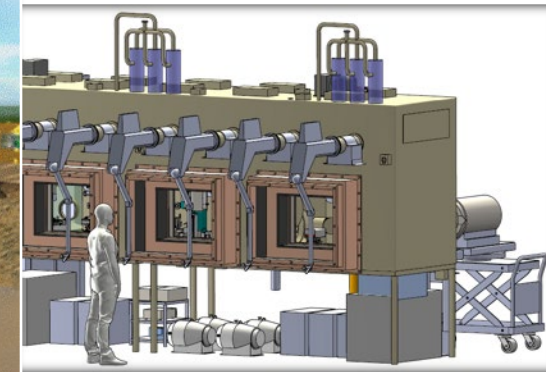
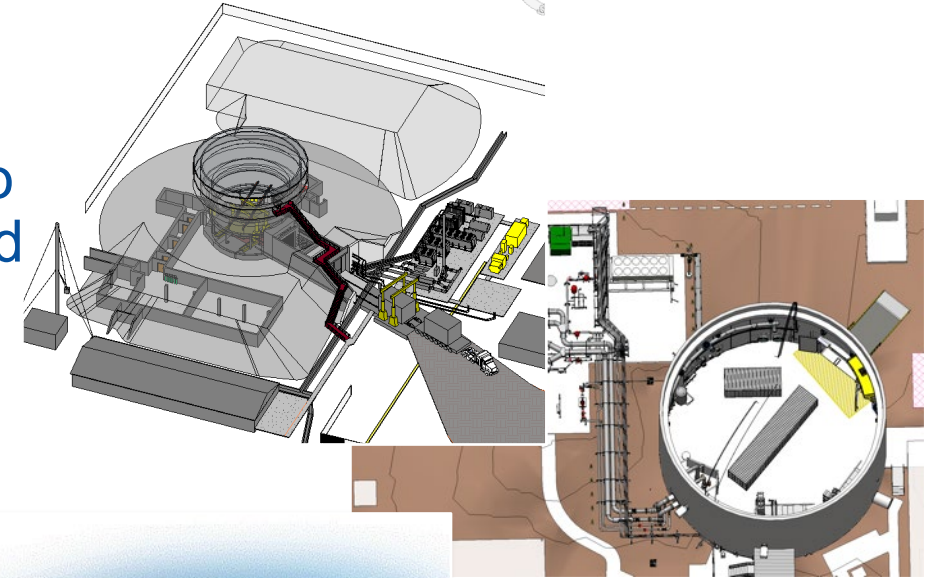
Nuclear Fuels, Materials and Sensor R&D

- **Advanced Materials and Manufacturing Technologies (AMMT)**
 - Combined materials and advanced manufacturing program
 - Accelerate the use of new materials and production technologies in nuclear systems
- **Nuclear Science User Facilities (NSUF)**
 - Experiments awarded competitively to university, industry, and laboratory researchers in nuclear facilities at 20 partner institutions, including ATR, TREAT, HFIR, MITR, and BR2 reactors
- **Advanced Sensors and Instrumentation (ASI)**
 - Development/implementation of instrumentation for irradiation experiments and in-reactor applications
- **Advanced Fuels Campaign and Fuel Testing Capabilities**
 - Advanced Test Reactor Steady-State Irradiations
 - TREAT Transient fuel testing
 - Post-Irradiation Examination and Material Characterization
 - Accelerated fuel testing methodologies

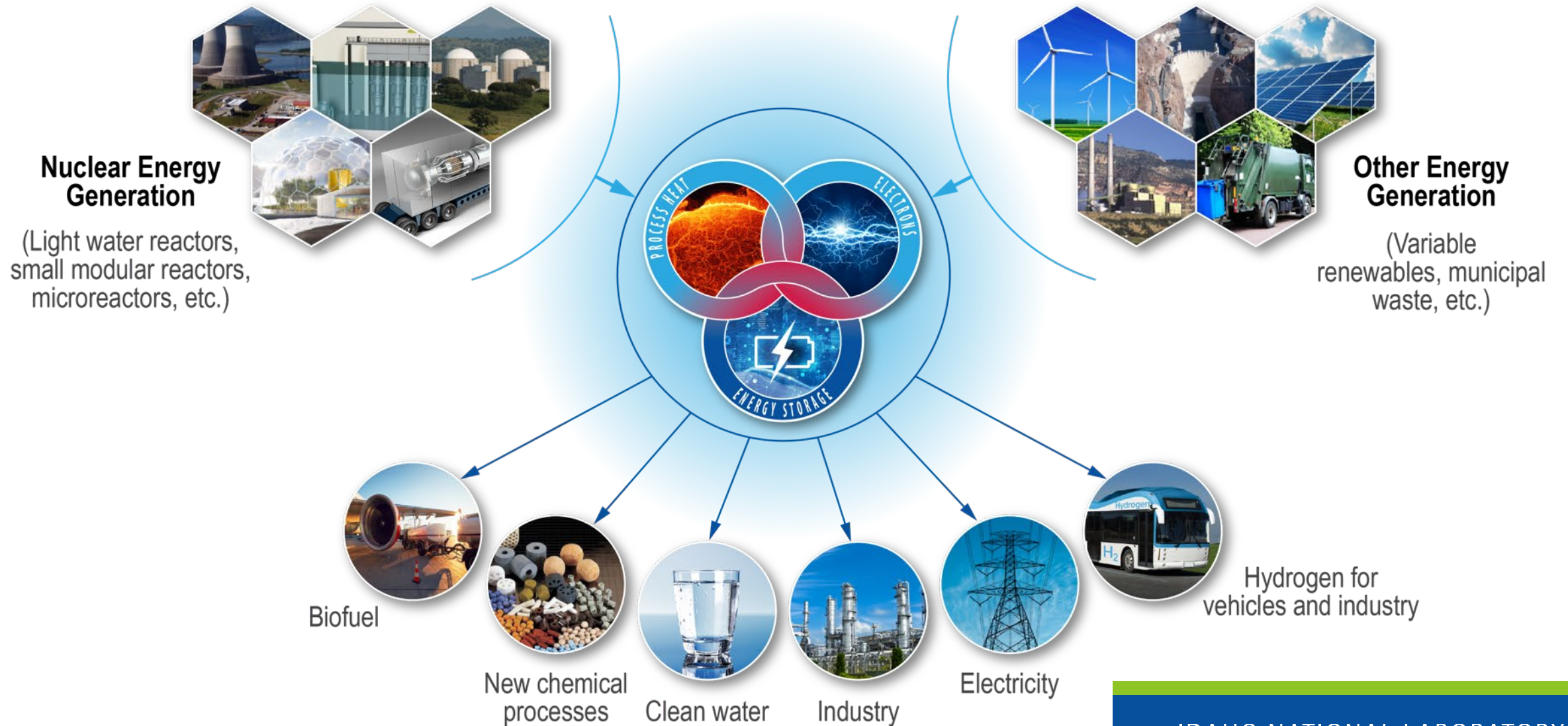


National Reactor Innovation Center

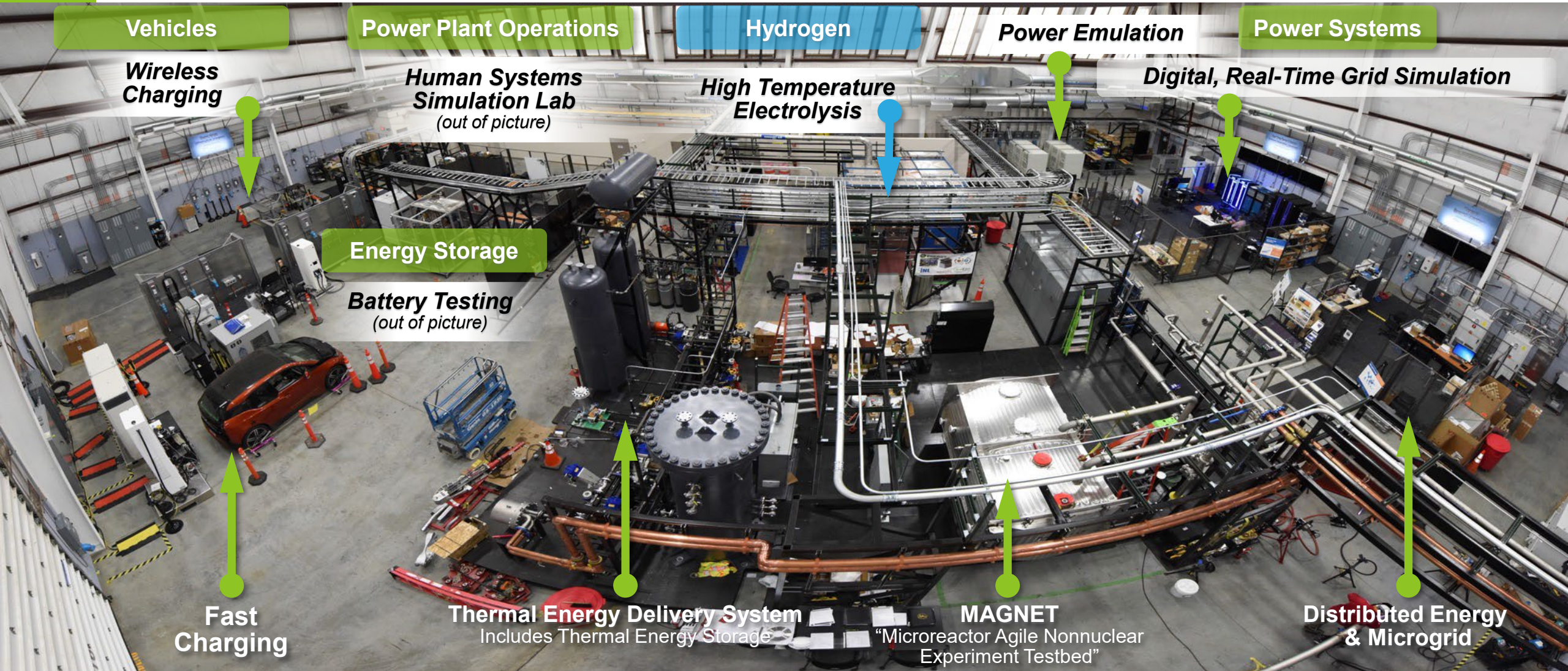
- Established in 2019 by the DOE Office of Nuclear Energy with the purpose to provide the capabilities to support development and demonstration of advanced reactors
- Enabling reactor developers through:
 - Test beds
 - Demonstration Sites
 - Experimental Facilities
 - Resource team support
- Addressing cost and markets:
 - Advanced Construction Technologies
 - Integrated Energy Systems
 - Digital Engineering



Integrated Energy System - Shifting the energy paradigm



INL Energy Systems Laboratory IES Capability



INL/JAEA Collaborations

- Collaboration between INL and JAEA provide for significant sharing of information, data, and expertise
- Collaboration on fuels experiments provides access to facilities and data that supports development of ATF and advanced reactor fuels.
 - Advanced Reactor Experiments for Sodium Fast Reactor Fuels (ARES)
 - Irradiation tests of accident tolerant fuel (ATF) cladding in the Advanced Test Reactor (ATR) at INL
 - High Burnup Experiments in Reactivity Initiated Accident (HERA) in the Nuclear Energy Agency's Framework for Irradiation Experiments (OECD/NEA FIDES) international framework
- Improving high temperature gas-cooled reactor (HTGR) simulation methods and models

Additional topics for consideration

- Energy transitions (e.g. coal-to-nuclear)
- Hydrogen production using nuclear energy
- High performance computing, modeling and simulation, applications of artificial intelligence
- Fuels and materials testing in JOYO



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