What's New at the Labs: DOE Applied Energy Technology National Laboratories

Marianne C. Walck, PhD
Deputy Director for
Science and Technology,
Chief Research Officer

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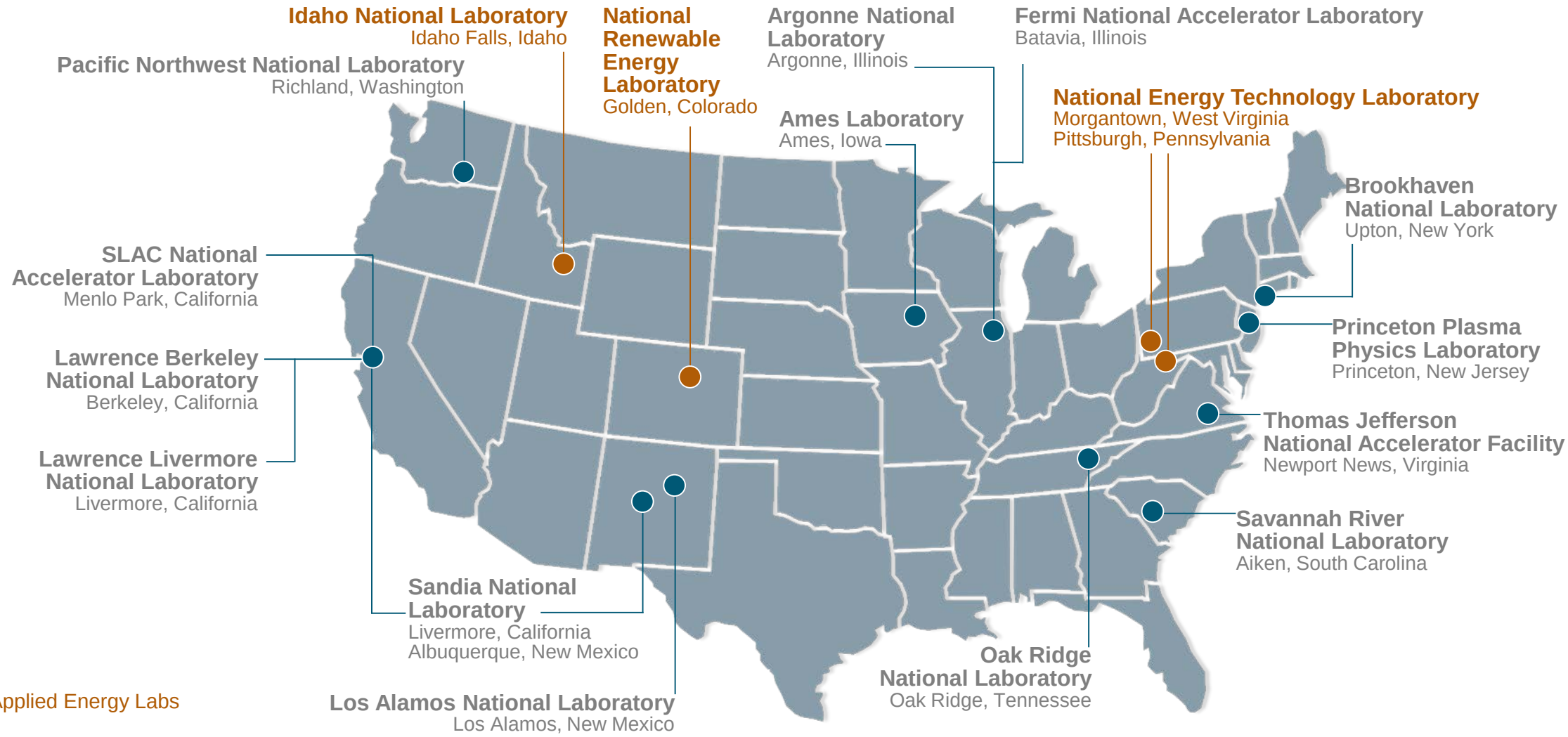
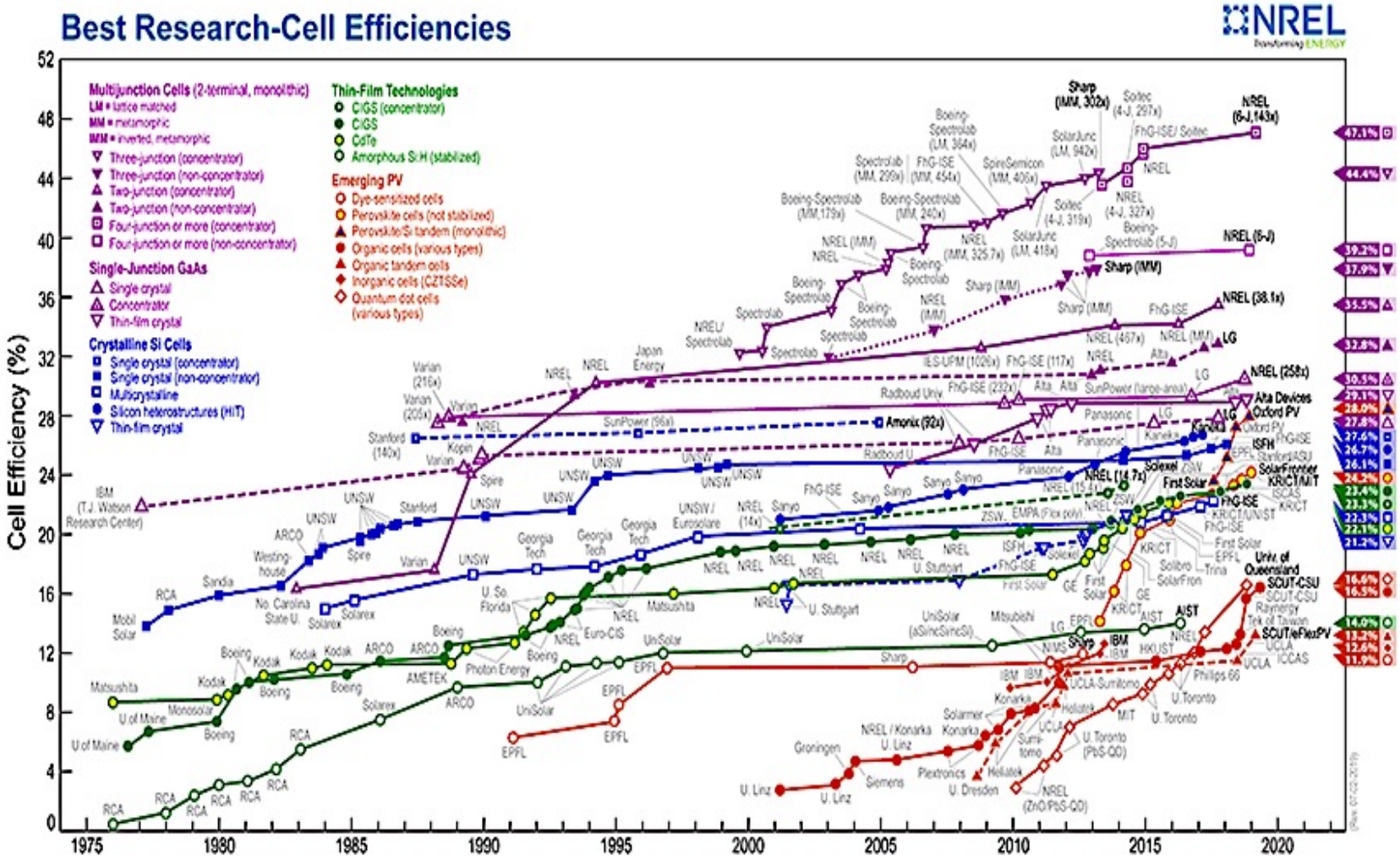
Idaho National Laboratory

Applied Energy National Laboratories



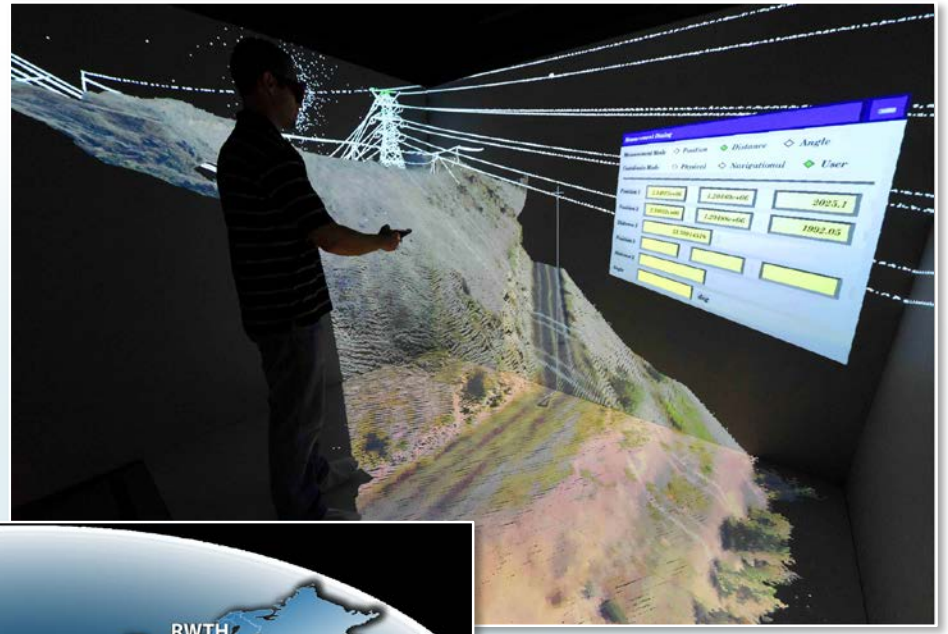
Renewable Energy Examples

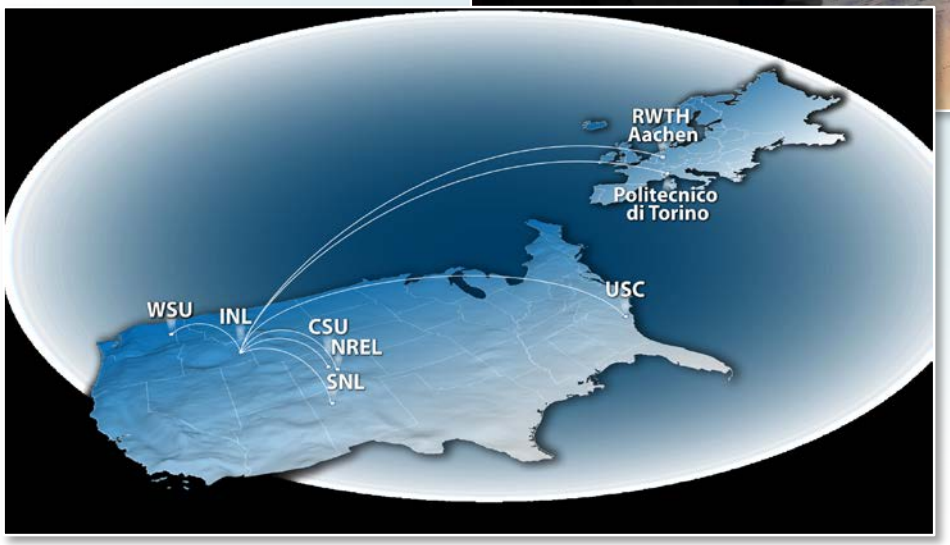
- **Solar**
  - Research-Cell Efficiency advancements
  - Software: GO-Solar, PRECISE Wind
- **Wind**
  - Wake steering: WISDEM
- **Geothermal**
  - FORGE
- **Water**
  - Hydro black start resiliency
- **Hydrogen**
  - Advanced water splitting: High-temperature and low-temperature electrolysis advancements



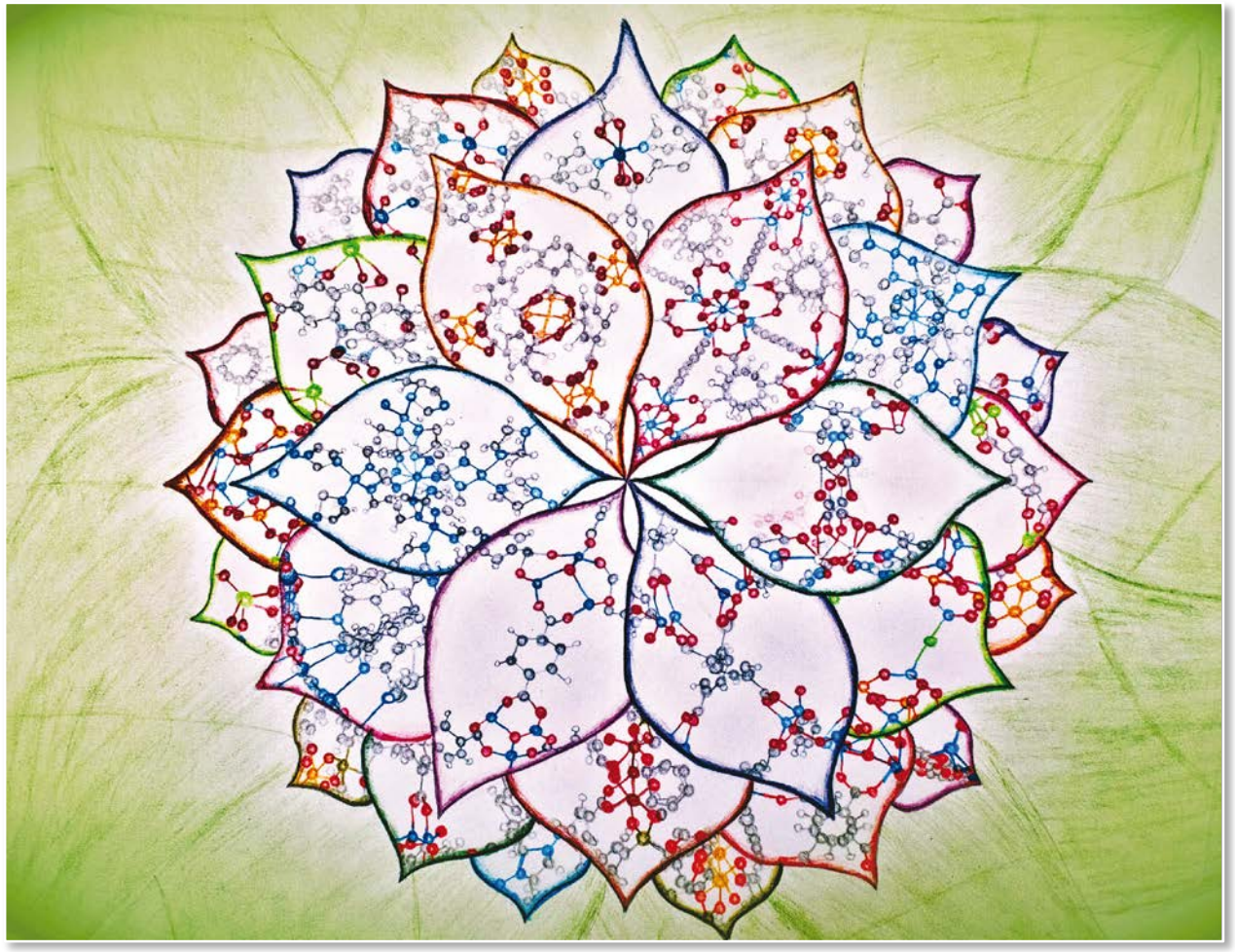
Grid Reliability, Integration, Technology Examples

- **Grid Reliability and Technologies:**
  - Transformer monitoring technology
  - Global Real-time Super Lab (moving electrons vast distances quickly)
  - Self-healing microgrids
  - Software and simulations: GLASS and HELICS
  - Autonomous Energy Grids concept
  - Peer-to-peer energy exchange using blockchain technology
- **Technologies for Self-Powered systems**
  - Piezoelectric nanomaterials
  - Soft polymers that scavenge mechanical systems





Fossil Energy and Energy Storage Examples

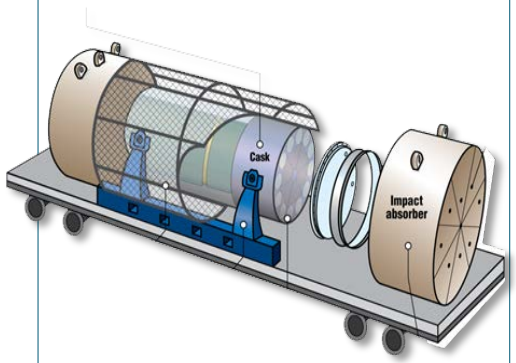


- **Carbon Capture**
  - Screening method for mixed matrixed polymeric membranes (using Metal Organic Frameworks)
- **Batteries/Storage**
  - Key challenges for high-energy, long-cycle life batteries
  - Extreme fast charging: fading of positive electrode performance identified
  - Flow batteries in advanced distributed grids

Aggressive Timeline for New Nuclear in the US: Led by INL

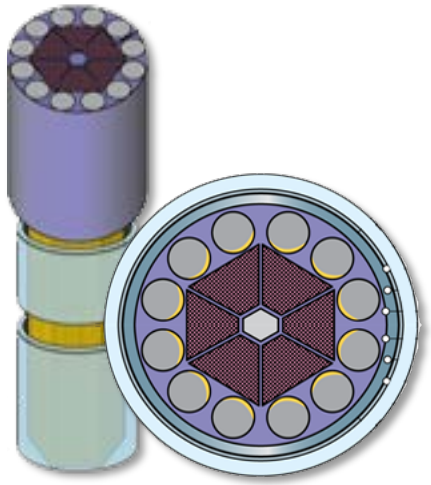
Microreactor (<10MW) demonstration by early 2020s

- Advanced reactor designs
- New markets for nuclear energy



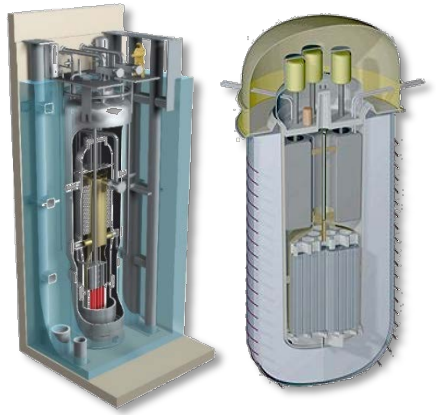
Commercial microreactors deployed

- Remote site power and process heat customers



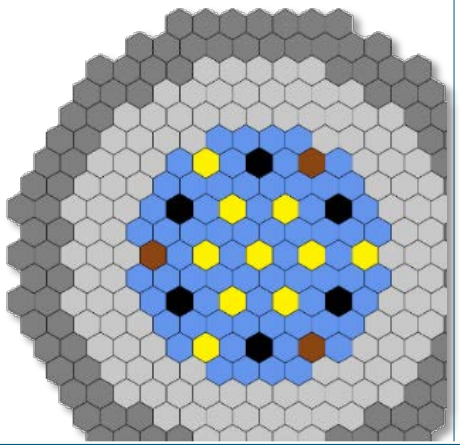
SMR(s) operating by 2026

- SMR siting and technical support
- Joint Use Modular Plant (JUMP)



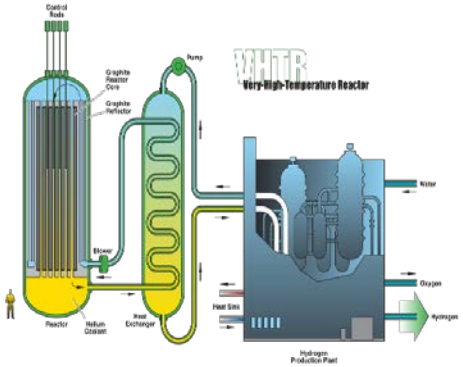
Versatile Test Reactor (VTR) operating by 2026

- Fast-spectrum testing and fuel development capability



Non-LWR advanced demonstration reactors by 2030

- Replacement of U.S. baseload clean power capacity



2023 — 2030

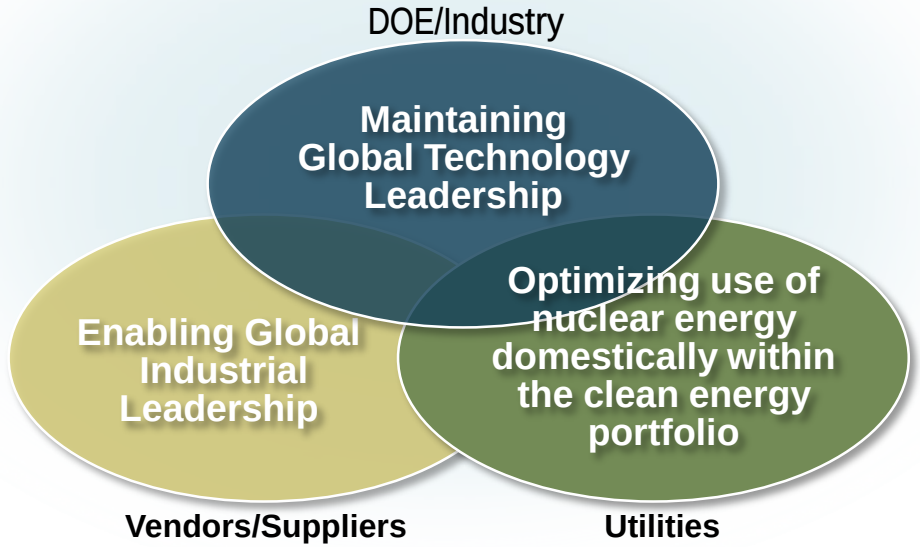
Gateway for Accelerated Innovation in Nuclear (GAIN)

GAIN
Gateway for Accelerated Innovation in Nuclear

Removing barriers to a cleaner, safer nuclear energy source

Idaho National Laboratory · Argonne National Laboratory · Oak Ridge National Laboratory

In parallel, create private-public partnership and funding approach, engage industry on technology needs and focus advanced reactor R&D on common technology needs, innovative designs, and reducing cost of advanced nuclear energy systems.

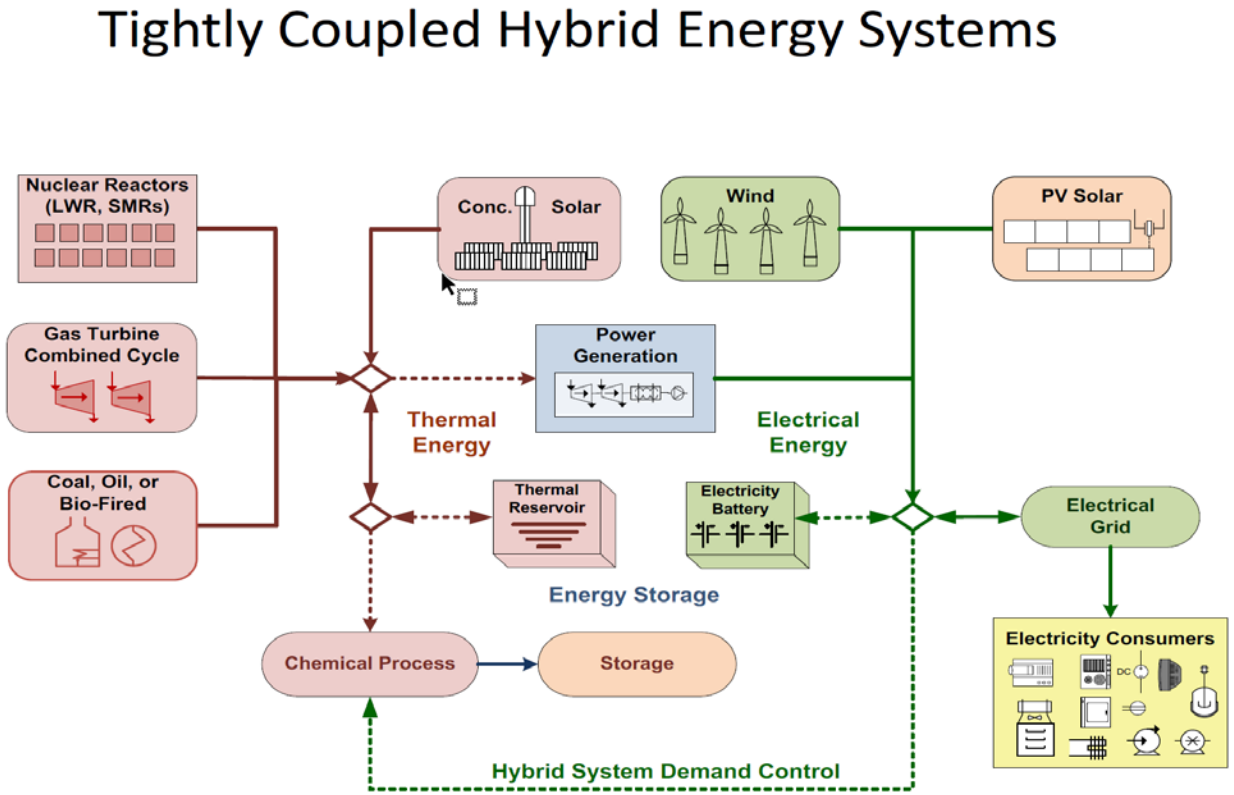


***Integrated Approach for Innovation to Achieve All 3 Strategic Objectives** Simultaneously*

DOE-VENDORS-UTILITIES
Private-Public Partnership Model
Optimized strategy for development, demonstration, and deployment of advanced technologies.

Integrated Hybrid Energy Systems: INL, NETL, NREL

- **Integration of DOE Applied Energy Activities enables:**
  - Renewables Integration into the Grid
  - Flexible use of nuclear, fossil, renewable power sources for thermal, H_2, and chemical production as well as electricity
- **Tri-Lab team has developed a series of initial proposals for concept maturation and demonstration**
  - Hydrogen Production
  - CO_2 utilization powered by low-carbon energy
  - Carbon Conversion
  - Thermal Energy Storage (solar, nuclear)
  - Thermal Energy Utilization for Energy Efficiency



Thank you!

INL Idaho National Laboratory