

# Renewable Energy and Clean Technologies Working Group Governor's Energy Advisory Council Delaware

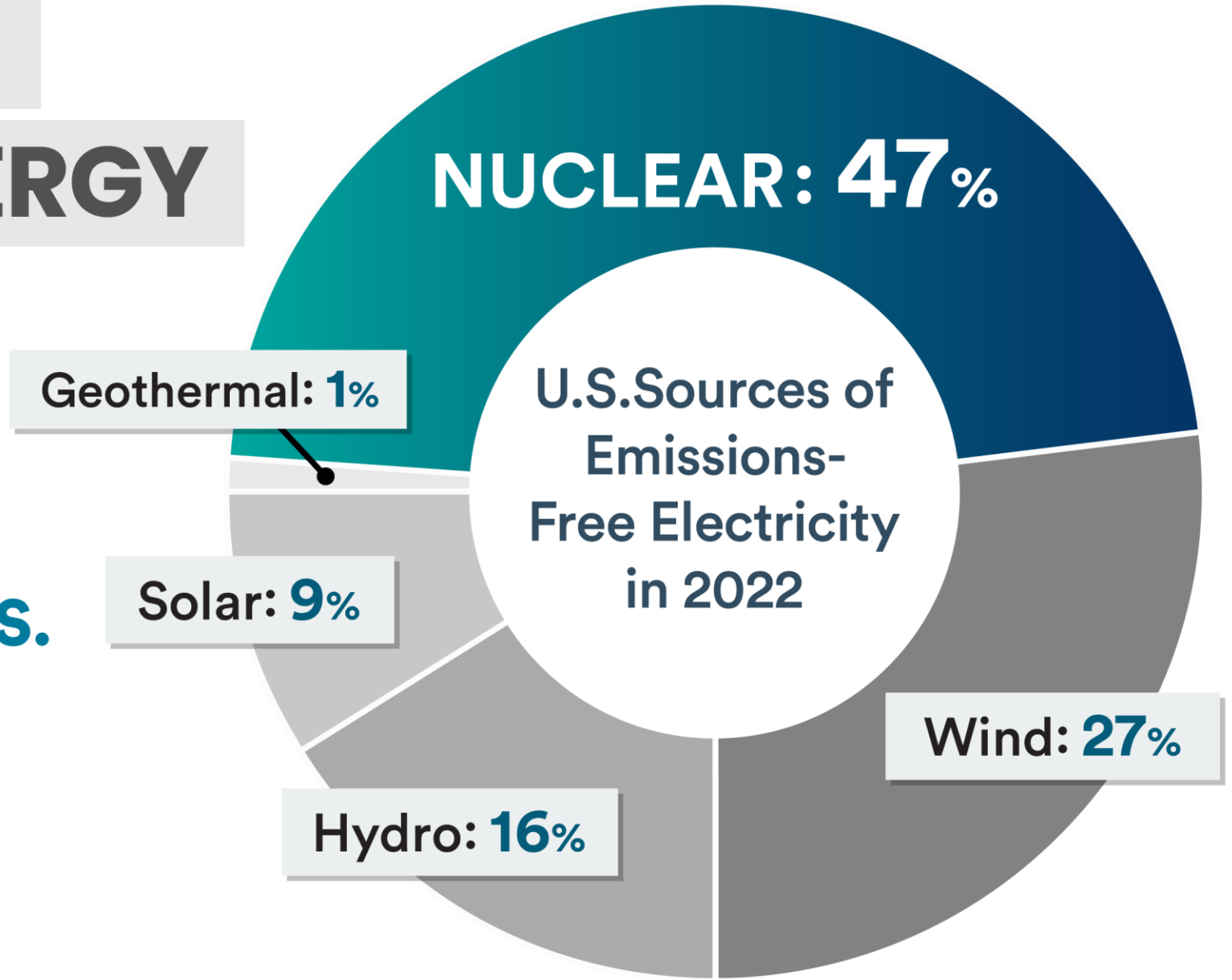
**Dr. Kathryn (Katy) Huff**

**Assistant Secretary for Nuclear Energy**

**September 7, 2023**

# Fast Facts on NUCLEAR ENERGY

Nuclear power is the **largest source of clean energy in the U.S.**



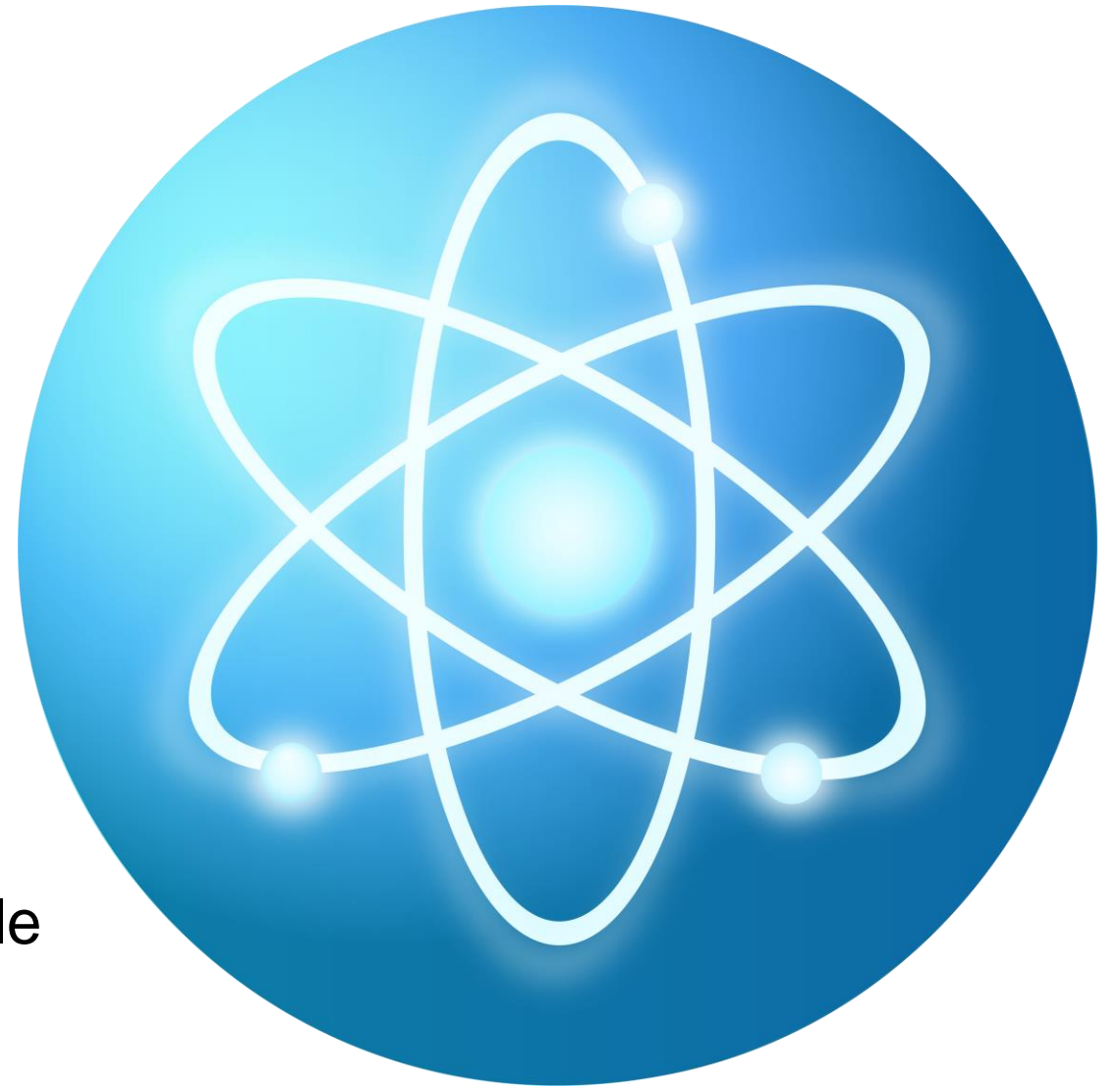
# DOE - Nuclear Energy

## Our Mission

To advance nuclear energy science and technology to meet U.S. energy, environmental, and economic needs

## Priorities

- Keep existing U.S. nuclear reactors operating
- Deploy new nuclear reactors
- Secure and sustain our nuclear fuel cycle
- Expand international nuclear energy cooperation

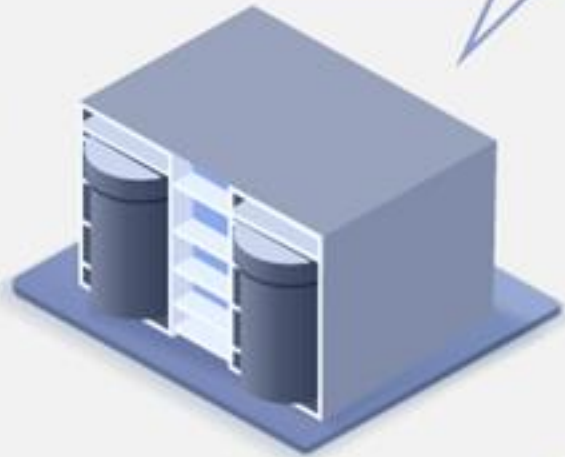


# Flexibility of Nuclear Energy

**MICROREACTOR**  
1 MW – 20 MW



**SMALL MODULAR REACTOR**  
20 MW – 300 MW



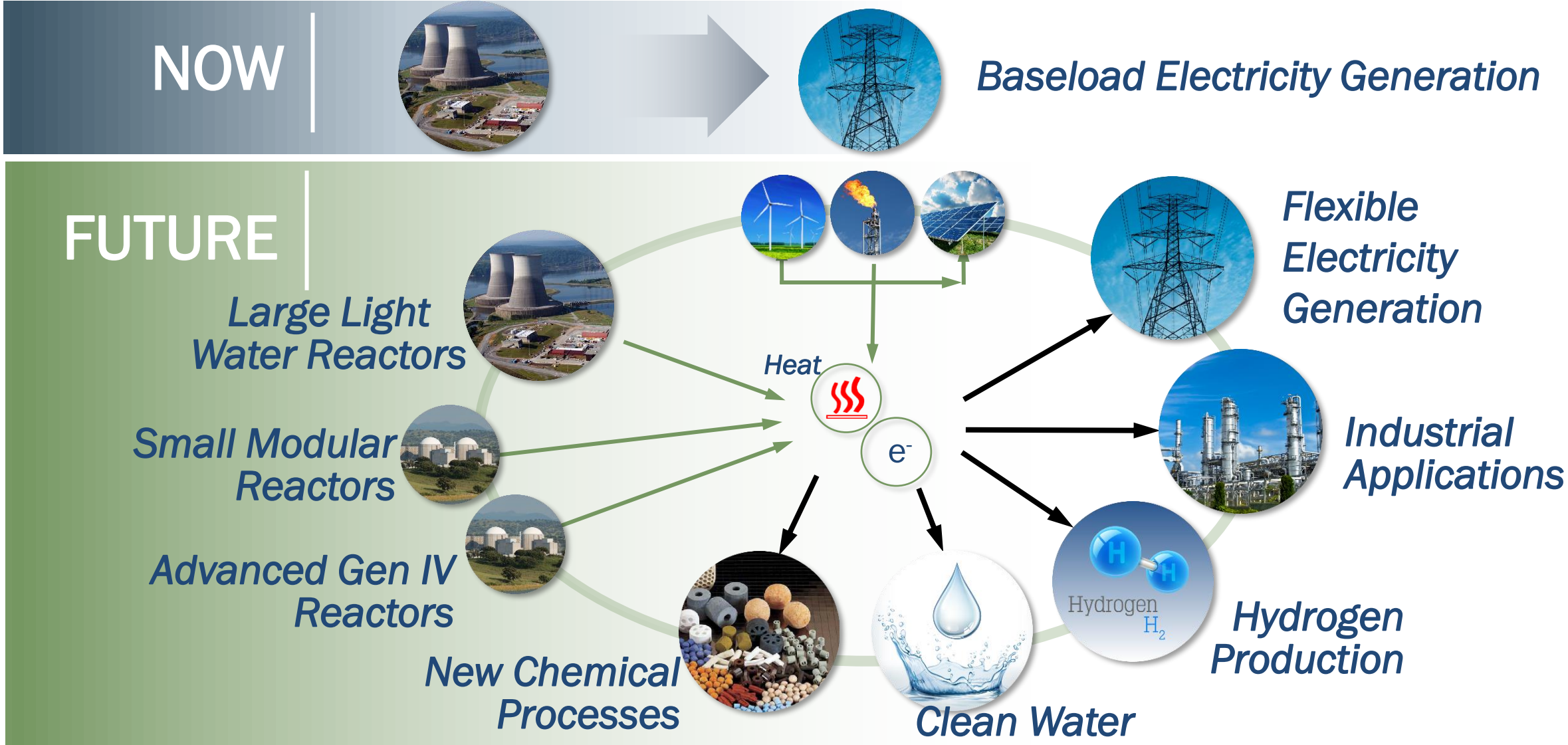
**LARGE SCALE REACTOR**  
300 MW – 1,000+ MW



## SIZE

Nuclear has the **right-sized reactors** to meet the energy needs of any community.

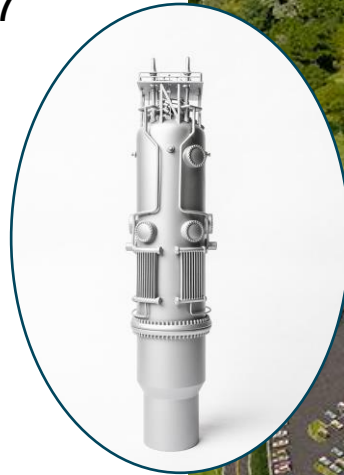
# Flexibility of Nuclear Energy



# Carbon-Free Power Project

## NuScale Power Demonstration Project at Idaho National Laboratory

- 6 Nuclear Power Modules - 462MWe (77 MWe per module)
- Leverages proven and commercially-available LWR fuel
- Air Cooled Condensers substantially reduce water use
- Initial site characterization work completed
- First module operation planned for 2029



# Deploy New Reactors

## 1 DEMONSTRATION

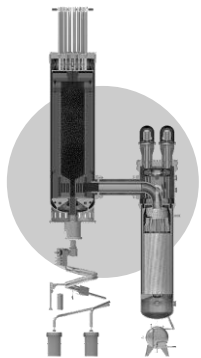
Bipartisan Infrastructure Law –  
Office of Clean Energy  
Demonstrations - \$2.5 B



### Natrium Reactor

Sodium-cooled fast reactor +  
molten salt energy storage system  
TERRAPOWER

Kemmerer, WY



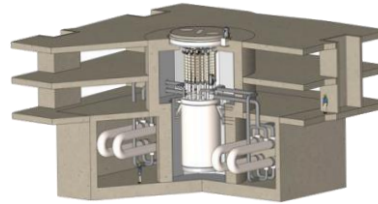
### Xe-100

High-temperature gas reactor  
X-ENERGY

Seadrift, TX

## 2 RISK REDUCTION

Solve technical, operational and regulatory  
challenges to support demos within 10-14  
years



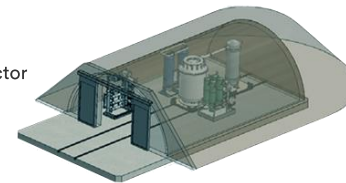
### KP-FHR

Fluoride salt-cooled  
high-temperature reactor  
KAIROS POWER



### eVinci

Heat pipe-cooled microreactor  
WESTINGHOUSE NUCLEAR



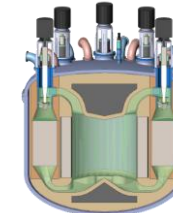
### BWXT Advanced Nuclear Reactor (BANR)

High-temperature gas-cooled  
microreactor  
BWX TECHNOLOGIES



### SMR-160

Advanced light-water  
small modular reactor  
HOLTEC INTERNATIONAL

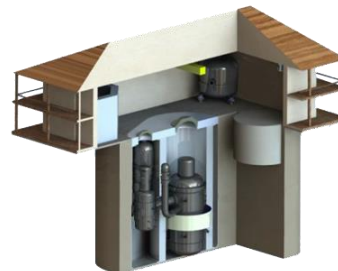


### Molten Chloride Fast Reactor

SOUTHERN COMPANY

## 3 CONCEPT DEVELOPMENT

Solidify concept to mature technology for  
potential demo in mid-2030s



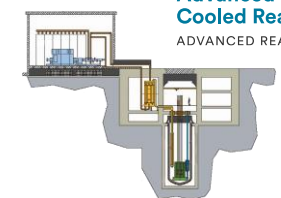
### Fast Modular Reactor

GENERAL ATOMICS



### Horizontal Compact High-Temperature Gas Reactor

MASSACHUSETTS INSTITUTE OF TECHNOLOGY



### Advanced Sodium-Cooled Reactor Facility

ADVANCED REACTOR CONCEPTS

# **LIFTOFF Report aims to create a shared fact base for answering key investor and stakeholder questions**

***What is advanced nuclear and its value proposition?*** Report covers Gen III+ and IV across large reactors, SMRs, and microreactors; nuclear is clean, is firm, uses land efficiently, requires less transmission buildout, provides regional economic benefits, and has additional use cases and benefits beyond traditional electricity generation.

***Do we need new nuclear for net zero?*** Likely **100-200 new GW** in the US by 2050, especially given renewables buildout.

***Why will it be different than recent over-budget builds?*** SMRs may avoid historical cost and constructability challenges; Vogtle provides lessons on the importance of rigorous pre-construction planning.

**[liftoff.energy.gov](https://liftoff.energy.gov)**

## **Pathways to Commercial Liftoff: Advanced Nuclear**





# Opportunities

# Energy Transformation: Coal-to-Nuclear Report

- DOE-issued report on converting coal power plant sites to nuclear power plants
- Identified **157 retired coal plants** and **237 operating coal plants** as potential candidates
- Significant benefits to site conversion: add jobs, increase economic benefit, and improve environmental conditions
- Of candidate sites, 80% could host SMRs or microreactors

# Expand International Nuclear Energy Cooperation



- The world nuclear energy market has been projected to double or triple by 2050.
- The U.S. export opportunity for nuclear technology could be \$1.9 trillion.

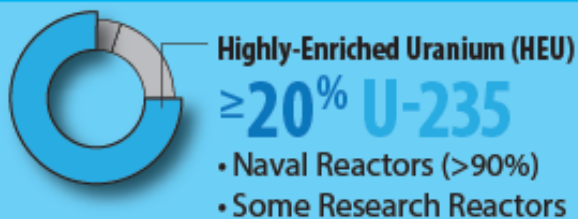
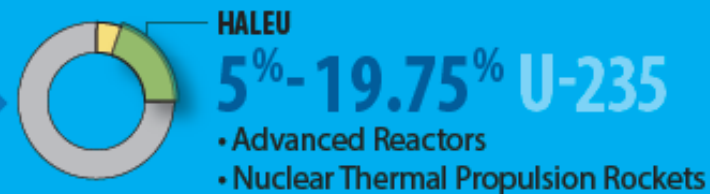
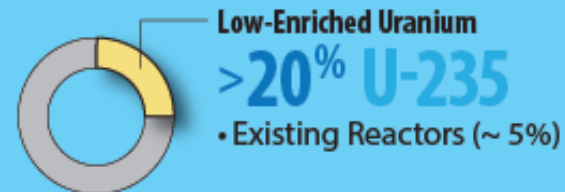
# Challenges

# HIGH-ASSAY LOW-ENRICHED URANIUM

A next generation fuel for next generation nuclear reactors.

## WHAT IS IT?

Uranium enriched between **5% AND 20%** in uranium-235—the main fissile isotope that produces energy during a chain reaction.



## ALLOWS FOR...



Smaller Designs



Longer Life Cores



Increased Fuel Efficiency



Less Waste

## HOW IT'S MADE

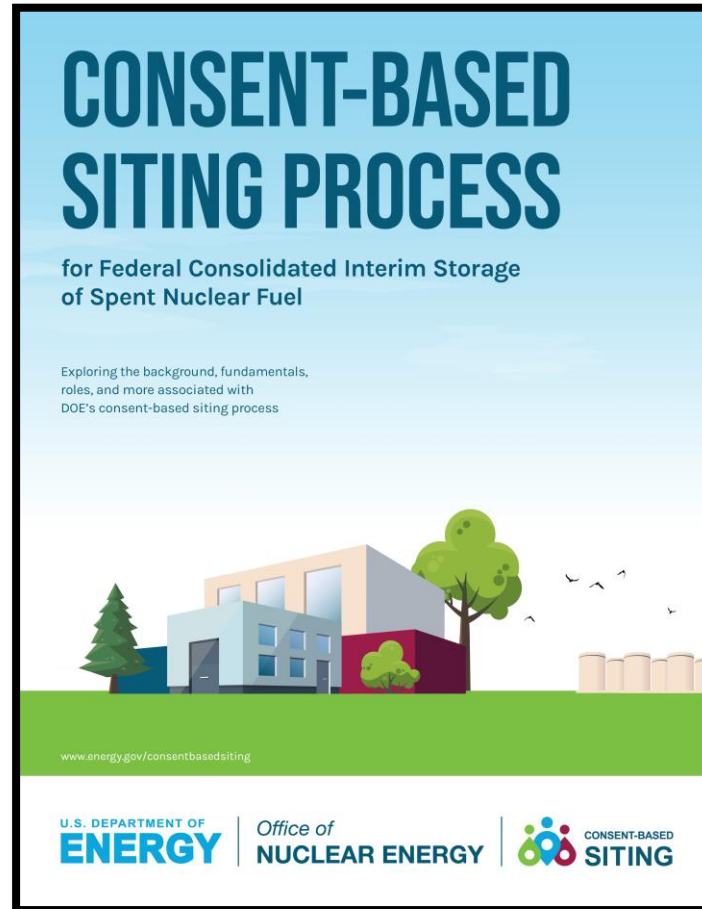
**Chemical Processing**  
Recycle government-owned HEU and downblend to HALEU.

**Enrichment**  
Separate uranium isotopes by weight to produce higher percentage of U-235 in the uranium.



# The Consent-Based Siting Process

The U.S. Department of Energy is pursuing one or more federal consolidated interim storage facilities to store the nation's spent nuclear fuel in the near-term using a multi-stage consent-based approach that puts communities' interests at the forefront.



- Prioritizes people and communities
- Centers equity and environmental justice
- Collaborative, phased, and adaptive

# Ways to Continue Engagement

- **NE engages in partnerships for outreach and education as state policymakers are developing transformative energy policies to:**
  - Promote an understanding of emerging nuclear energy technologies
  - Provide technical information to assist in decision-making
  - Enable states to maximize their resources and participate in the policies, programs, and activities undertaken by DOE/NE and the USG as a whole
  - Technical assistance through national laboratories
- **Partners include:**
  - National Association of Regulatory Utility Commissioners/Nuclear Energy Partnership and the NARUC-NASEO Advanced Nuclear State Collaborative
  - National Conference of State Legislatures/Nuclear Energy Legislative Working Group
  - National Governors Association Center for Best Practices/Nuclear Energy cohort being established
  - Energy Communities Alliance