

Overview of U.S. Advanced Reactor Programs

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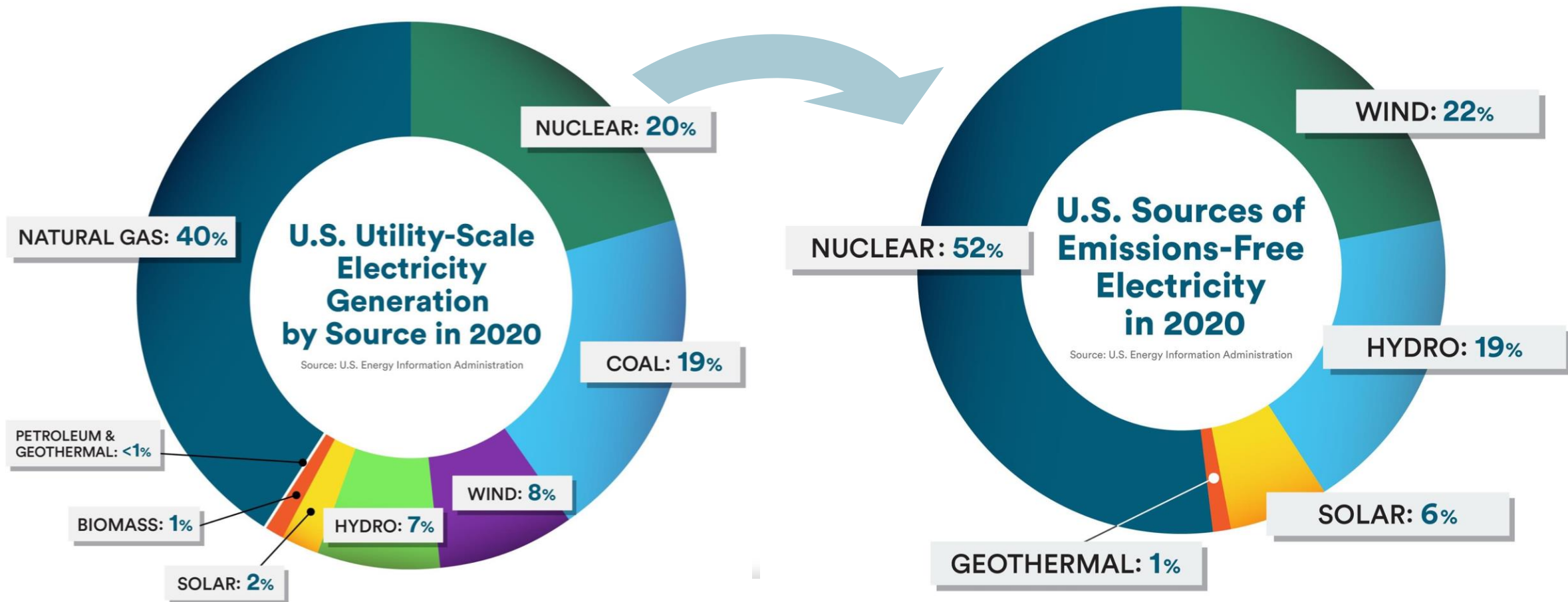
Office of Nuclear Energy

Fast Reactor 2022 Conference
April 19, 2022

- In the United States, we are committed to:
 - 100 percent clean energy on our transmission grid by 2035
 - Net-zero carbon emissions by 2050
- Investments in clean energy technologies are essential to combat the climate crisis, create good-paying union jobs, and strengthen our communities.



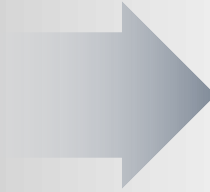
Nuclear: Crucial for Clean Energy Mix



Source: U.S. Energy Information Administration

Advanced Reactors: Integrated Grid for Net-Zero Future

TODAY



Baseload Electricity Generation

FUTURE

Large Light Water Reactors



Small Modular Reactors



Microreactors



New Chemical Processes



Heat



e^-



Clean Water

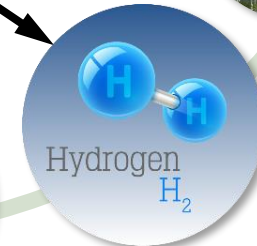
Flexible Electricity Generation



Industrial Applications



Hydrogen for Vehicles and Industry



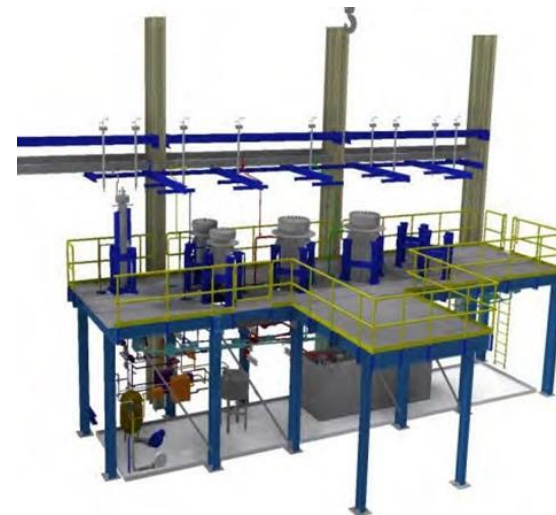
U.S Fast Reactor Research Program

For commercial deployment of fast reactors, stakeholders have identified two recurring needs:

- Addressing technical challenges to reduce capital costs and improve economic competitiveness
- Providing validated experimental and operational data supporting fast reactor licensing cases

High-priority R&D areas:

- Preserving, streamlining access to, and qualifying legacy DOE fast reactor metallic fuel, R&D, and operational data for use in industry design and licensing cases
- Researching more effective fast reactor primary component, sensor, and reliability monitoring technology options identified by fast reactor designers
- Operating the Mechanisms Engineering Test Loop (METL) facility to demonstrate innovative fast reactor components and instrumentation in a prototypic in-sodium environment
- Improving, benchmarking, and validating existing fast reactor design and safety analysis code suites
- Providing the technical basis for ASME qualification of advanced structural materials for use in fast reactors



METL




Thermal Hydraulic
Experimental Test
Article (THETA)

Gateway for Accelerated Innovation in Nuclear (GAIN)

- Simplify private industry's access to the assets of the DOE complex:
 - expertise
 - historical data
 - facilities
- Funding opportunities to accelerate deployment



National Reactor Innovation Center (NRIC)

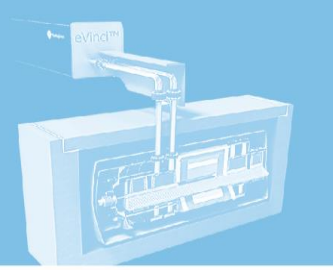
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- An aerial rendering of the National Reactor Innovation Center (NRIC) facility. The complex features several large, modern buildings with blue-tinted glass facades. A prominent white dome structure is situated in the center, surrounded by a green lawn and a circular driveway. To the right, there is a large parking lot filled with cars. In the background, a desert landscape with mountains and a large, conical hill is visible under a clear sky.
- Demonstration siting support
 - Demonstration test beds
 - Experimental infrastructure
 - Advanced Construction Technology Initiative

Visit <https://nric.inl.gov>

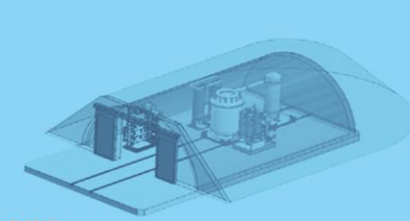


NUSCALE POWER MODULE

eVINCI



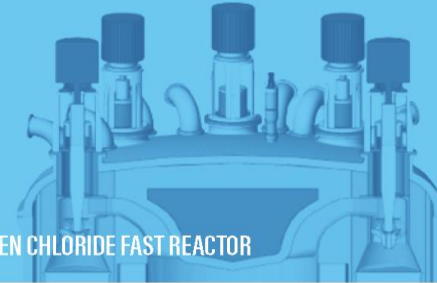
BANR



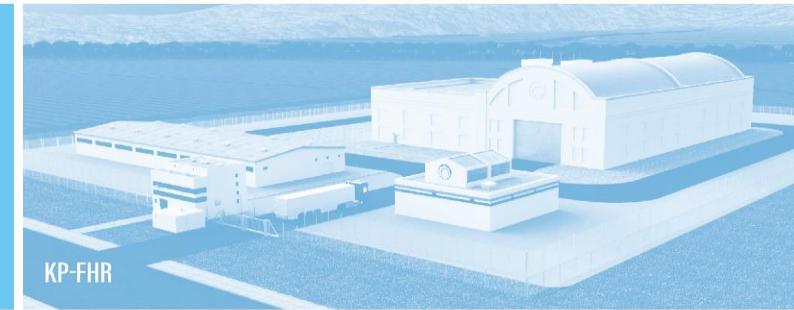
SMR-160



MOLTEN CHLORIDE FAST REACTOR



KP-FHR



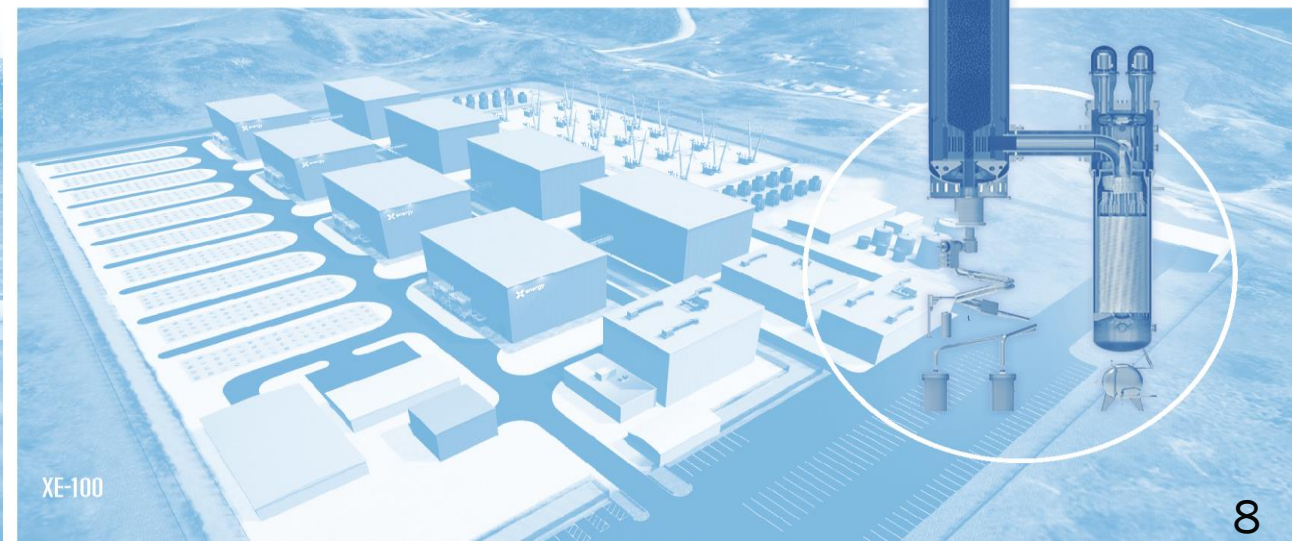
ADVANCED NUCLEAR TECHNOLOGY

U.S. DEPARTMENT OF
ENERGY

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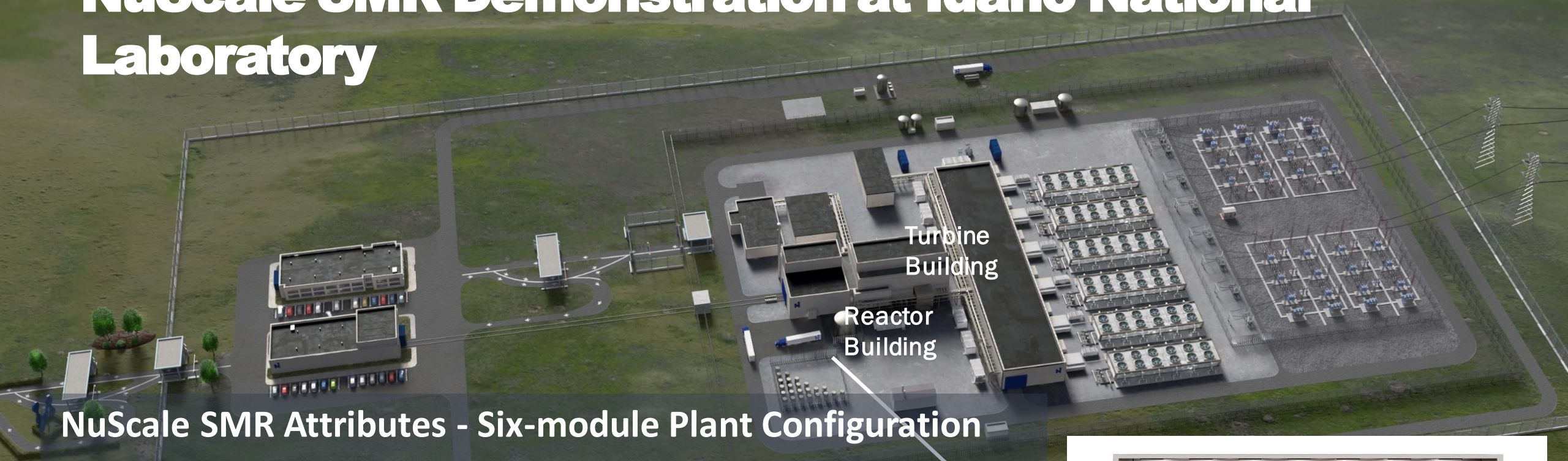


NATRIUM REACTOR



XE-100

Carbon Free Power Project: NuScale SMR Demonstration at Idaho National Laboratory



NuScale SMR Attributes - Six-module Plant Configuration

- 6 Nuclear Power Modules - 462MWe (77 Mwe per module)
- Leverages proven and commercially-available LWR fuel
- Air Cooled Condensers – reduces water use 95%
- Initial site characterization work completed
- First module operation planned for 2029



TerraPower's Sodium Sodium-cooled Fast Reactor

Natrium Attributes

- 345 MWe nominal electric power output
- Zero emission dispatchable resource
- Price follower... w/ reactor at 100% power 24/7
- Flex to 500 MWe for 5.5 hours through thermal energy storage
- To be sited at retiring coal plant site in Wyoming

X-energy's Xe-100 High Temperature Gas-cooled Reactor



Xe-100 Attributes

- Zero emission, 24/7 energy resource
- Nominal 4-unit, 320 MWe
- Very high temperature steam
 - Ideal for hydrogen production / process heat
- Flexible load follow capacity to pair w/ renewables
- TRISO fuel particle is fission product containment
- Modular design for price/schedule certainty

Conclusion

- Advanced reactors are crucial for achieving national and global carbon reduction goals
- The U.S. will continue to perform foundational R&D on advanced reactor and fuel cycle technologies to improve nuclear energy safety and performance
- We are linking nuclear developers with the expertise and capabilities of our National Laboratories
- International engagements continue to be a high priority for DOE
- Private-public partnerships are bringing first-of-a-kind demonstrations to the grid within this decade

The background is a collage of various nuclear energy components, including a cooling tower, a reactor core, a fuel assembly, and a worker in a hard hat, all rendered in a blue and teal color scheme.

Thank you!

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