GAIN Overview

INFUSE Workshop

November 6, 2025

GAIN
Gateway for Accelerated Innovation in Nuclear

INL/MIS-25-82903

GAIN Gateway for Accelerated Innovation in Nuclear

Gateway for Accelerated Innovation in Nuclear

Small enough to be nimble, big enough to be relevant

GAIN Gateway for Accelerated Innovation in Nuclear

G GATEWAY

Gateway to national labs.

A ACCELERATED

Accelerated to match advanced nuclear developer pace and market window.

I INNOVATION

Innovation in all spaces with a bias toward taking risks.

N NUCLEAR

Nuclear to meet the nation's energy, environmental and economic needs

GAIN Gateway for Accelerated Innovation in Nuclear

GAIN's Areas of Expertise

- Department of Energy Office of Nuclear Energy initiative
- Focus on initiating and completing projects that support commercial deployment of advanced reactors and technologies

2024 HIGHLIGHTS

Awarded 16 ***GAIN Nuclear Energy Vouchers*** at a value of nearly $5.4 million

Published the ***advanced reactor cost study*** developed cost ranges for modeling and energy planning and provided the data for NREL's Annual Technology Baseline, which is used by utility planners and grid operators when planning their energy investments

Worked with ***coal communities*** in Kentucky, Arizona and Montana to conduct feasibility studies to convert decommissioned coal stations into nuclear power stations

Worked with ***states and communities*** across the U.S. to provide them with advanced nuclear information through conversation and testimony and connect them with Department of Energy financial and technical resources

Nuclear Energy Voucher Program

- Vouchers competitively award access to DOE national laboratory facilities and staff
- ***NOT*** a financial award to businesses

VOUCHER VALUE ~$50K – $500K
Voucher recipient is responsible for 20% cost share

FOUR CYCLES PER YEAR

AVAILABLE TO MAJORITY (>51%) U.S. OWNED COMPANIES

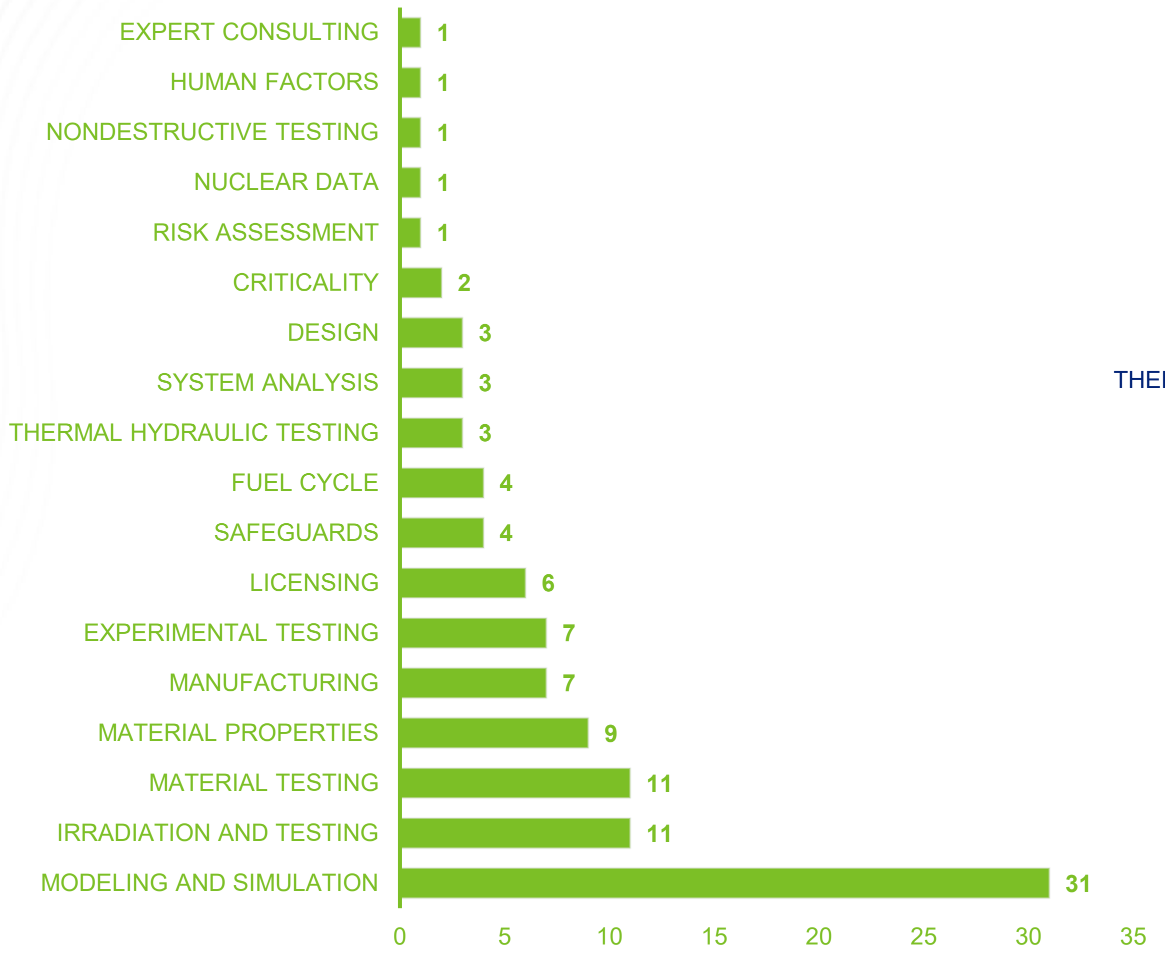
STANDARD CRADA

LIMIT TO ONE APPLICATION PER CYCLE

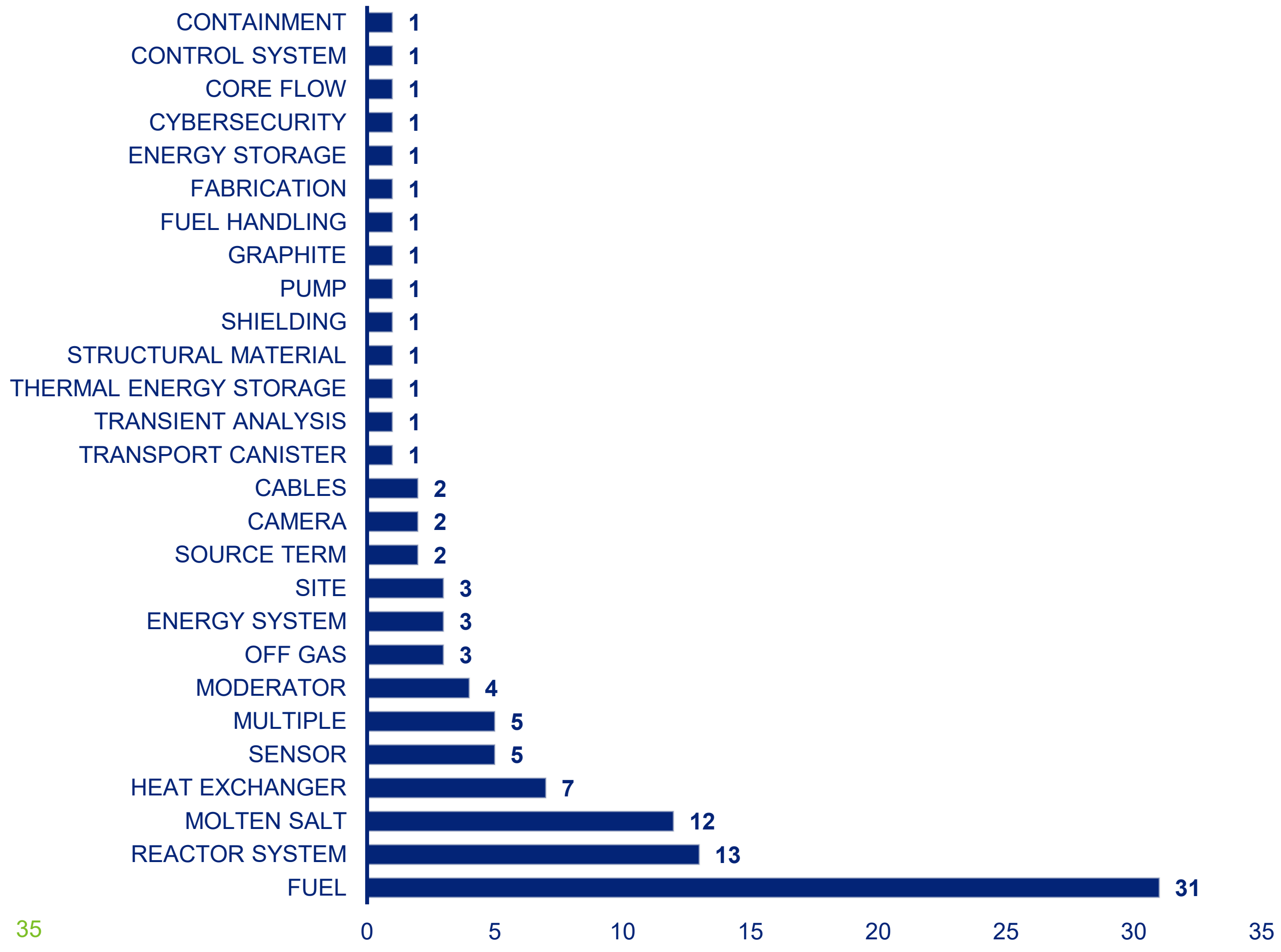
ONE-YEAR PERIOD OF PERFORMANCE

Voucher Statistics – Work Areas

Voucher Awards by Work Type



Voucher Awards by Component Type



Legacy Documents Program

- Legacy document release process
- Legacy document research packages
- Acquisition and Preservation
  - Digitization
  - Database creation

GAIN LEGACY CONTACTS

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What are legacy documents?

HISTORICAL DOCUMENTS

All nuclear legacy work from the last 70 years

APPLIED TECHNOLOGY DOCUMENTS

These are the documents most requested by industry. This marking was created by the DOE Office of Nuclear Energy in the 1970s to preserve the foreign-trade value of certain NE-funded work.

DATASETS

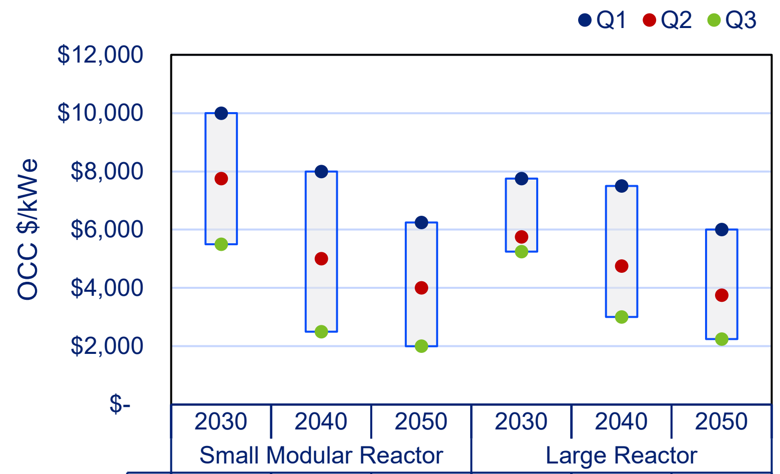
There is an increasing interest in having access to legacy datasets.

Reference cost ranges for large and small modular reactors

- Costs are shown as between-of-a-kind (BOAK) or costs after first-of-a-kind demonstrations have taken place, but before nth-of-a-kind learning as materialized
- The INL report behind these values includes important information to energy mix planners about how to adequately capture advanced nuclear technology (e.g., capital costs, construction times, ramp rates)

	Large Reactor			SMR		
	Advanced	**Moderate**	**Conservative**	**Advanced**	**Moderate**	**Conservative**
Nuclear Fuel Costs ($/MWh)	9.1	10.3	11.3	10.0	11.0	12.1
Nuclear Fuel Costs ($/MBTU)	0.88	0.99	1.09	0.97	1.06	1.17
Fixed non-fuel O&M ($/kWe-yr)	126	175	204	118	136	216
Fixed O&M ($/MWh) @ 93% capacity factor	15.5	21.5	25.1	14.5	16.6	26.5
Variable non-fuel O&M ($/MWh)	1.9	2.8	3.4	2.2	2.6	2.8
Total O&M ($/MWh)	26	35	40	27	30	41

Reference O&M costs for large reactors and SMRs

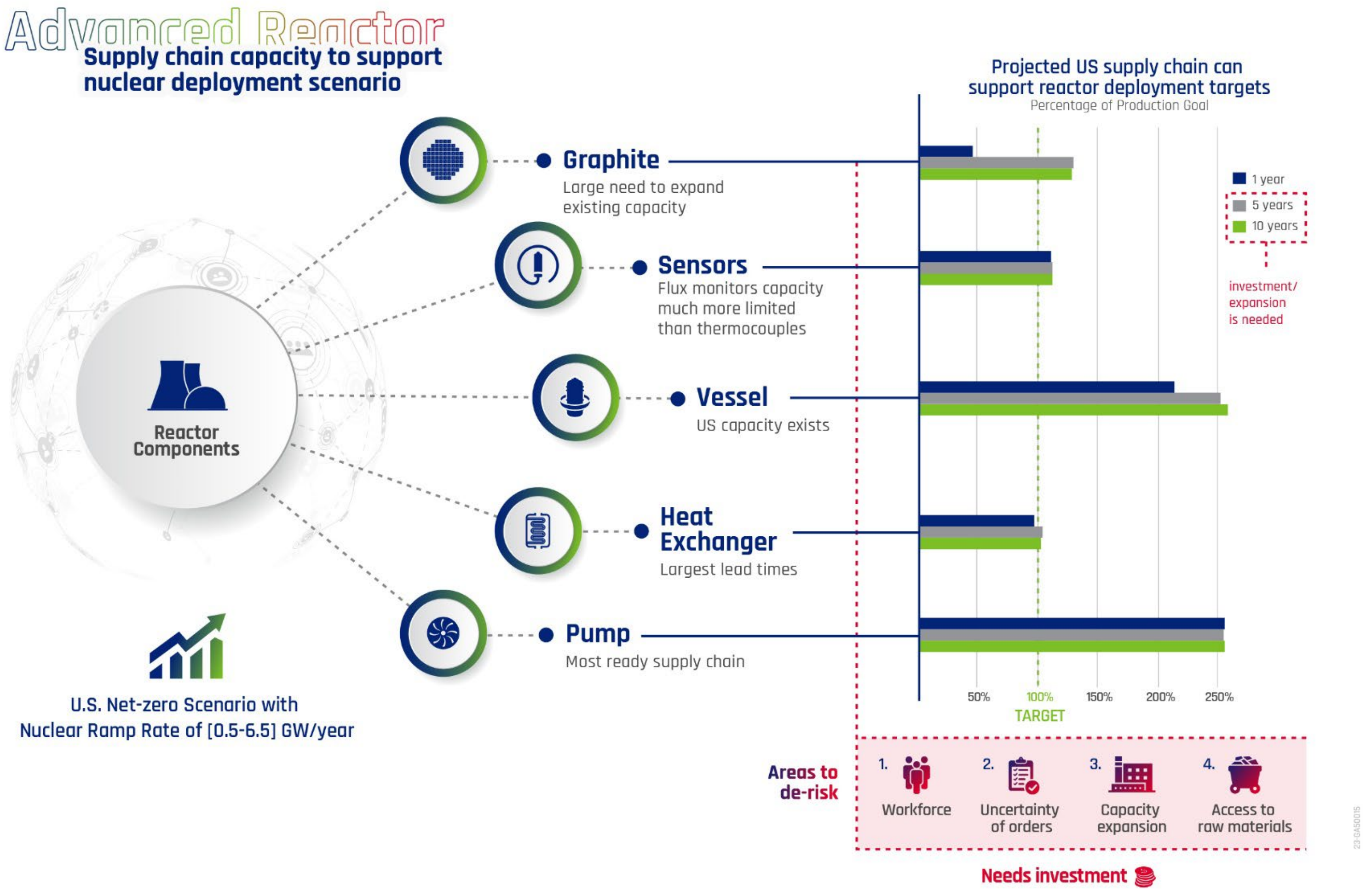


	Small Modular Reactor 2030	Small Modular Reactor 2040	Small Modular Reactor 2050	Large Reactor 2030	Large Reactor 2040	Large Reactor 2050
Q1	$10,00	$8,000	$6,250	$7,750	$7,500	$6,000
Q2	$7,750	$5,000	$4,000	$5,750	$4,750	$3,750
Q3	$5,500	$2,500	$2,000	$5,250	$3,000	$2,250

Reference overnight capital costs (OCC) for large reactors and SMRs

Overview of Supply Chain Assessment

- Builds on the prior DOE supply chain work
- Assessed the capacity of certain critical nuclear components
- Mapped aggressive projections for nuclear deployments rates to component production targets
- Surveyed 20+ companies on ability to meet production targets
- Initial findings:
  - We have an initial US capacity
  - Supply chain can ramp up with caveats



Some concerns noted

- Largest concerns are related to workforce issues:
  - Availability
  - Experience
  - Turnover
- Additional concerns include:
  - Uncertainty of demand
  - Other non-nuclear commitments
  - Production facility limits
  - Access to raw material
  - Cost of expansions/upgrades

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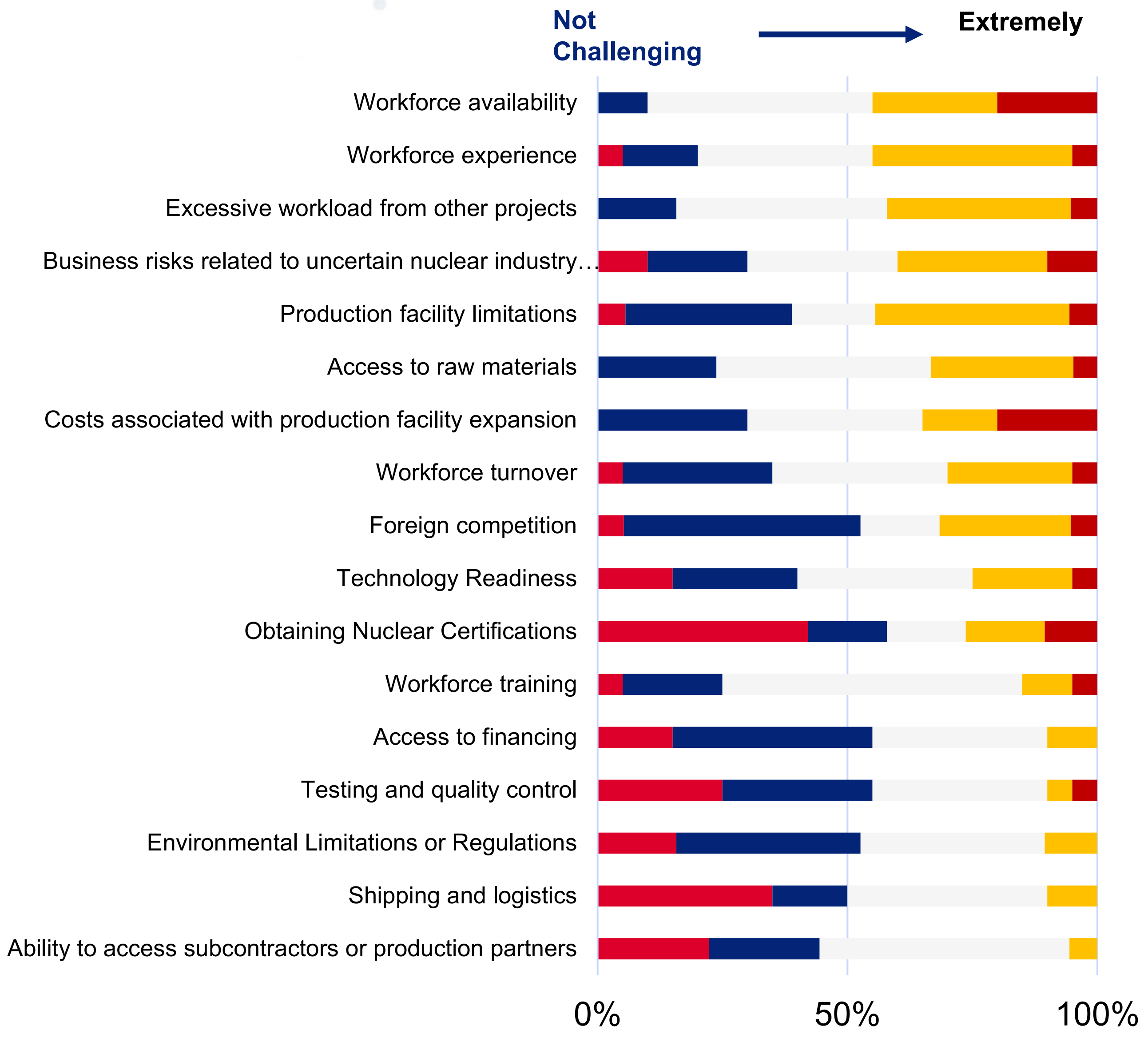
Workforce



GAIN state engagement

- GAIN works with nuclear curious states and communities around the nation as they consider advanced nuclear in their energy portfolios.

2024 STATE ENGAGMENTS

- Attended public meetings with local partners in ***Arizona***, ***Montana***, ***Pennsylvania***, and ***Colorado***
- Testified to state-level energy committees in ***Minnesota***, ***Montana***, ***Illinois***, ***Alaska***, and ***Colorado***
- Briefed staffers for several legislative delegates in many states
- Customized webinars and workshops for ***Kentucky***, ***Virginia***, and ***California***
- Worked with local economic development teams in ***West Virginia***, ***Pennsylvania***, ***Tennessee***, ***Montana***, and ***Utah***
- Supported the DOE engagement with the National Association of State Energy Officials, National Association of Regulatory Utility Commissioners, Governor's Association and National Conference of State Legislatures

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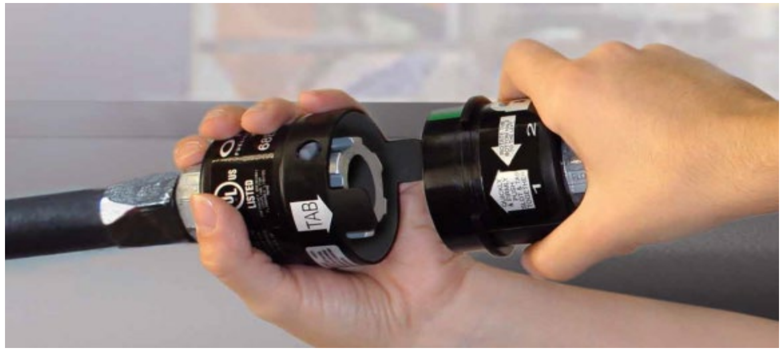
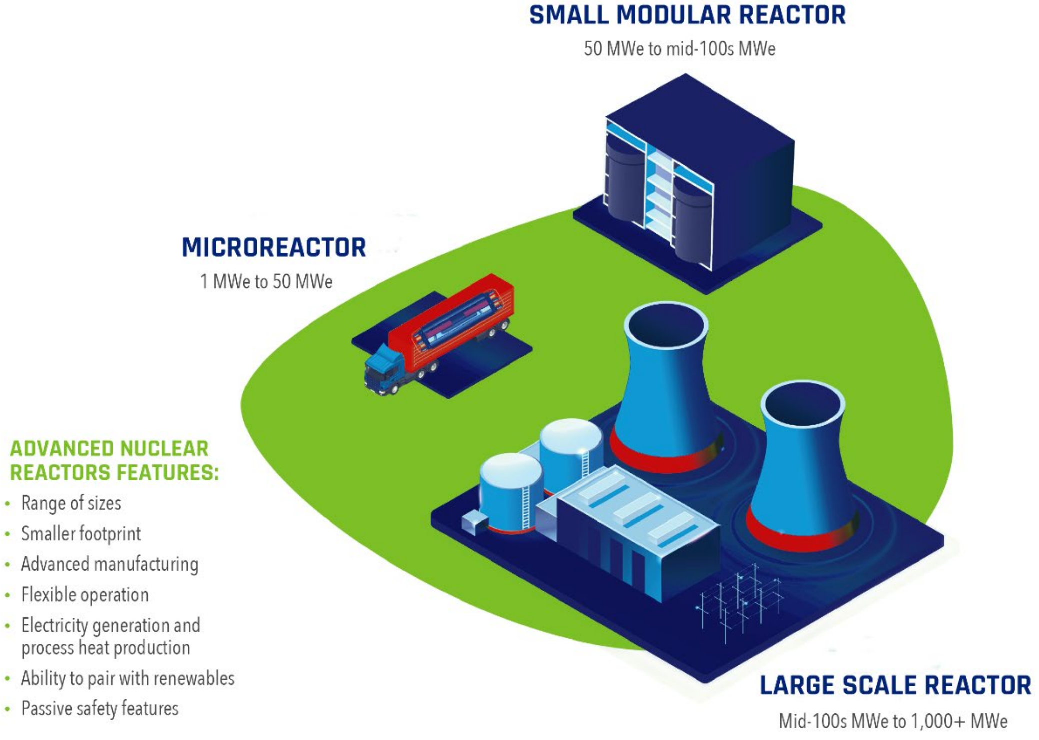
Active vs. Passive vs. Inherent Safety

ACTIVE	PASSIVE	INHERENT
Requires an external input to function	Relies on natural forces, property of materials, or internally stored energy	Relies on fundamental properties or design choices
A valve needs an electrical current to operate or a pump needs electricity to operate	Long term decay heat removal to heat sink using density changes and gravity heads	Design achieves reactor shutdown by negative power reactivity feedback (self limiting reaction)
Current plants	Advanced reactors (light water and non-light water)	Advanced reactors (light water and non-light water)
Example: Air Bag	Example: Self-Retracting lifeline	Example: Quick Disconnect Shutoff Valve

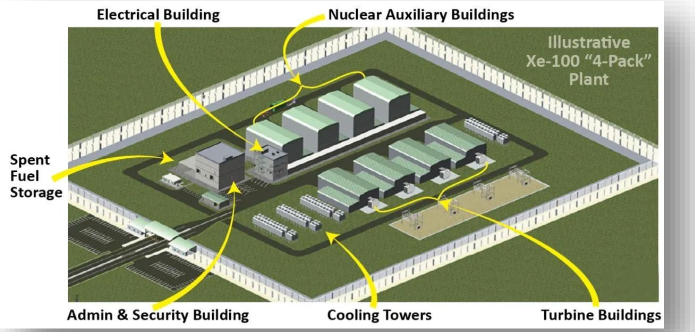


Nuclear Reactor Output and Footprint



VOGTLE PWR

- Output: 2,430 MWe
- Plant footprint: ~600 acres
- EPZ boundary: 10 miles



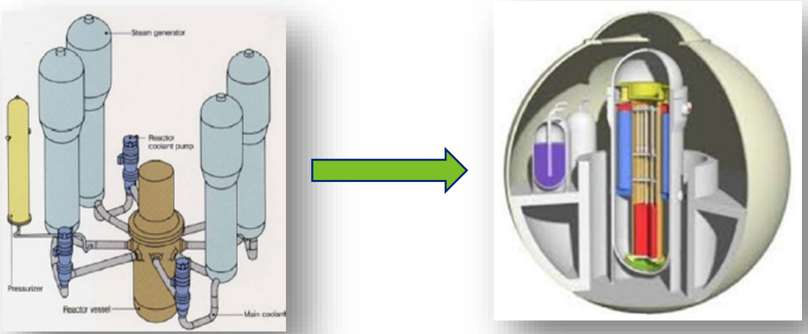
X-ENERGY

- Output: 320 Mwe (4 x 80 MWe)
- Plant footprint: 10 acres
- EPZ boundary: < 1 mile

Small Modular Reactors (SMRs)

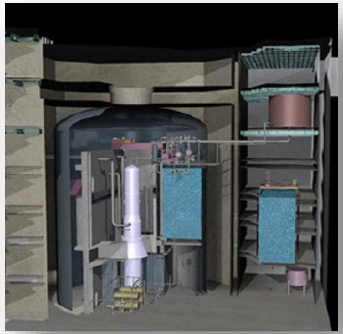
Multi-module Plant Layout Configuration

Simplification by Modularization and System Integration

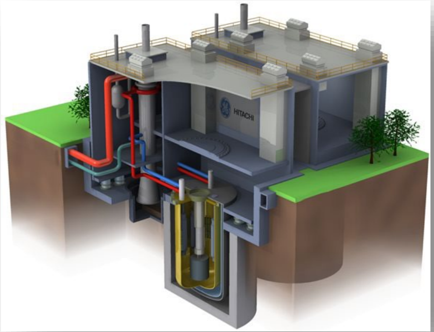


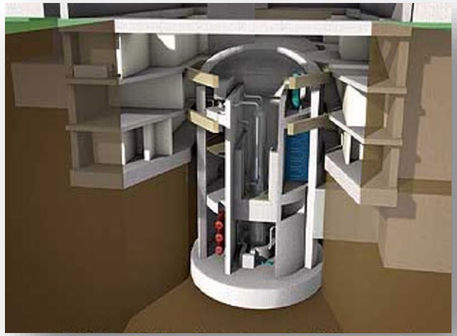
Enhanced Safety Performance through Passive Safety Systems

- Enhanced severe accident features
- Passive containment cooling system
- Pressure suppression containment



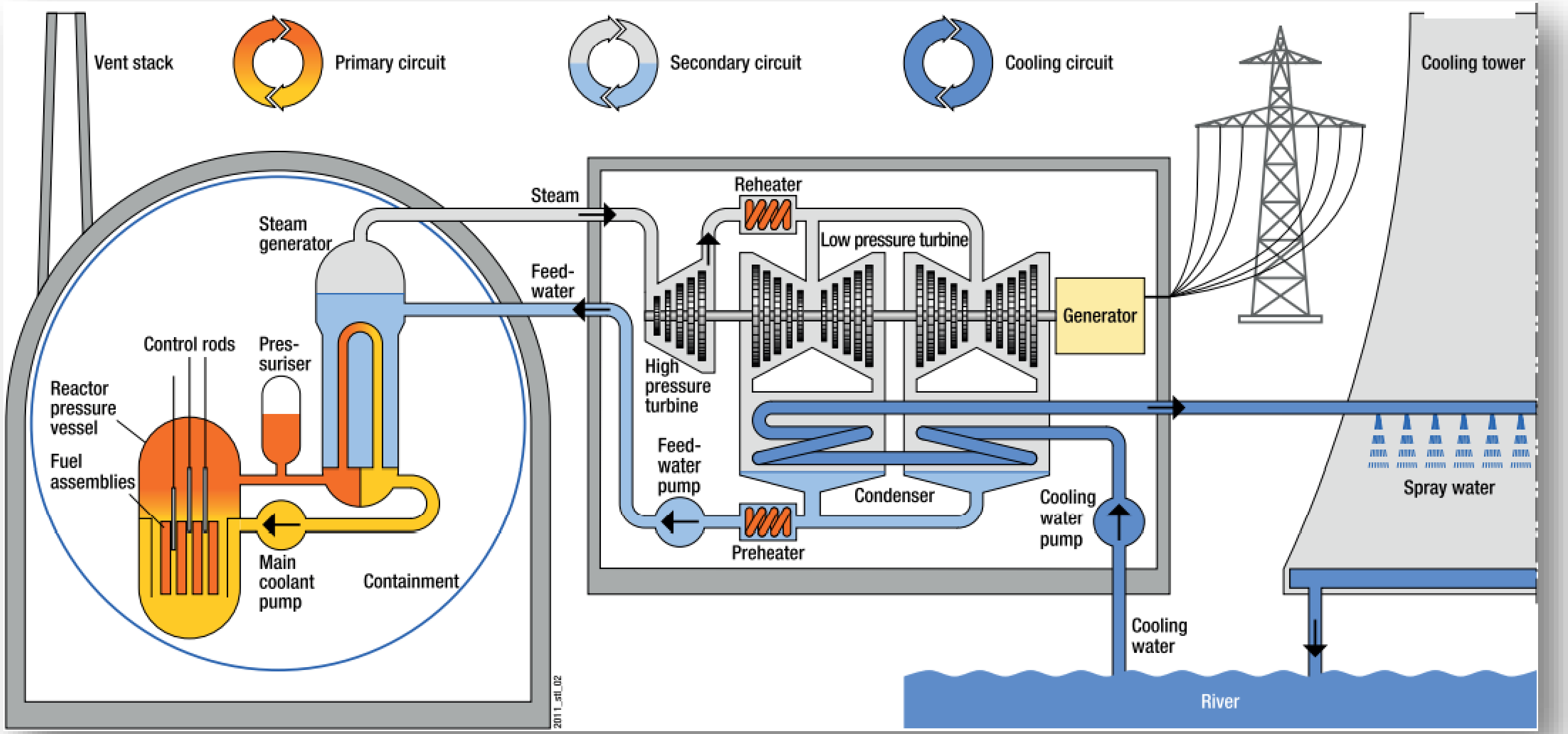
Underground Construction for Enhanced Safety and Seismic Resilience



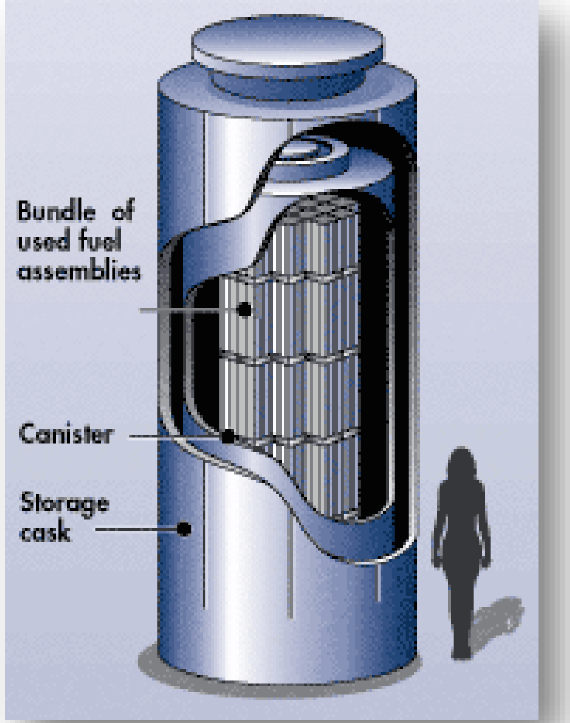


Water Usage

- All reactors through Gen III+ require a consistent source of water, ~500,000 gpm
- Gen IV designs require less water due to higher efficiency – Natrium uses 90% less water at 16,000 gpm for 4 reactors
- Some Gen IV Designs utilize an air cooled condenser
  - Fans utilize 5 to 7% of the energy production and this can go up with increased outside temperature



On-site storage of used fuel



The 57 used fuel casks hold all the fuel from 49 years of the DC Cook Plant in Michigan operations. Both units at DC Cook are still operating.

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Reprocessing

- The spent nuclear fuel from Gen II, III, and III+ reactors consist of ≥5% spent fuel, (fission products) and ≥95% unspent fuel (useable uranium). Spent nuclear fuel reprocessing, which the U.S. has decades of experience with, allows us to use this unspent fuel
- Currently, small modular reactor manufacturer Oklo and SHINE Technologies are pursuing spent nuclear fuel recycling. France has been reprocessing for 50 years.
- Spent nuclear fuel from EBR-II is being reprocessed to produce HALEU for Oklo's first reactor
- If the regulations supported reprocessing the remaining amount of
- may result in a 95% reduction in total waste – the size of a football field stacked 30 feet high
- There are two processes for recycling – pyroprocessing and PUREX

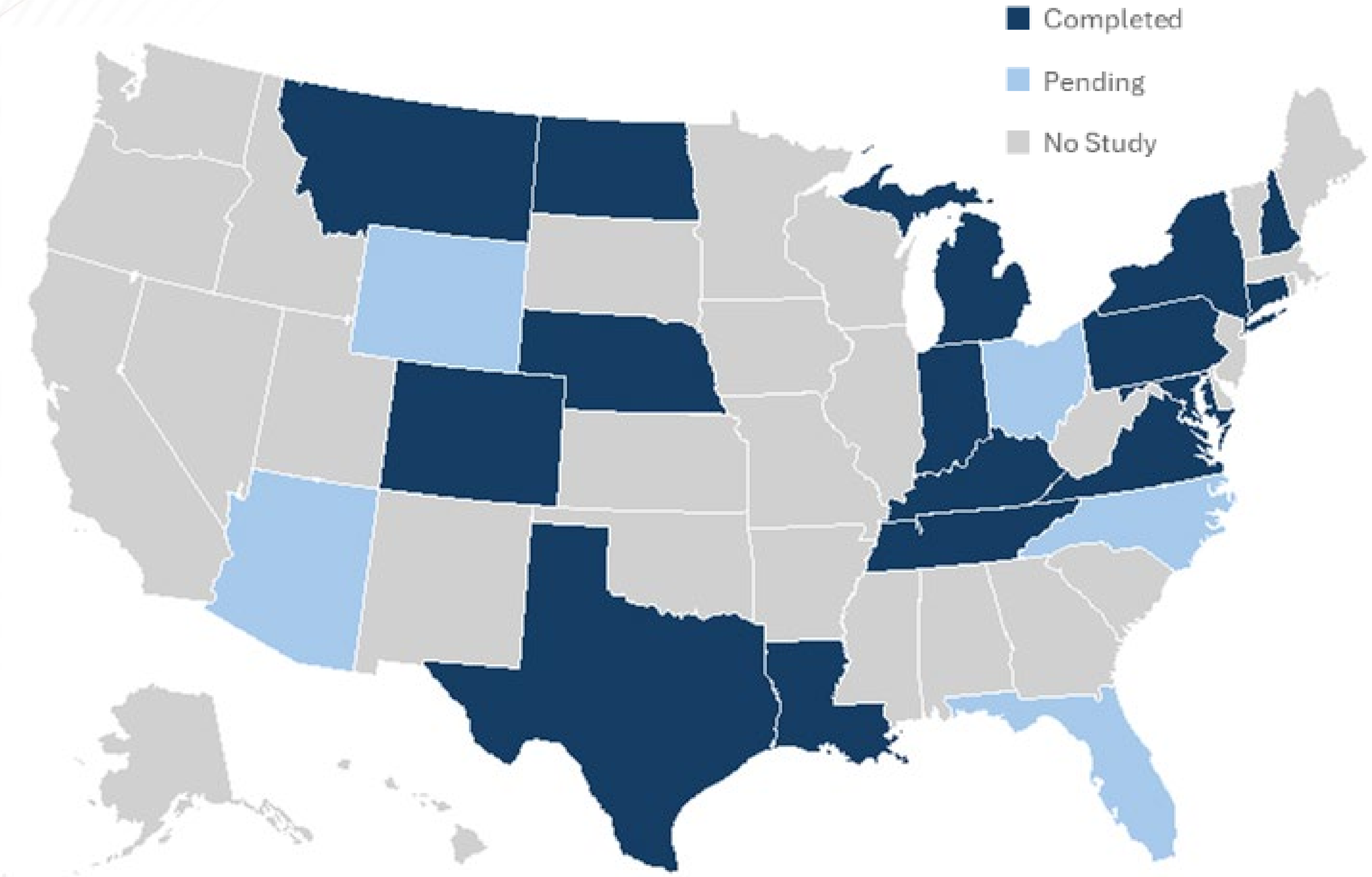
95 percent

The amount of useable uranium still left in spent nuclear fuel

All unspent fuel in this waste could power the U.S. for over

200 years

State nuclear feasibility studies and working groups



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feasibility studies covering a range of topics including policy, technical, and economic analyses

- ***18*** complete
- ***3*** pending completion by summer 2025
- ***4*** committed studies without set due date
- Active working groups in KY, OH, and TN

Feasibility Study Categories Covered by State

Current Fleet License Extension	Moratorium Repeals/ Exemptions	Classifying Nuclear	Feasibility Study/Working Groups	Establishment of Authorities	Promoting Development	Fossil Fuel Transition	Workforce Development	Supply Chain	Financial Incentives
Pennsylvania Washington	Connecticut	New Hampshire	Indiana New York North Dakota	Kentucky Texas	Indiana Louisiana Texas Virginia	Kentucky Maryland	Indiana Kentucky Maryland New Hampshire New York Tennessee Texas Virginia	Indiana Kentucky Maryland New Hampshire New York Tennessee Texas Virginia	Indiana Louisiana Michigan New Hampshire New York Tennessee Texas

Federal Resources	System-Wide (Framework) Cost	Advanced Rate Recovery	Design Suitability/ Standardization	Siting	Regulatory	Permitting Pathways	Consortia	Community Engagement/ Education
Connecticut Louisiana Virginia	Louisiana Washington	Texas	Indiana New York	Louisiana Nebraska New York Virginia	Connecticut Indiana Louisiana	Colorado Indiana Louisiana Michigan Texas	Louisiana Michigan	Indiana Louisiana Michigan Nebraska New Hampshire New York Texas

Note: 22 Categories identified – 19 have had actions take

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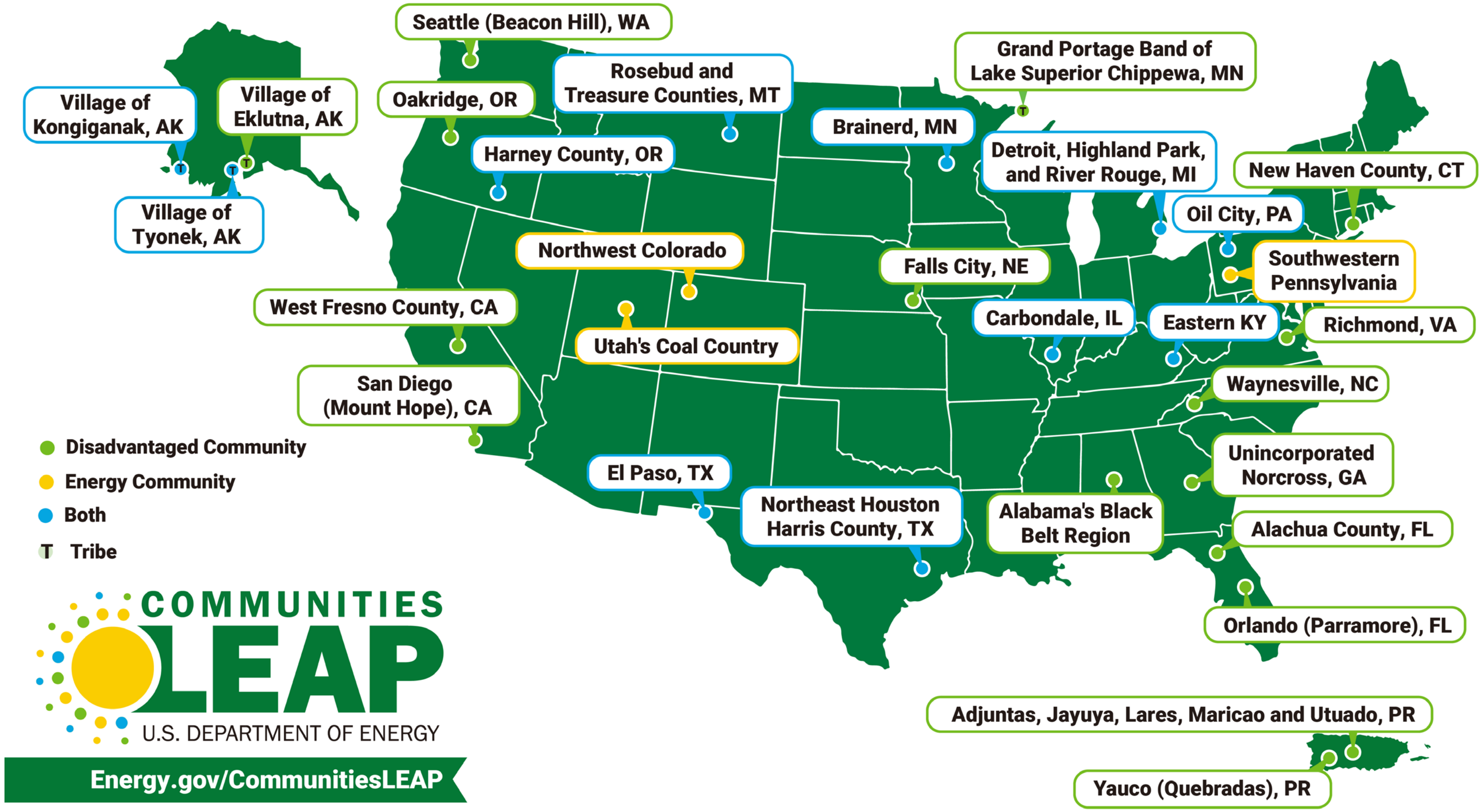
DOE C-LEAP funding opportunities

- C-LEAP communities exploring nuclear:
  - Eastern Kentucky
  - Northwest Colorado
  - Rosebud and Treasure Counties, Montana
  - Southwestern Pennsylvania
  - Utah’s Coal Country



COMMUNITIES LEAP
U.S. DEPARTMENT OF ENERGY
Energy.gov/CommunitiesLEAP

GAIN nuclear feasibility studies

CORONADO GENERATING STATION

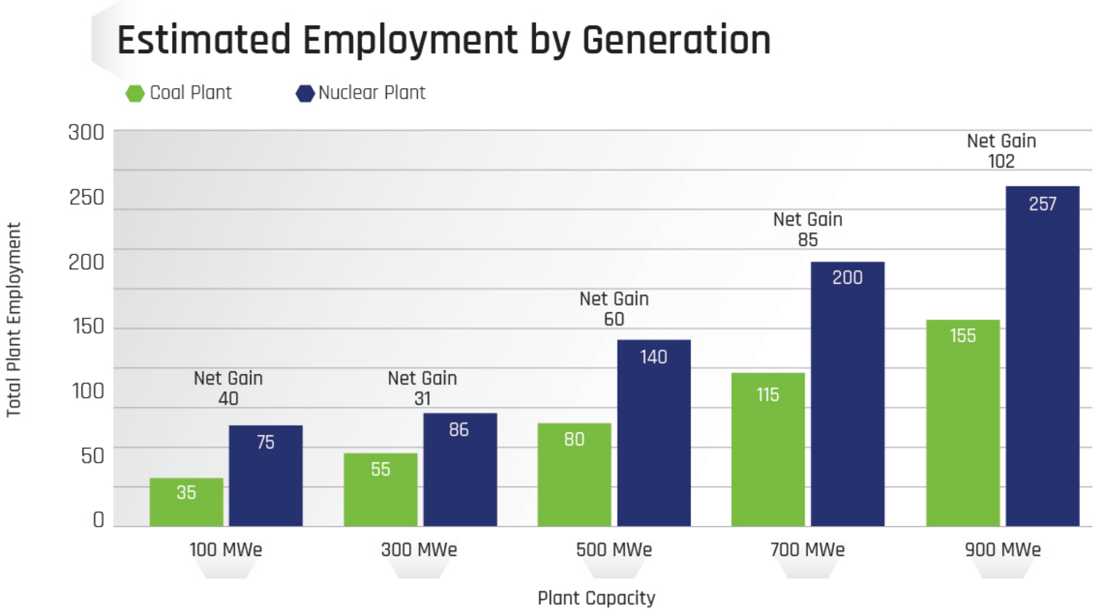
Location: St. John's AZ
Owner: Salt River Project (SRP)
Results:
- The site has ample, developable land for potential nuclear deployment.
- SRP will need to assess water availability, local ecology, and continue community engagement going forward.

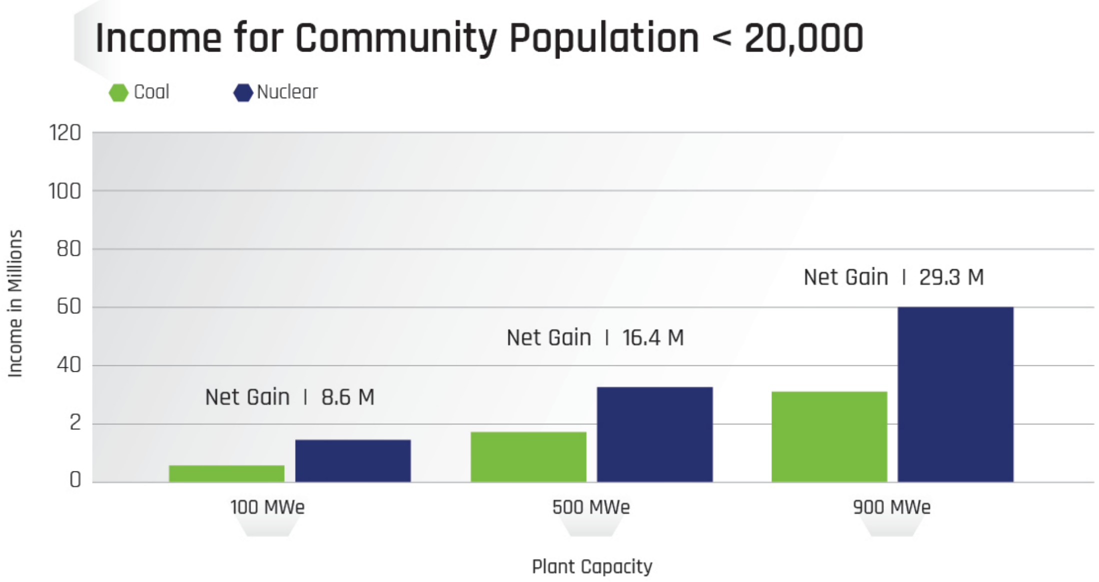
GHENT GENERATING STATION

Location: Ghent, KY
Owner: Louisville Gas and Electric, Kentucky Utilities (LG&E, KU)
Results:
- The site is capable of hosting small and medium-sized reactors, but site topography and potential coal combustion residue will limit the amount of developable land, and therefore total capacity.

What does nuclear power addition offer a community?

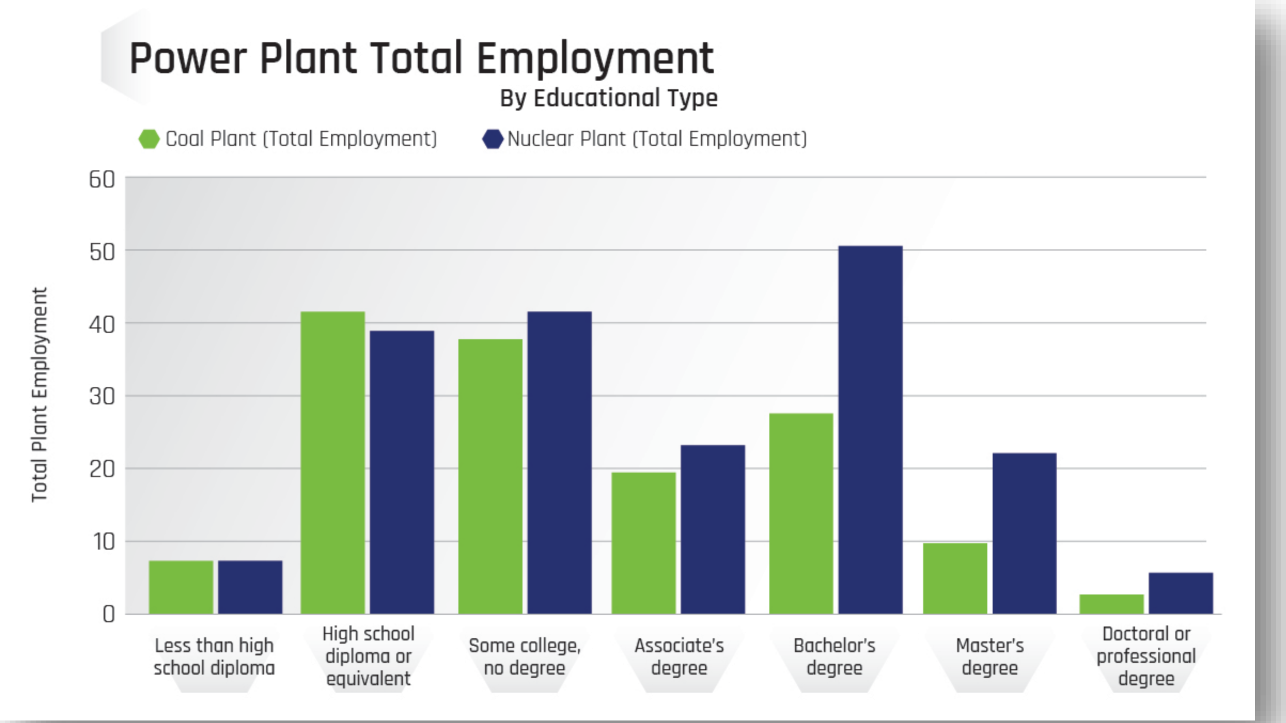
- Nuclear can bring lasting jobs to a plant for 40-80 years
- There are both direct jobs created as well as indirect and induced jobs
- Many other technologies such as wind, solar, and gas only bring construction jobs
- For every $100 of electricity produced, $50 of economic activity occurs in suppliers and support industries





Overlap in job types and education levels

- Compared occupation codes shows the similarity in roles from each power plant type.
- Many occupations at a coal power plant have the educational background to work at the nuclear power plant.
- Analysis does not account for nuclear, industry-specific training.



45%

of added nuclear jobs share identical occupation codes with a coal plant

72%

of the added jobs share similar occupation codes

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