NUCLEAR INNOVATION ALLIANCE

New Nuclear Energy: Projects and Progress

Vermont System Planning Committee

October 28, 2026

Zach Koshgarian, Analyst and State Policy Lead

zkoshgarian@nuclearinnovationalliance.org



Who is Nuclear Innovation Alliance (NIA)?

- NIA is a non-profit, non-partisan, “think-and-do” tank based in Washington D.C.
- Our mission is to help create the conditions for success for nuclear energy so it can be part of the climate and energy solution.
- NIA identifies barriers, performs technical analysis, and engages with stakeholders and policy makers.

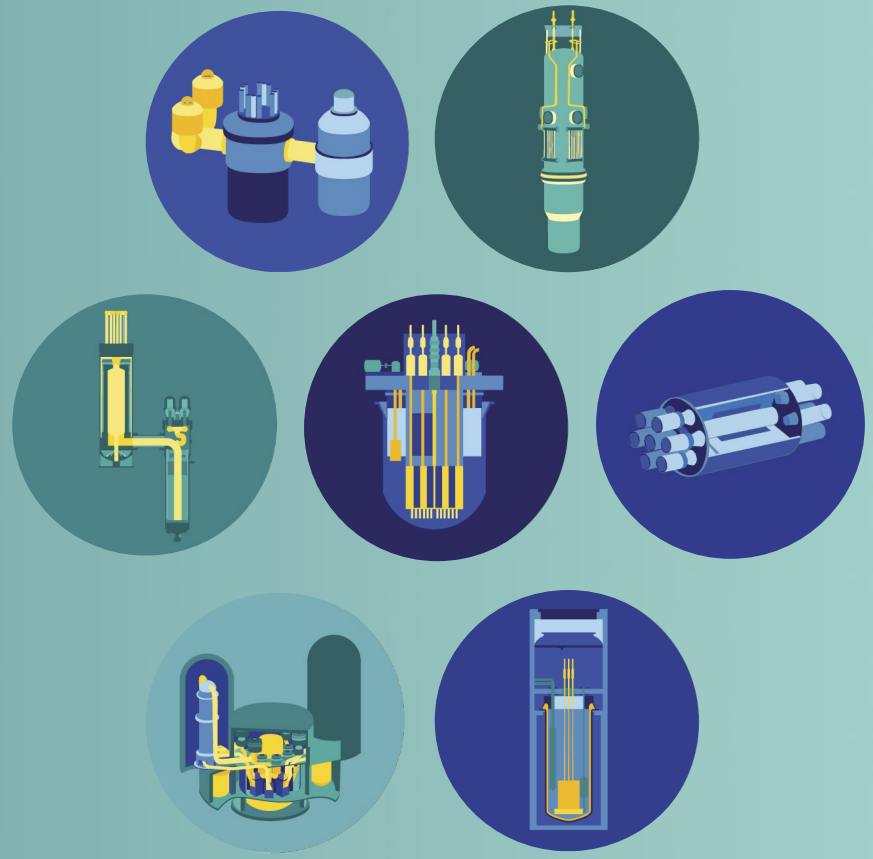


Agenda: New Nuclear Energy Projects and Progress

What is nuclear energy?

What is happening in new nuclear energy?

What are the key considerations

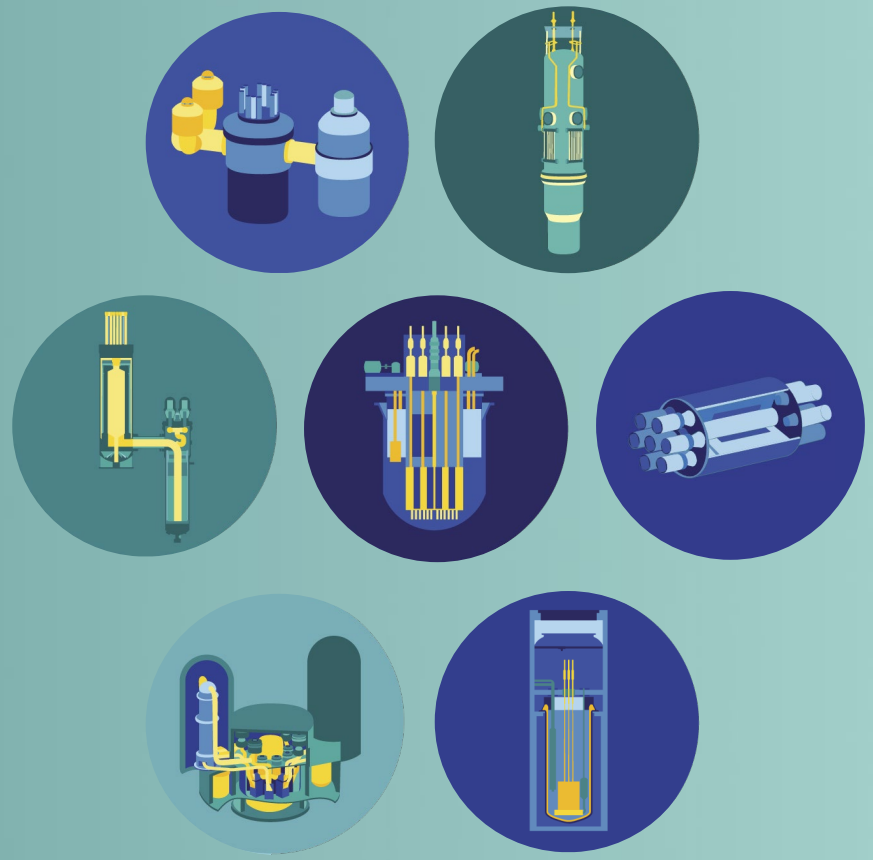


Agenda: New Nuclear Energy Projects and Progress

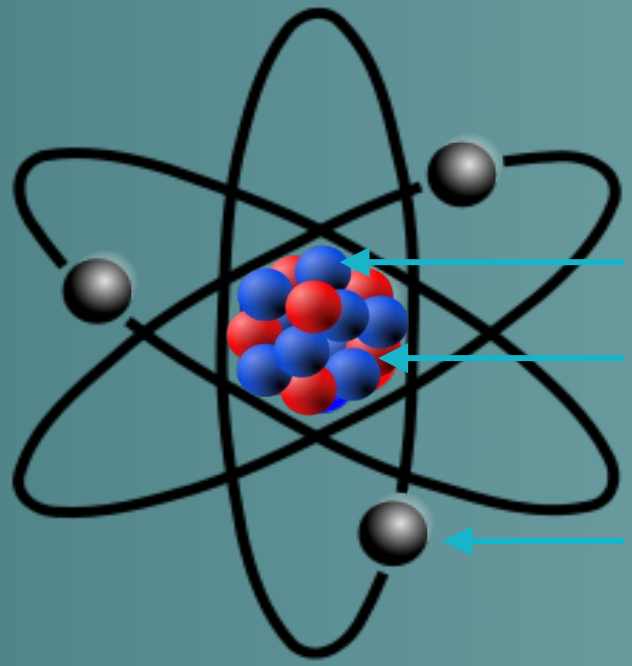
What is nuclear energy?

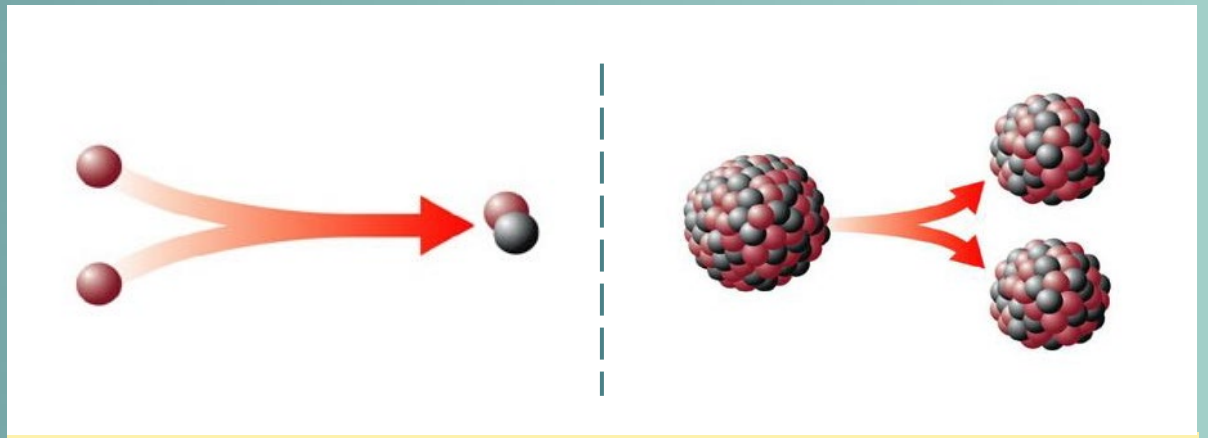
What is happening in new nuclear energy?

What are the key considerations?



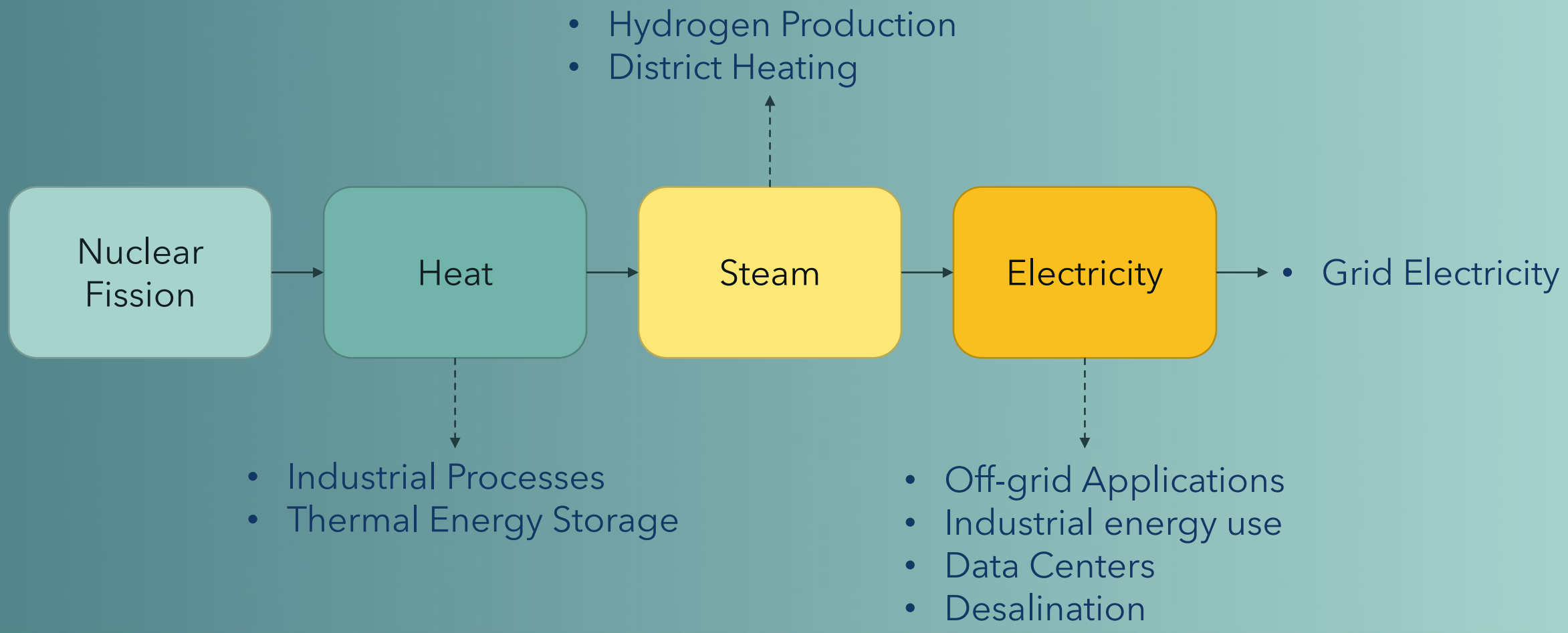
Nuclear energy is the energy released when you split the nucleus of an atom (fission) or merge two nuclei together (fusion)





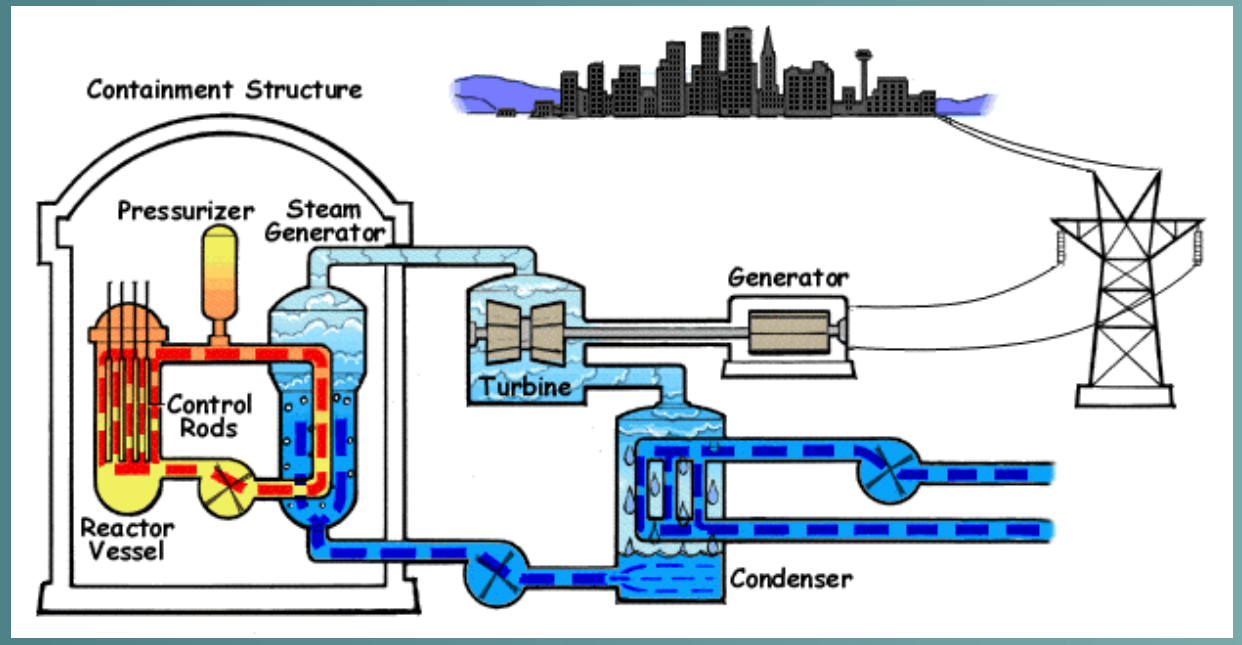
Chemical combustion reaction:	4 eV
Nuclear fusion reaction:	17,600,000 eV
Nuclear fission reaction:	200,000,000 eV

What is a nuclear power plant and how do they convert energy from fission into usable energy?

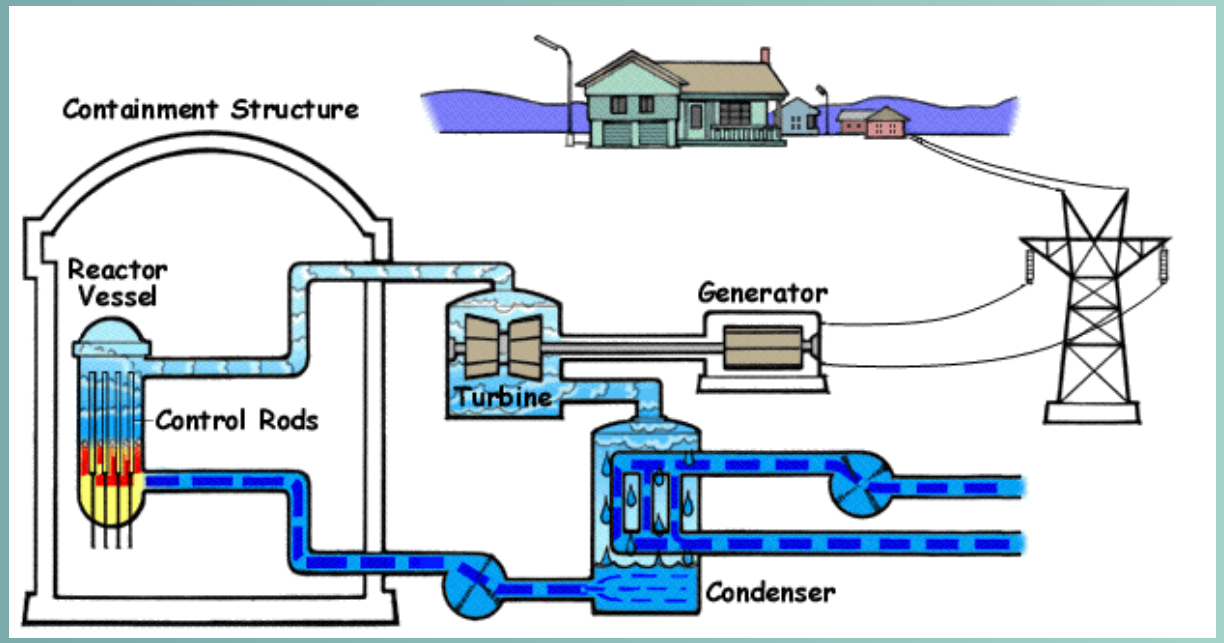


Conventional Nuclear Energy Technologies

Light Water Reactors | LWRs



Pressurized Water Reactor | PWR



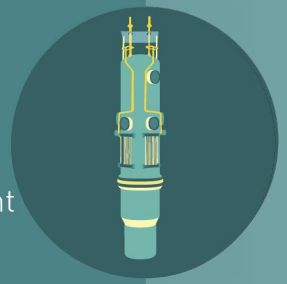
Boiling Water Reactor | BWR

Advanced Nuclear Energy Technologies

Thermal Fission

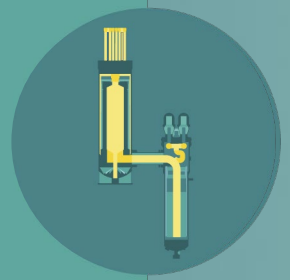
Advanced Light-Water Reactors

Evolutionary design from existing reactors with inherent safety features



High-temperature reactors (HTRs)

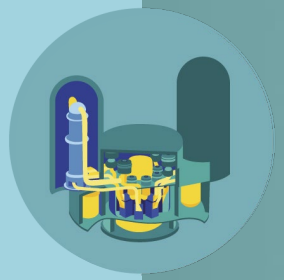
High temperatures drive high efficiency, well-suited for process heat or hydrogen production. Uses TRISO fuel



Thermal or Fast Fission

Molten Salt-Fueled Reactors (MSRs)

Using molten salt for coolant and a fuel form, MSRs can bring significant safety benefits



Fast Fission

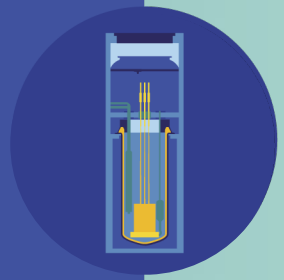
Gas-cooled fast reactor (GFR)

An evolution of HTRs, GFRs operate at very high temperatures while using a more sustainable fuel cycle



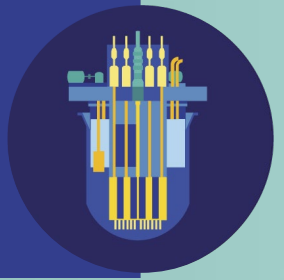
Sodium-cooled fast reactor (SFR)

With many existing experimental reactors, SFRs offer increased fuel efficiency, reduced waste, and passive safety features



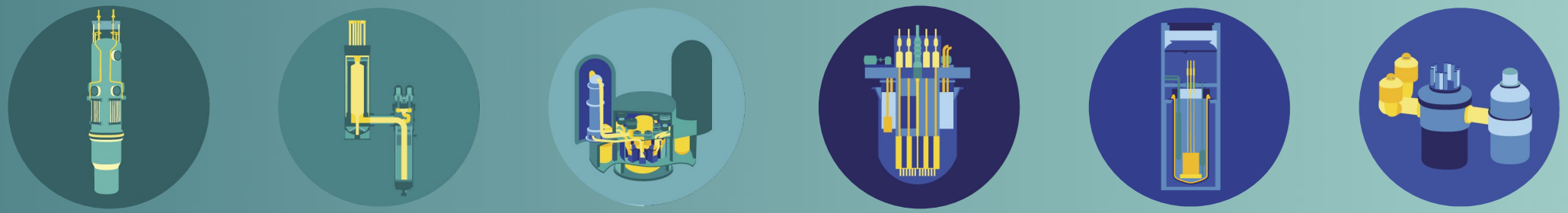
Lead-cooled Fast Reactor (LFR)

Similar in design to SFRs, LFRs are advantageous as lead is operationally safer than sodium



For more information: nuclearinnovationalliance.org/advanced-nuclear-reactor-technology-primer

Advanced Nuclear Energy Technologies



Two key takeaways on *advanced* nuclear energy:

Advanced nuclear reactor technologies are characterized by their unique **coolant** type, **fuel** type, and **power output**

Advanced reactor design choices can significantly increase **safety** and **efficiency** and impact the **use case** of the reactor when compared to conventional reactors

The wide variety of advanced reactors can provide clean, firm power in multiple use cases

Replacing Retiring Fossil Fuel Plants





TerraPower
Natrium
100 MW – 500 MWe

Process Heat





X Energy
Xe-100
80 MWe

Large Load Customers





Kairos Power
KP-FHR
140 MWe

Remote Locations





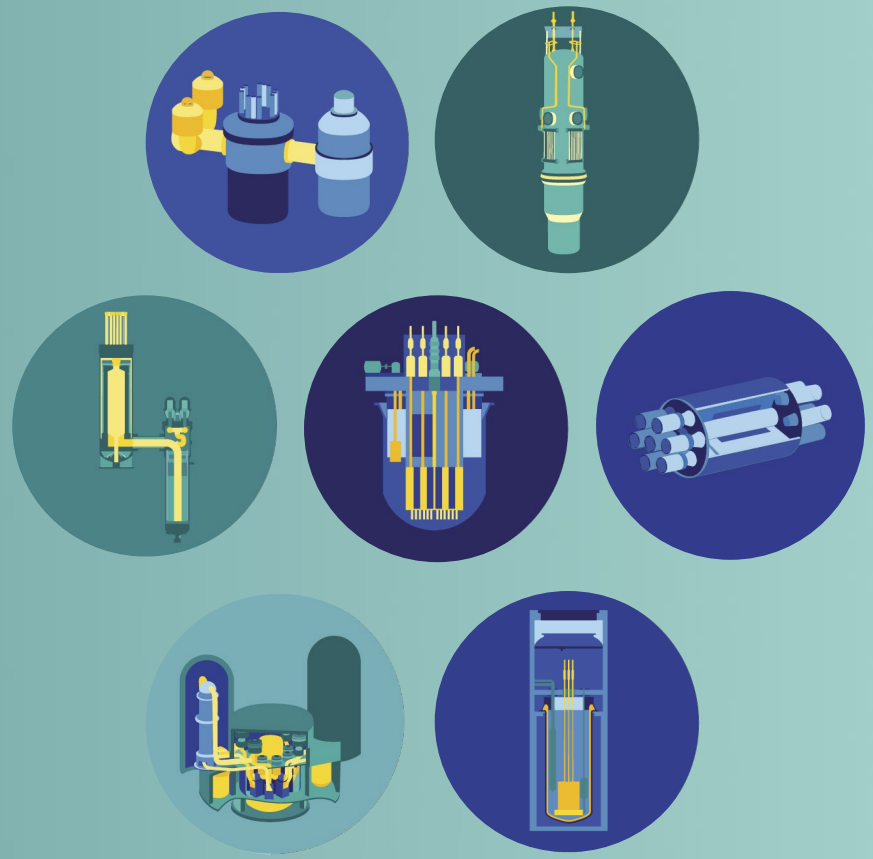
BWXT
BANR
15 MWe

Agenda: New Nuclear Energy Projects and Progress

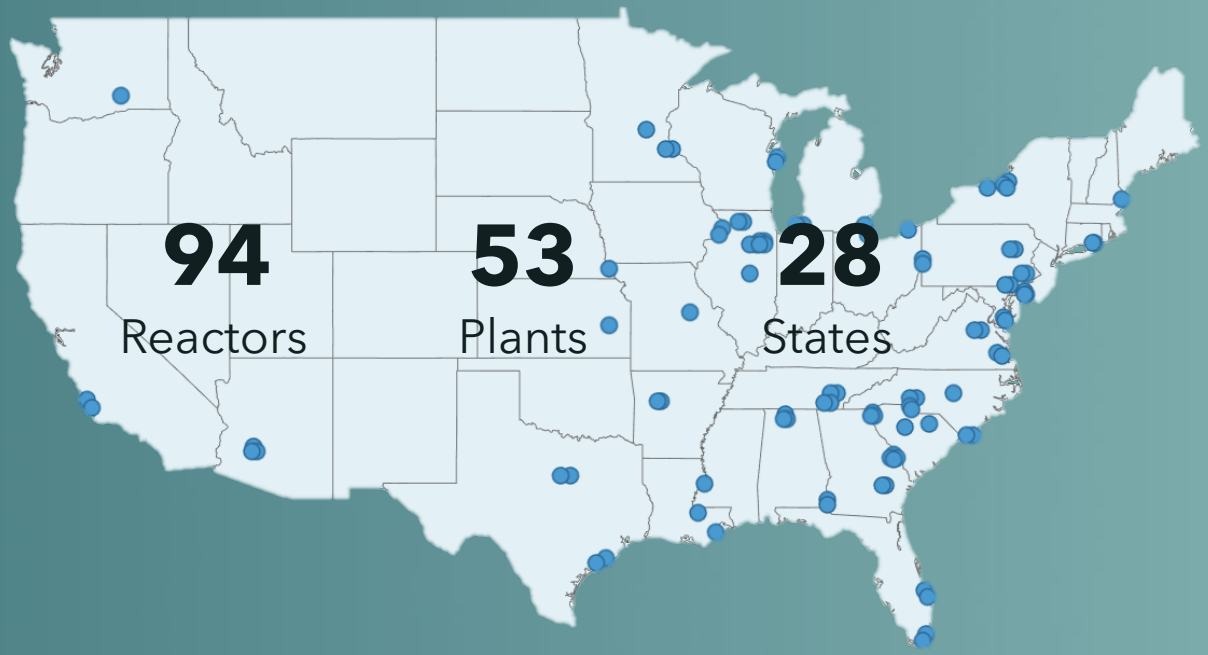
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Existing U.S. Nuclear Reactors Provide Clean, Firm Power



Reactor Technologies

63
Pressurized Water Reactors

31
Boiling Water Reactors

Fleet Performance

46%
Of carbon-free electricity

437M
Metric tons of avoided carbon emissions

72M
Homes powered by nuclear energy

475k
Well-paying jobs

93%
Capacity factor as of 2023

3 Planned Restarts

Source: Nuclear Energy Institute (data from 2025)

Vermont's Energy Mix



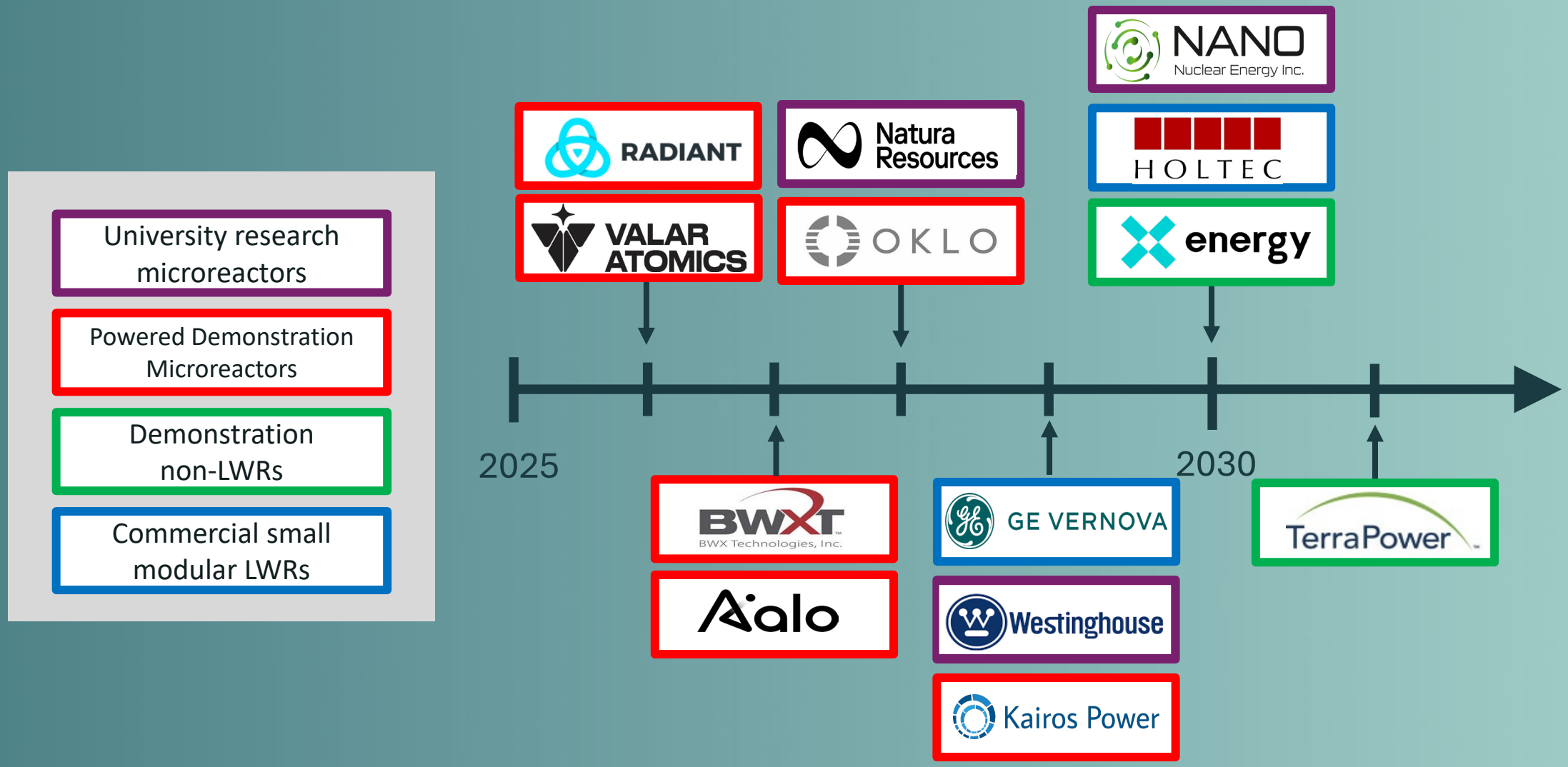
Renewables: 99.5%

Petroleum and Natural Gas: 0.5%



Source: U.S. Energy Information Administration, 2024

First-of-a-kind projects are making progress



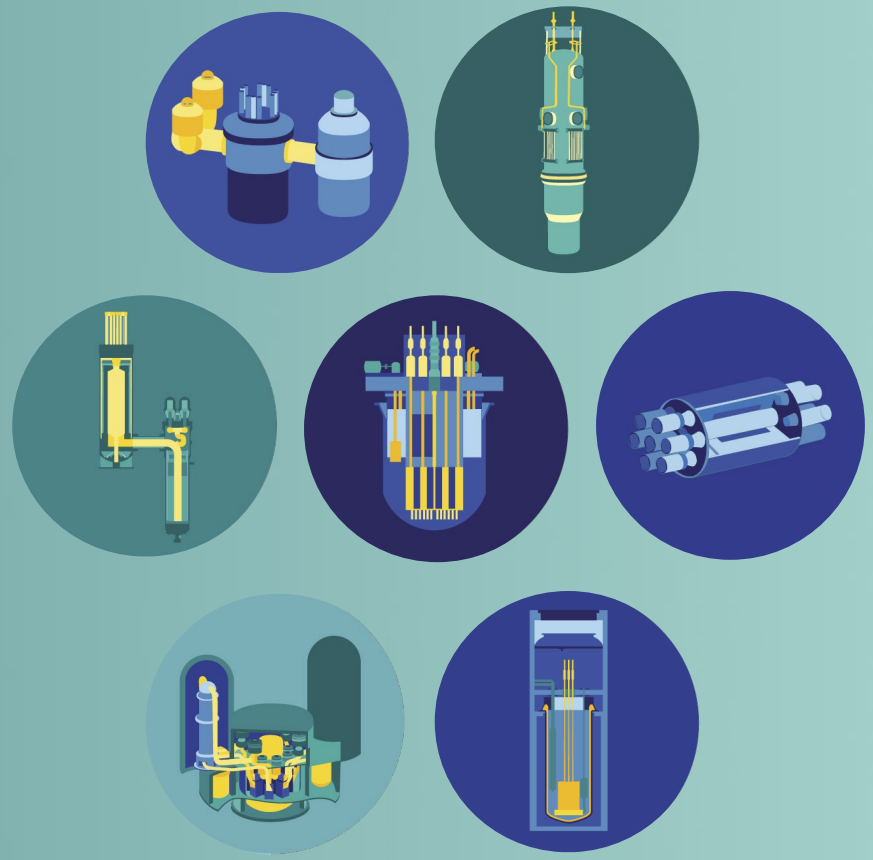
For more information: Advanced Reactor Deployment Timelines | NIA

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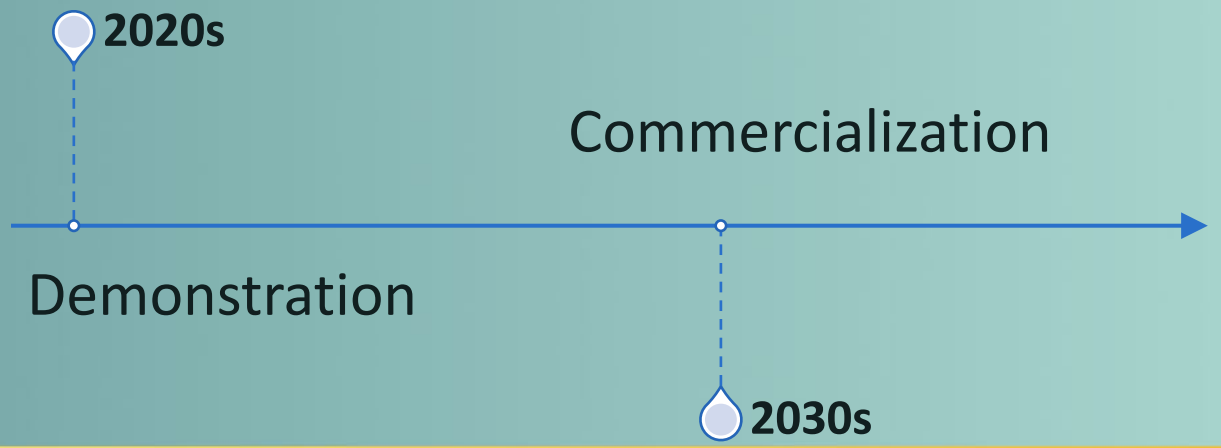


Enablers

- Financing
- Fuel Availability
- Effective Regulation
- Education
- Workforce Development
- Permanent Waste Solutions

Conditions for Success

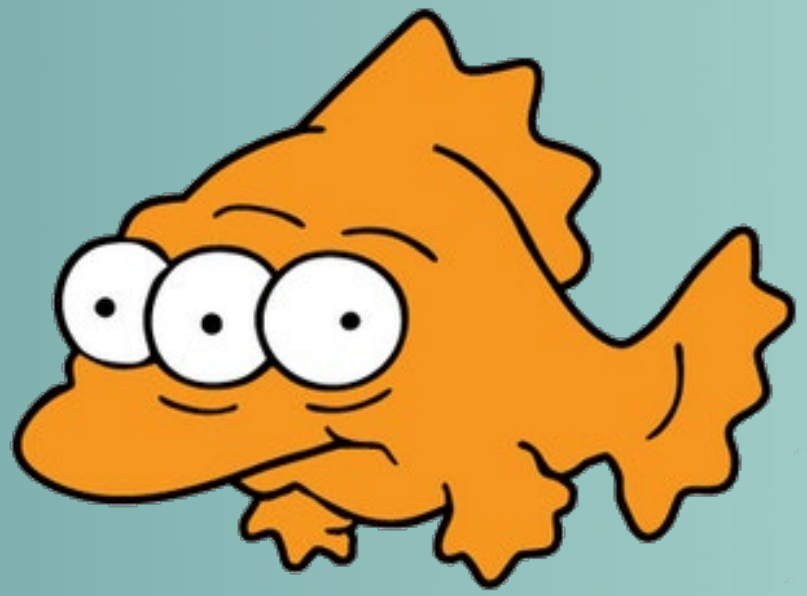
- Competitive cost
- Getting to market
- Public acceptance
- Scaling



Cultural discussions around nuclear waste can portray an unmanaged and unsolvable problem



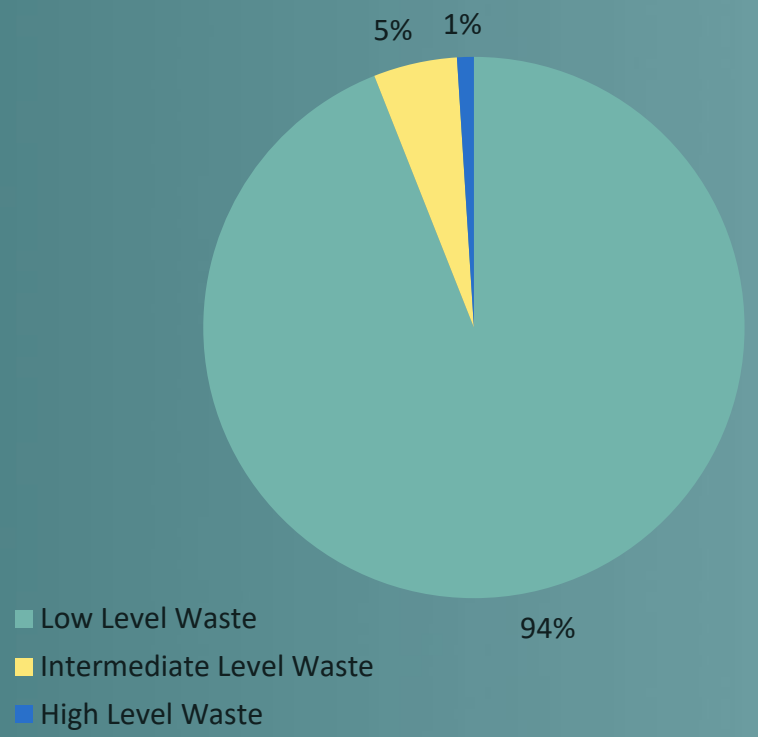
WorldAtlas Article on Nuclear Waste

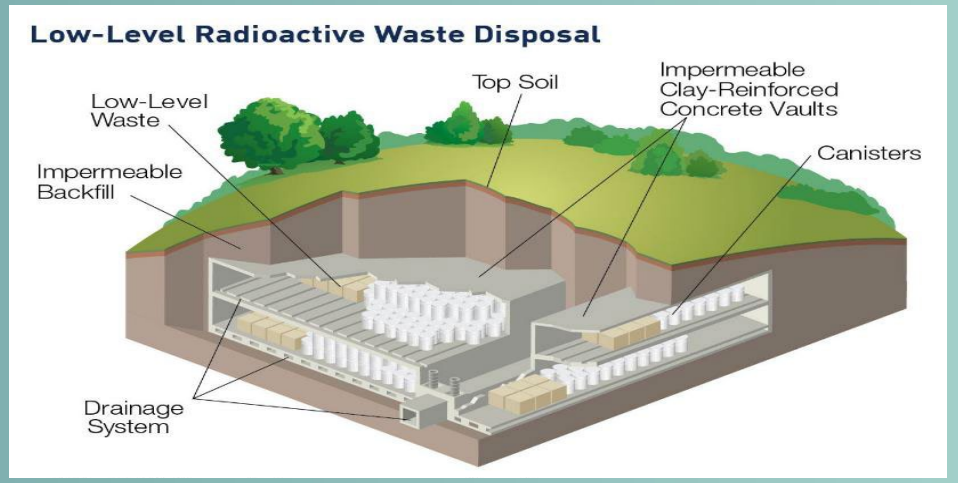


Mutated Fish “Blinky” from *The Simpsons*

Nuclear Waste is Carefully Monitored and Stored

Relative annual production of radioactive wastes



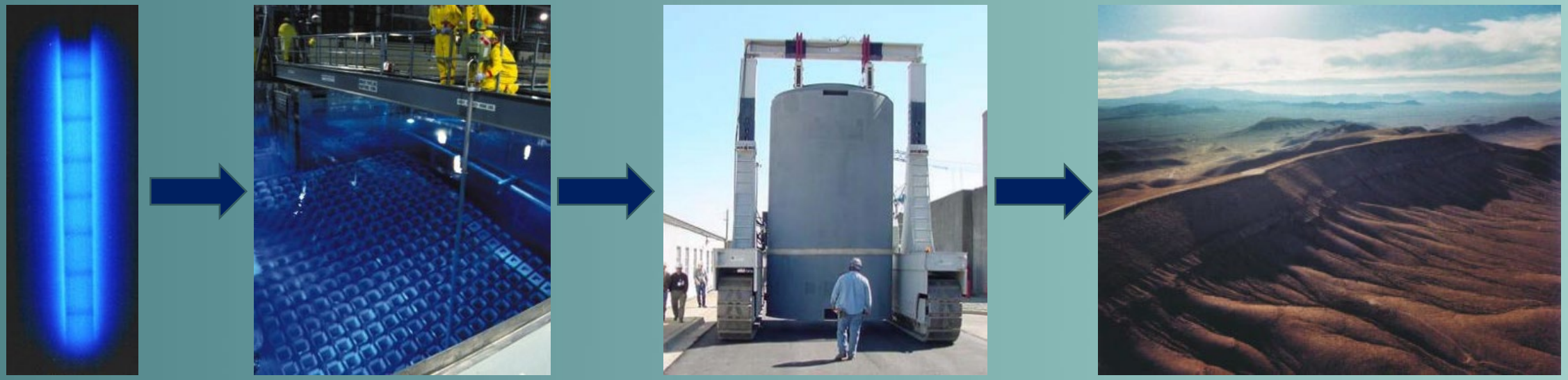




UK Radwaste Briefing Memo

US NRC Brief on Low Level Radioactive Waste Sites

Management of high-level waste or spent nuclear fuel will vary over time based on storage and disposal options



Reactor

Pool

Dry Cask

Geologic Repository

Interim storage of spent nuclear fuel on-site or in a future consolidated storage facility enables safe waste storage

Vertical Storage Casks



Horizontal Storage Module





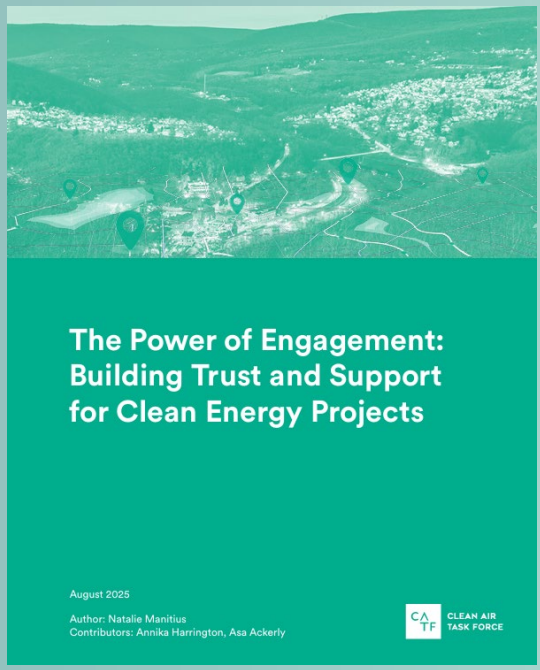
Spent Fuel Storage at Maine Yankee after Shutdown

Community Engagement and Preparedness

- Engage early and often
- Align with community
- Ongoing engagement establishes trust and creates transparency
- Free, prior, and informed consent
- Access to technical information and expertise
- Two-way communication is essential

GAIN
Gateway for Accelerated Innovation in Nuclear

Envoy Public Labs



Source: Clean Air Task Force

Fast Takeaways

Nuclear energy provides clean, firm power in many use cases

Several new nuclear energy projects are in progress

There are several key considerations for new nuclear energy projects

What can States do?

Workforce Development

- Expand community college programs
- Create nuclear-focused apprenticeship programs
- Develop university nuclear energy programs

Siting and Permitting

- Identify sites for new nuclear projects
- Coordinate state permitting requirements
- Consider brownfield sites as candidates

Develop Funding and Risk-Sharing Mechanisms

- Create state-backed funding authorities
- Authorize cost recovery mechanisms
- Develop public-private partnerships for federal and state funds and grants

Community Engagement

- Fund community engagement efforts
- Hold stakeholder discussions
- Provide technical assistance to communities

Regional or Multi-State Deployment

- Develop reactor orderbooks
- Coordinate workforce development
- Share expertise

Active

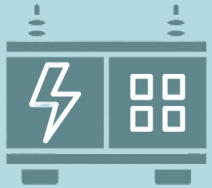
Requires an active action, signal, or mechanical equipment

Common Example



Seat Belt

Nuclear Example



Operator-activated backup generator

Passive

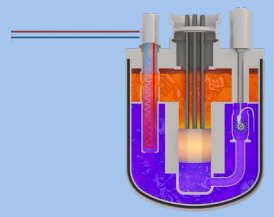
Achieves its safety function using natural forces or stored energy, without active operator intervention

Common Example



Air Bag

Nuclear Example



Molten-salt Reactor (freeze plug & emergency drain tanks

Inherent

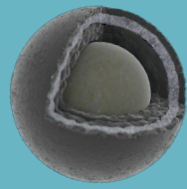
Safety is built into the physical characteristics of the material or design itself

Common Example



Chassis

Nuclear Example



TRISO fuel
Coated particle fuel retains fission products