

***Opportunities, Challenges, and
Solutions to Enable a Clean Energy Future:***

The Role of Nuclear Energy



Dr. Mark Peters

Director, Idaho National Laboratory

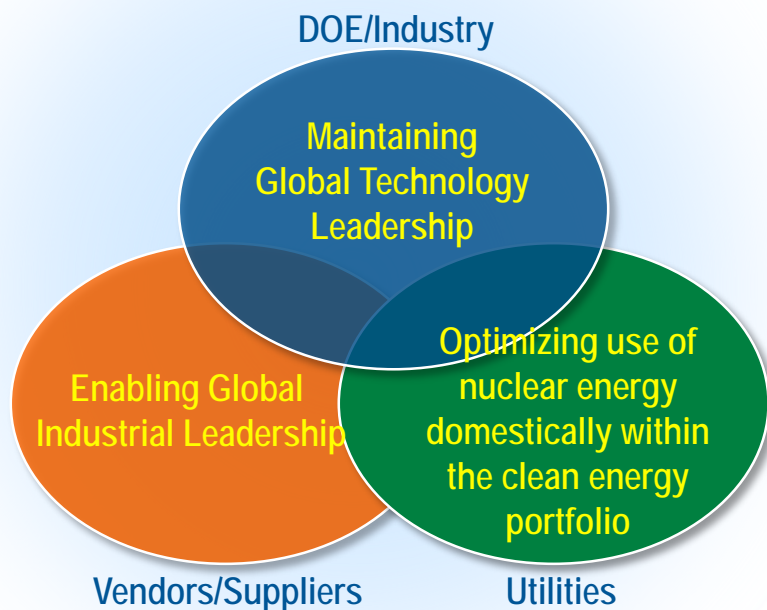
www.inl.gov



June 14, 2016

The Urgent Need for Clean and Reliable Energy Provides Opportunities for Nuclear Energy

STRATEGIC OBJECTIVES



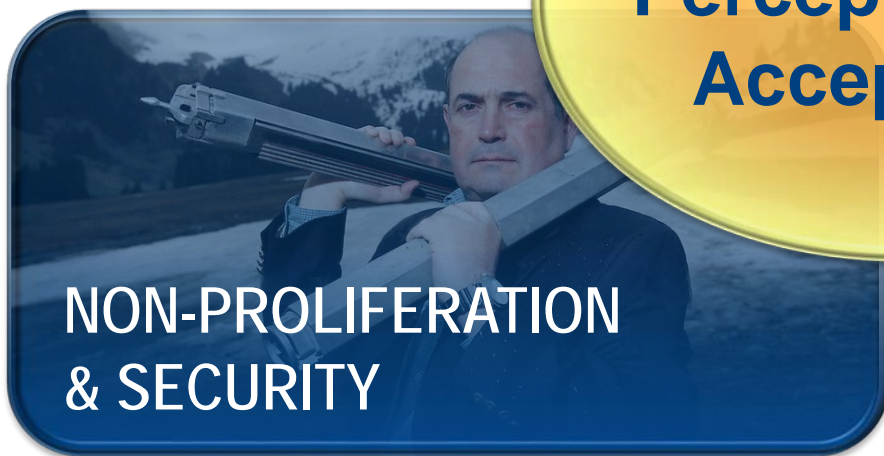
- National and global demand for nuclear energy is increasing and U.S. global leadership is decreasing
- There is a **sense of urgency** with respect to the development and deployment of advanced nuclear reactor technologies
- There is considerable private sector investment emerging in advanced nuclear reactor technologies

A progressive private-public RDD&D execution model must aim at achieving all three strategic objectives simultaneously.

There are Challenges that Need to be Overcome to Enable Nuclear Energy Future and Increase Our International Nuclear Energy Leadership



**Public
Perception and
Acceptance**



Policy Enablers for Nuclear Energy Future and Increasing International Nuclear Energy Leadership

ECONOMICS

- Production tax credits
- State-level clean energy standards
- Financial support and power purchase agreements
- Loan guarantees
- Price on carbon

SAFETY

- 123 agreements
- Technology export
- NRC as “gold standard”
- Regulatory process update

**PUBLIC
ACCEPTANCE**
Safe and Affordable

NON-PROLIFERATION & SECURITY

- 123 agreements
- Technology export
- NRC as “gold standard”
- Assured fuel supply & take back regime

WASTE MANAGEMENT

- Long-term storage
- Consent-based siting of interim storage facilities and geologic repository
- Future fuel cycles
- Nuclear waste policy update

RD&D Enablers Support Policy

ECONOMICS

- Advanced manufacturing
- Hybrid energy applications
- Advanced energy conversion systems
- Reduced licensing and construction times

SAFETY

- Designs with improved inherent safety
- Advanced instrumentation & control systems
- Components with enhanced severe accident resistance (e.g., accident tolerant fuels)
- Enhanced severe accident management

**PUBLIC
ACCEPTANCE**
Safe and Affordable

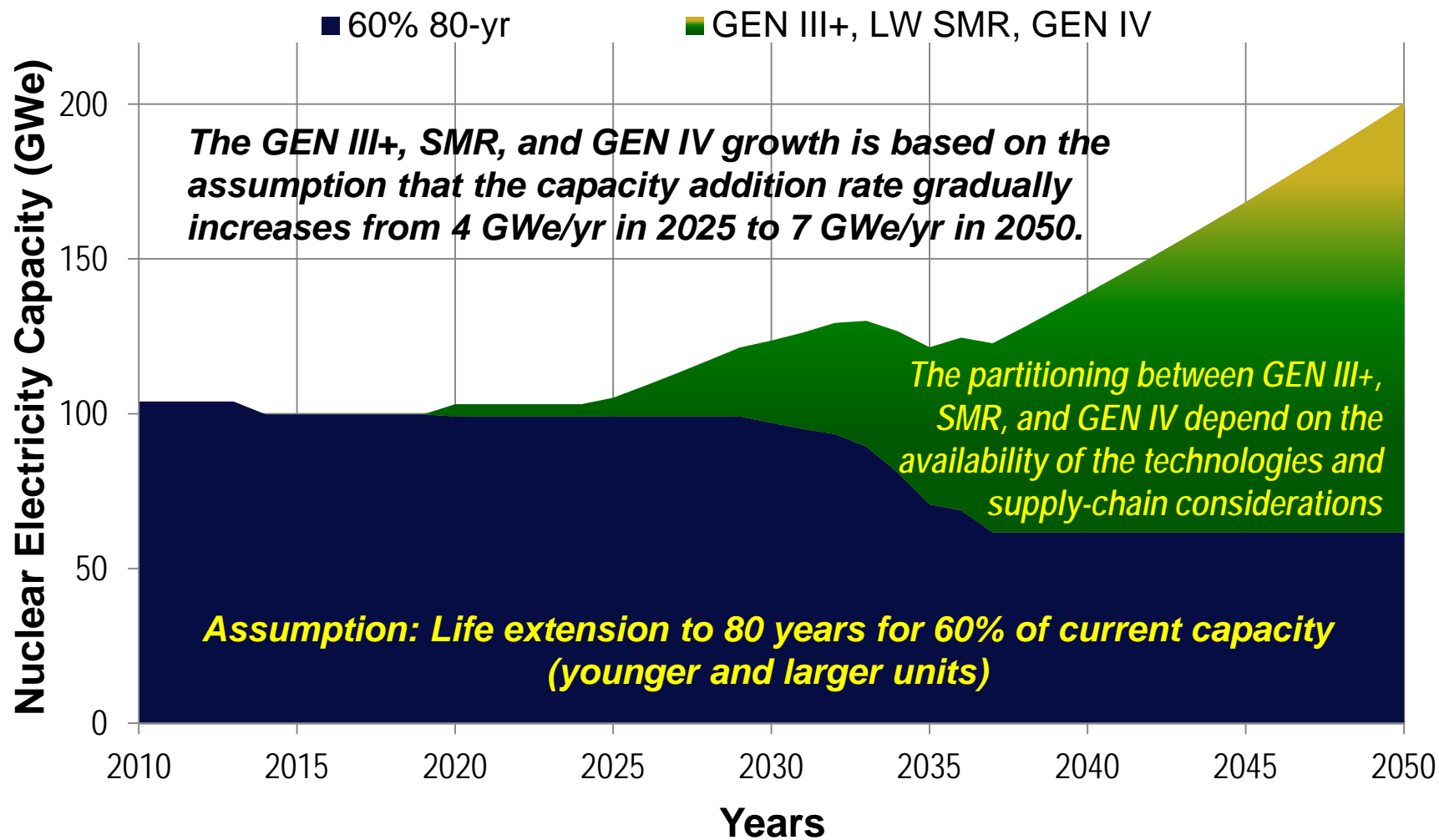
NON-PROLIFERATION & SECURITY

- Monitoring & verification technologies
- Safeguards by design
- Advanced cyber and physical security technologies

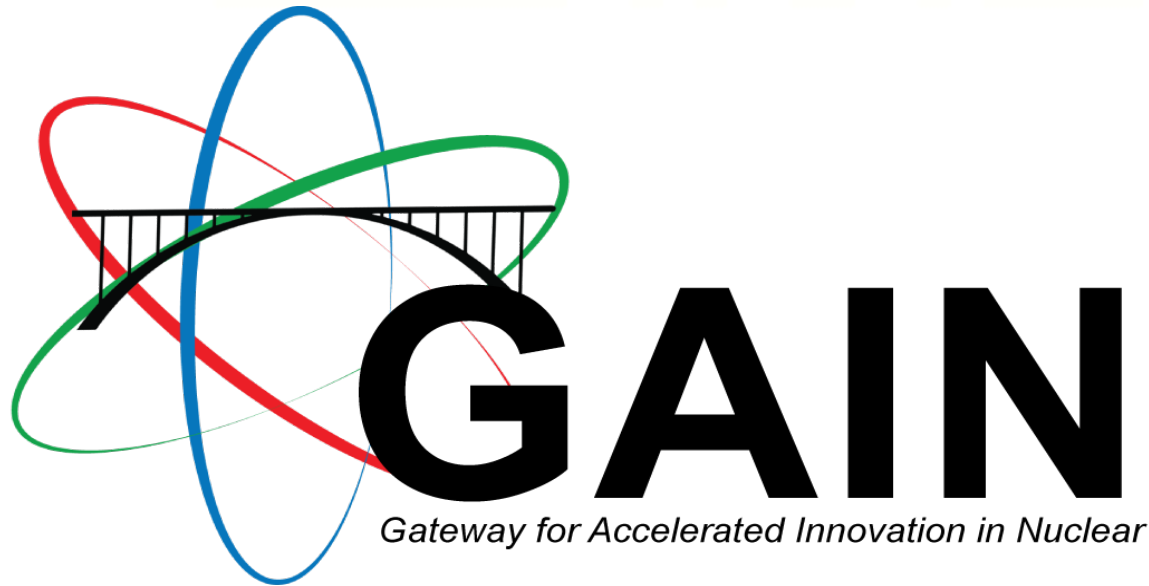
WASTE MANAGEMENT

- Advanced monitoring technologies
- Spent fuel integrity
- Disposal alternatives
- Safe, secure, and affordable recycling technologies
- Robust waste forms

There is a Need for Acceleration of Deployment



Requires Acceleration of Innovation



Removing barriers to a cleaner, safer nuclear energy source

We Are Developing a New Framework For Faster and More Cost-Effective Innovation Cycle for Nuclear Energy

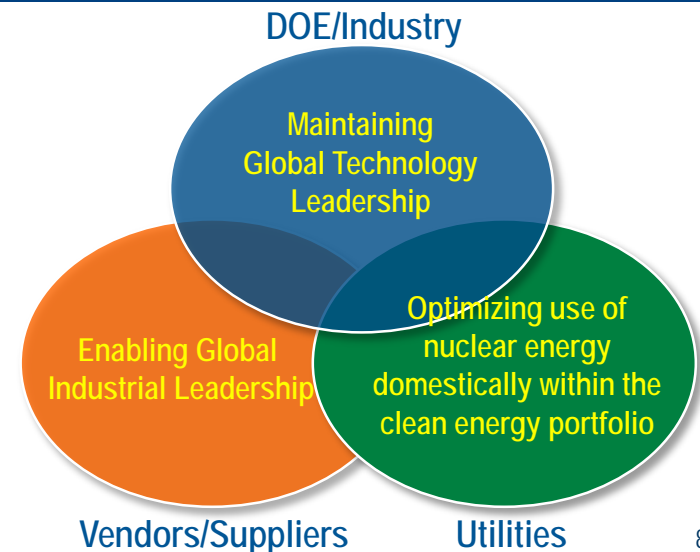
Sequential Progression For Innovation



For complex technologies such as nuclear energy, the sequential model becomes less effective when large amounts of funding are required and the technology maturation cycle is long.

GAIN

Integrated Approach for Innovation to Achieve All 3 Strategic Objectives

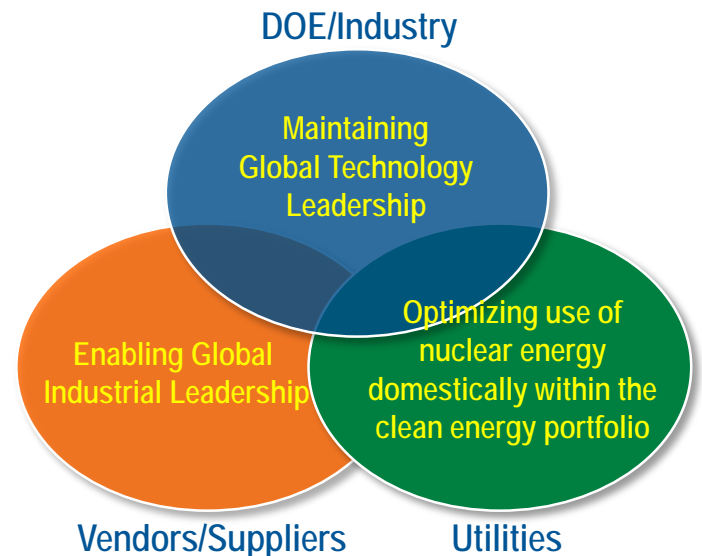


Implementing GAIN

In parallel with creating the 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.

GAIN

Integrated Approach for Innovation to Achieve All 3 Strategic Objectives

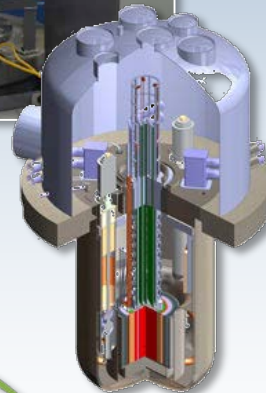


R&D Test Bed and Demonstration Platform are Critical for Rapid Development and Commercialization of Advanced Nuclear Reactor Technologies

1	2	3	4	5	6	7	8	9
Proof-of-Concept			Proof-of-Performance			Proof-of-Operations		

R&D Test Bed to Address Technical Feasibility

- Knowledge and Validation Center
- Validated predictive modeling and simulation capabilities
- Experimental Capabilities



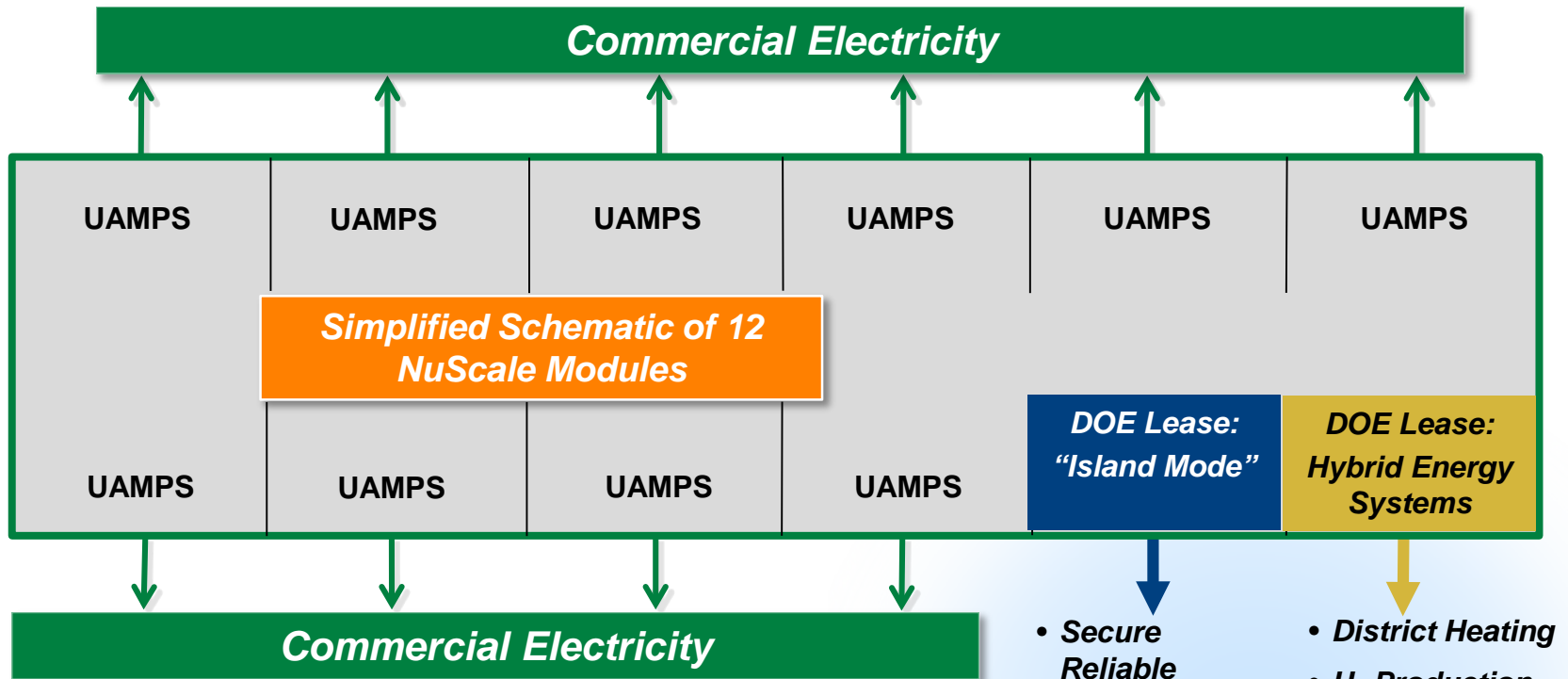
Demonstration Platform to Address Economic/Operational Feasibility

- Site
- Licensing Support
- Financial Support



✓ Major missing element is a *versatile fast-spectrum test reactor*.

Joint Use Modular Plant (JUMP) Concept for NuScale Plant - Proposed



- DOE renewable lease(s) for 5 year increments
- INL responsible to develop, design, and construct demonstrations
- Potential industry and international collaborations

INL's Nuclear Science & Technology Capabilities and Programs are Key Enablers

Nuclear Fuels and Materials



Advanced Reactor Design and Optimization



Fuel Cycle Technologies



Light Water Reactor Fleet Sustainability

National Laboratory Partnerships Are Key

