OCED
Office of Clean Energy Demonstrations

THE OFFICE OF
# CLEAN ENERGY DEMONSTRATIONS


# Department of Energy Support of Advanced Reactor Technologies

# DOE Advanced Reactor Goals and Objectives

- Support diversity of U.S.-based advanced designs that offer significant improvements to current generation of operational reactors.
- Enable a market environment for commercial advanced reactors that are safe and affordable to both construct and operate in the near-and mid-term.
- Stimulate domestic nuclear commercial enterprise, including supply chains.
- **Advanced reactor deployment ties into the Administration's goals:**
  - **100% clean energy** on our transmission grid by **2035**
  - **Net-zero** carbon emissions by **2050**.

***"Investments in clean energy technologies will ensure the U.S. is the global leader in research, development, and deployment of critical energy technologies to combat the climate crisis, create good-paying union jobs, and strengthen our communities in all pockets of America."***

***U.S. Secretary of Energy Jennifer Granholm***

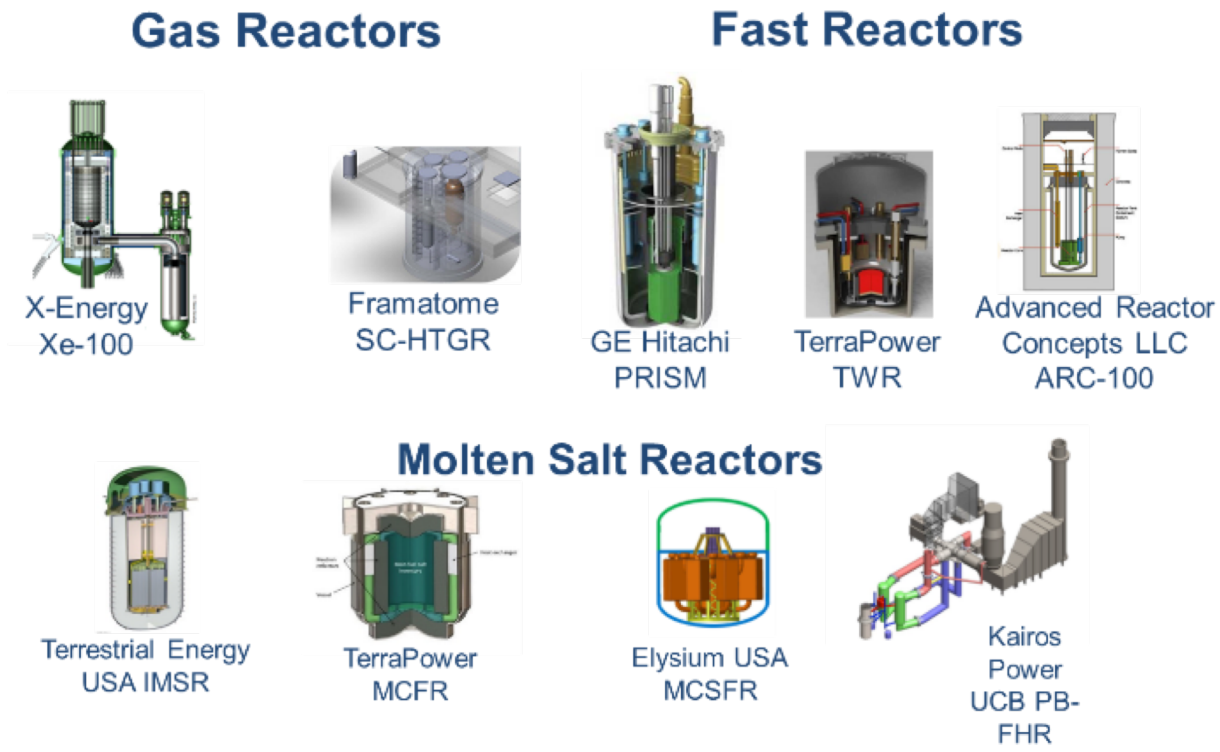
# Advanced Reactors – Advantages and Attributes

**Nominal Definition for Advanced Reactor**:
*a nuclear fission or fusion reactor, including a prototype plant (as defined in sections 50.2 and 52.1 of title 10, Code of Federal Regulations), with significant improvements compared to currently operating commercial nuclear reactors.*

**Improvements include:**

- inherent safety features and passive decay heat removal
- lower levelized cost of electricity
- greater fuel utilization and lower waste yields
- increased proliferation resistance
- increased thermal efficiency
- ability to integrate into electric and nonelectric applications

**Example technologies:**



# Advanced Reactors: Integrated Into a Net-zero Future

**Nuclear Energy Generation**

Light water reactors, high temperature advanced reactors, small modular reactors, microreactors

**Other Energy Generation**

Variable renewables, municipal waste, fossil with carbon capture, etc.


Biofuel

New chemical processes

Clean water

Industry

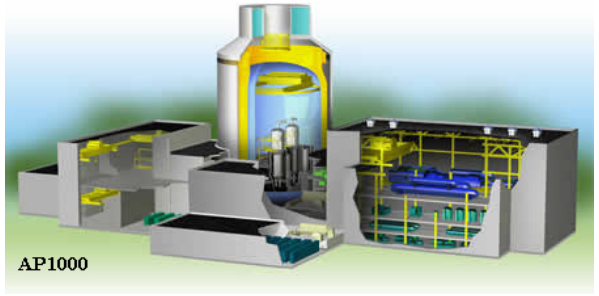
Electricity

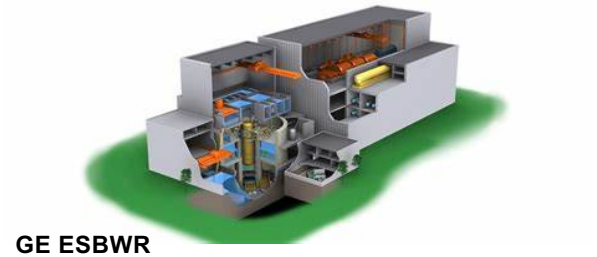

Hydrogen for vehicles and industry

# Evolution of DOE Nuclear Industry Partnerships

**Nuclear Power 2010 Program**
*Supported development of GEN 3+ advanced LWR designs*

2005 — 2011





GE ESBWR

2012

**Small Modular Reactor Licensing Technical Support Program**
*Design and licensing of SMR designs; generic research and studies important to siting and licensing of SMR designs*

**B&W mPower SMR**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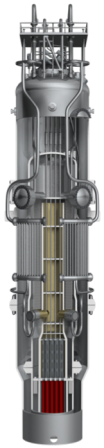
**NuScale Power Module**



2017

**Advance NuScale SMR technology through licensing and demonstration**
*Design finalization and commercialization efforts supported through Industry awards; NuScale SMR FOAK Nuclear Demonstration Readiness Project (2019-Present); Carbon Free Power Project – a first deployment of a NuScale reactor (2020-Present)*

2020

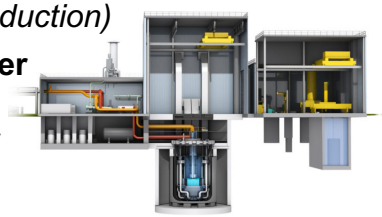
TODAY

**Advanced Reactor Demonstration Program**
*Congressionally-driven program to demonstrate two commercial advanced designs in 7 years; provides risk reduction funding for a diverse set of less mature designs; offers cost-share based on technology maturity (up-to 50/50 for demos, 80/20 for risk reduction)*

ARDP

**X-energy Xe-100 SMR**

**TerraPower Natrium Reactor**



# Market Uptake: Achieving Fleet-Level Deployment of Advanced Reactors

DOE is currently conducting a Demonstration & Deployment Pathway assessment examining necessary conditions to drive advanced nuclear deployment supporting carbon reduction goals

Based on extensive industry interviews.

Early conclusions from the report identify the following core factors as important to promoting widespread adoption:

- A **committed order book** for additional reactors before demonstration projects are operational
- The necessary **industrial base** (supply chain and workforce) to add 10-12 GW of new nuclear energy production on the US grid per year
- **Predictable licensing** schedules and timely regulatory execution
- The ability to **drive down cost** through the learning curve from first-of-a-kind to nth-of-a-kind plants

# Office of Clean Energy Demonstrations (OCED) Mission and Scope

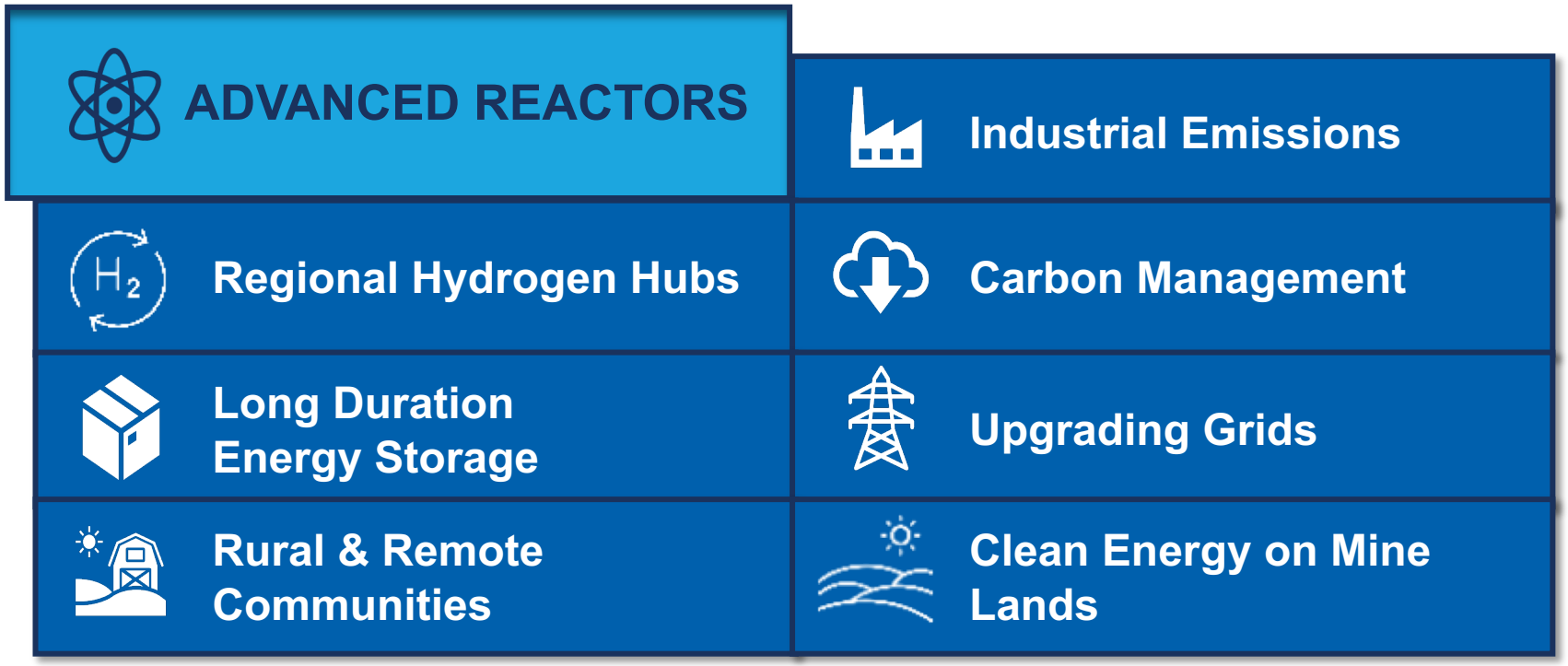
**Mission** | Deliver clean energy technology demonstration projects at scale in partnership with the private sector to accelerate deployment, market adoption, and the equitable transition to a decarbonized energy system.

- OCED was organized under the Bipartisan Infrastructure Law. With the Inflation Reduction Act, the office has budget authorization of up to

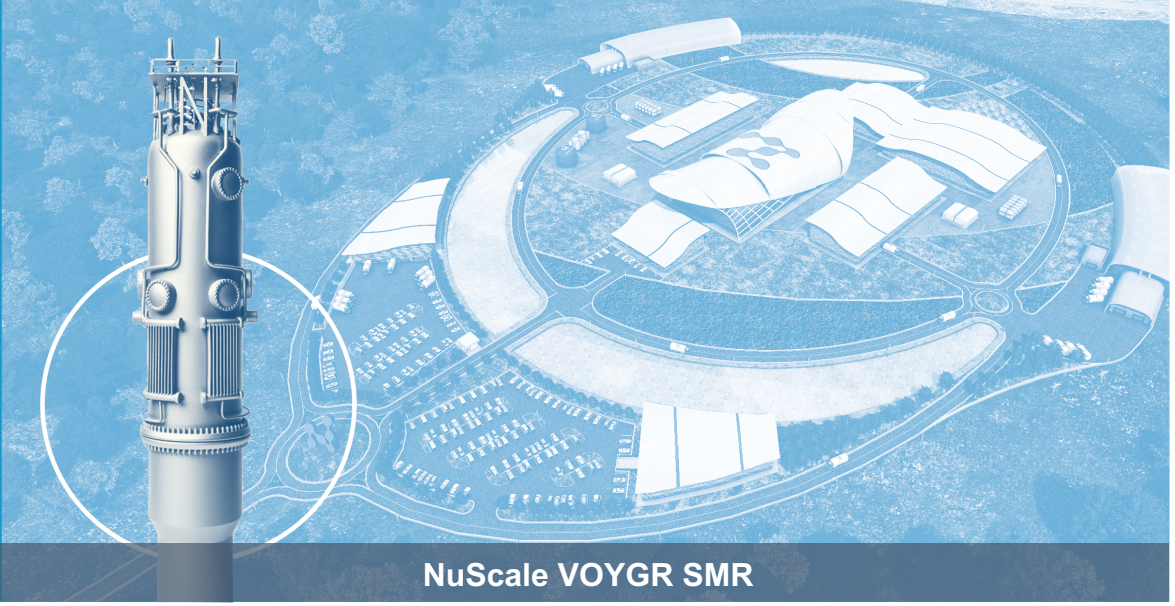
**$25+ billion***

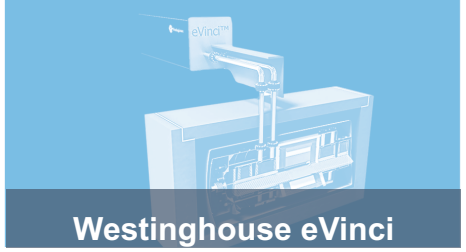
touching multiple project areas, and is collaborating closely with experts across the Department.

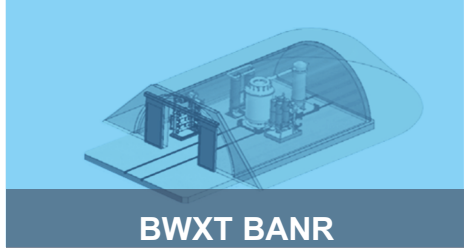
- Through BIL the Advanced Reactor Demonstration Program was moved to OCED and provided ~$2.5B

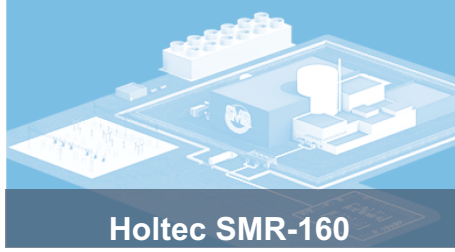



**$21.6B from Bipartisan Infrastructure Law and $5.8B from the Inflation Reduction Act*

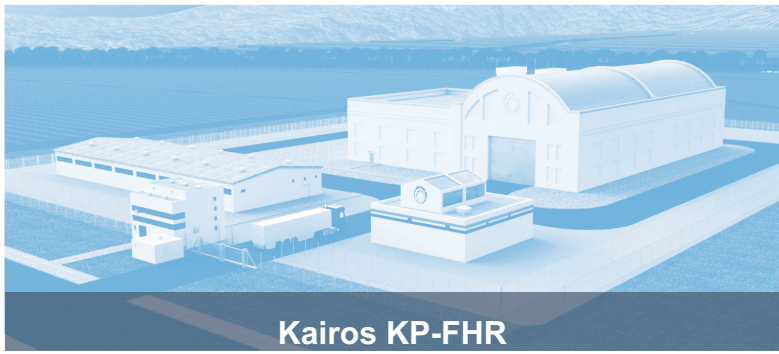

NuScale VOYGR SMR


Westinghouse eVinci


BWXT BANR


Holtec SMR-160

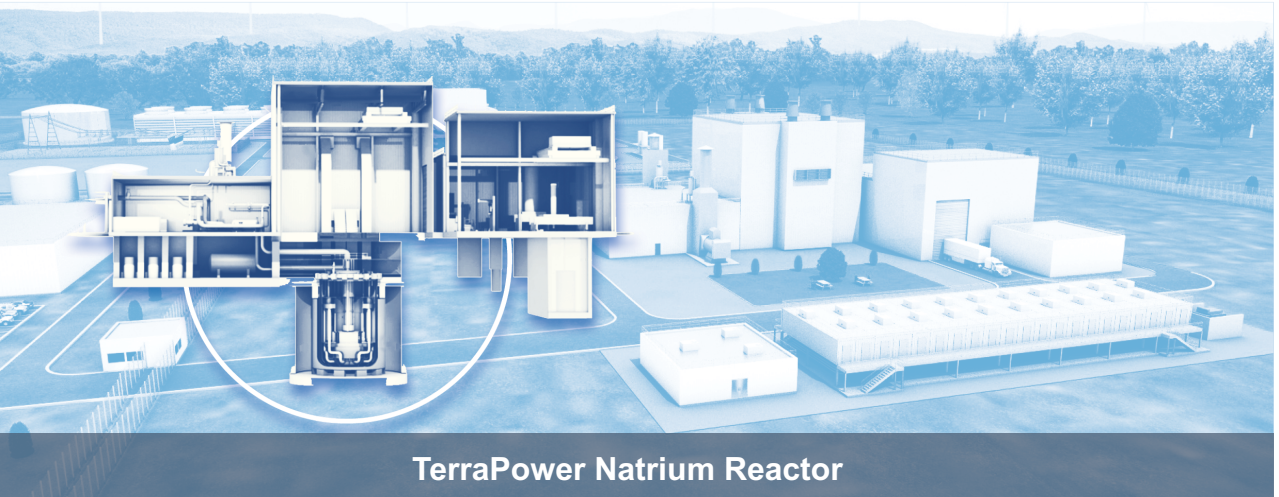

TP Molten Chloride Fast Reactor

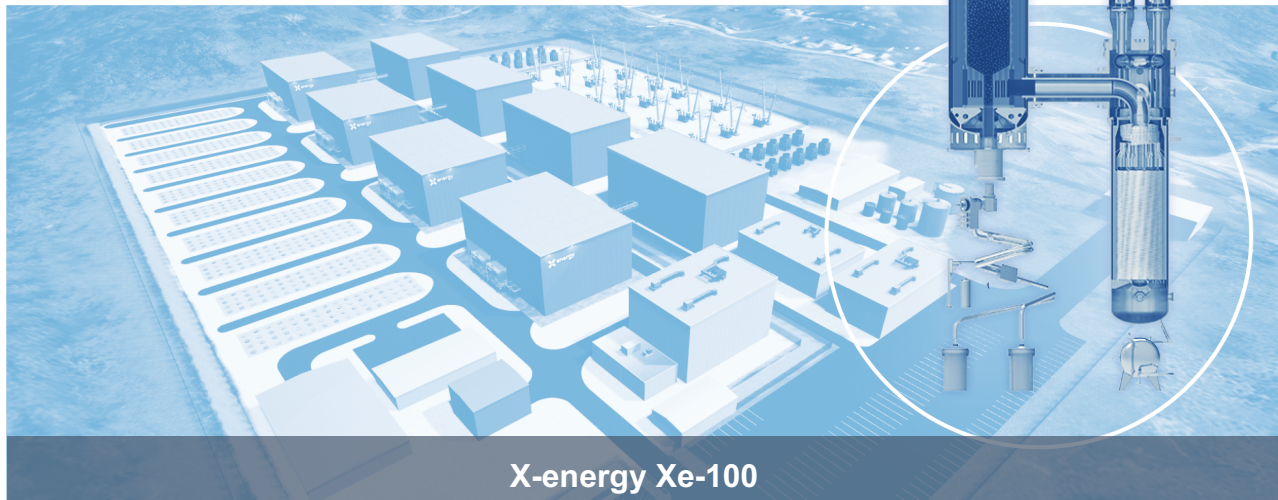

Kairos KP-FHR

# Advanced Nuclear Public-Private Partnerships

Office of Clean Energy Demonstrations

Office of NUCLEAR ENERGY


TerraPower Natrium Reactor


X-energy Xe-100

# Carbon Free Power Project:
# NuScale Small Modular Reactor (SMR) Demonstration

Turbine Building

Reactor Building

## NuScale VOYGR SMR Attributes - Six-module Plant

- 6 NuScale Power Modules - 462MWe (77 Mwe per module)
- Leverages proven and commercially-available LWR fuel
- Air-cooled condensers substantially reduces water use
- Initial site characterization work completed
- NRC certified the NuScale SMR design in Jan. 2023
- First module operation planned for 2029

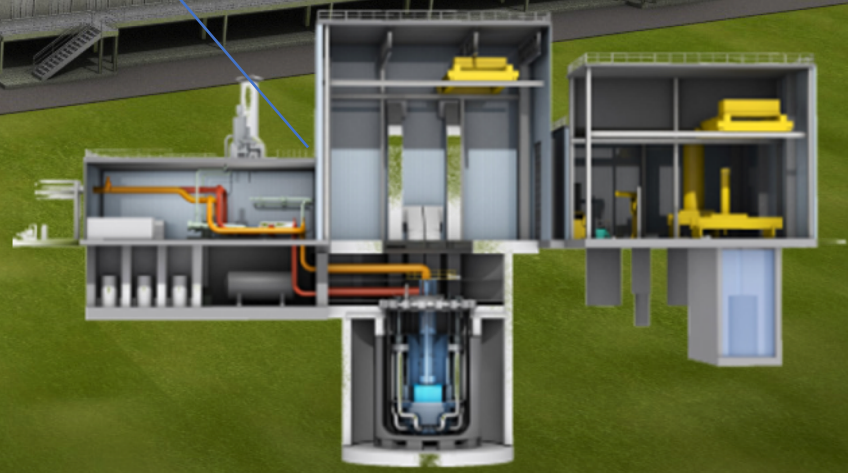
**Idaho National Laboratory (Idaho Falls, ID)**

# TerraPower's Natrium Sodium-cooled Fast Reactor Demonstration

## Natrium Attributes – Single Module Plant

- Sodium Cooled Fast Reactor (SFR)
- 345 MWe nominal electric power output
- Flexible to 500 MWe for 5.5 hours with thermal energy storage
- Builds on DOE Experimental Breeder Reactor – II (EBR-II) development
- To be sited at a retiring coal plant

**Kemmerer, Wyoming**



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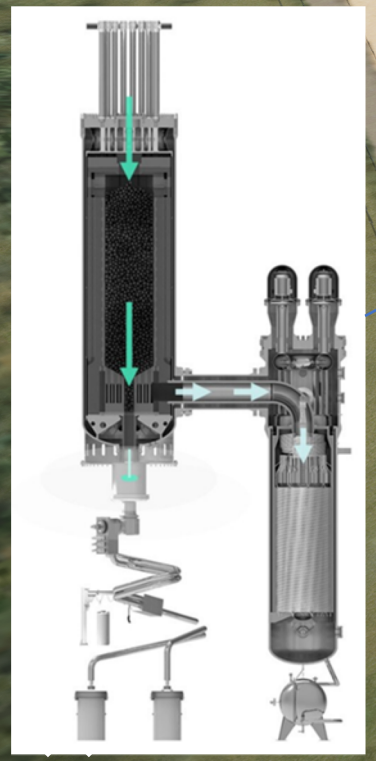
# X-energy's Xe-100 High Temperature Gas-cooled Reactor Demonstration



Xe-100

## Xe-100 Attributes – Four Module Plant

- High-temperature Helium-cooled Gas Reactor (HTGR)
- 80 MWe nominal electric power output per unit
- Uses DOE-developed TRISO fuel particle technology that provides defense-in-depth
- Modular design for scalability
- Provides high-temperature steam for industrial process heat

Dow Chemical Facility in Seadrift, TX

# Conclusions

- Aggressive decarbonization goals have been set for energy production and industrial applications in the United States
- The U.S. Department of Energy is investing over $3.25B in nuclear demonstrations, recognizing that substantial new nuclear energy production (~200GW) will be necessary to meet 2035 and 2050 decarbonization goals
- Commercial deployment will require a robust supply chain that can support ramping up nuclear construction projects in advance of completion of the demonstration projects

# Thank you!!

**How to engage with OCED:**

- OCED Website and Newsletter Sign-up
  energy.gov/oced
- OCED Exchange (RFIs, NOIs, and FOAs)
  oced-exchange.energy.gov
- Get in touch via email
  DL-OCED-Engagement@hq.doe.gov

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