U.S. DEPARTMENT OF ENERGY | Office of NUCLEAR ENERGY

Advanced Reactors:
Crucial for a Net-Zero Economy

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Office of Nuclear Energy

Battelle Conference on Innovations in Climate Resilience

March 29, 2022

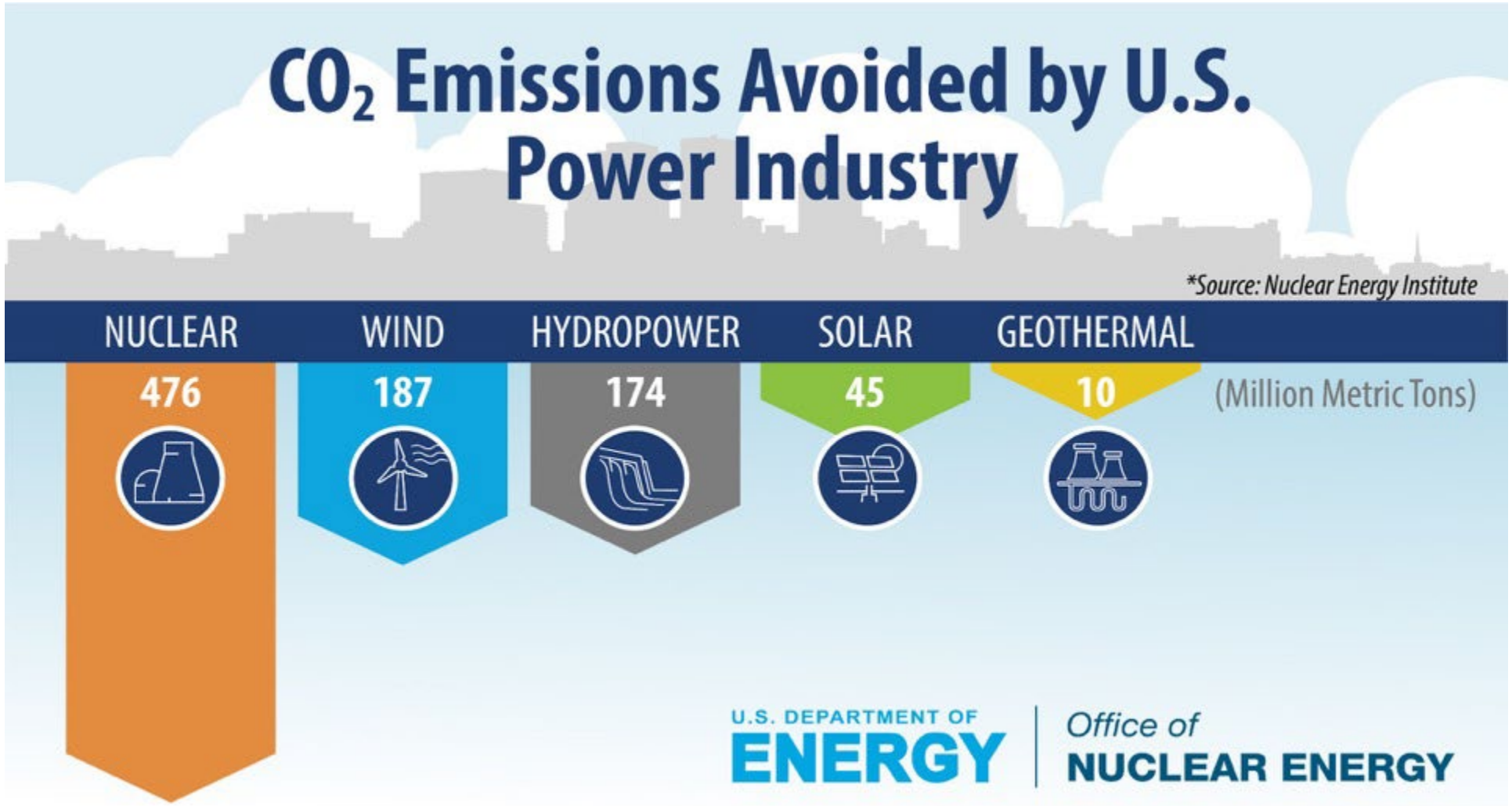
Clean energy enthusiast!

- I heat my home with biomass
- I own 110 solar panels
- I drive an all-electric vehicle

- In the United States, we are committed to getting to:
  - 100 percent clean energy on our transmission grid by 2035, and
  - net-zero carbon emissions by 2050.

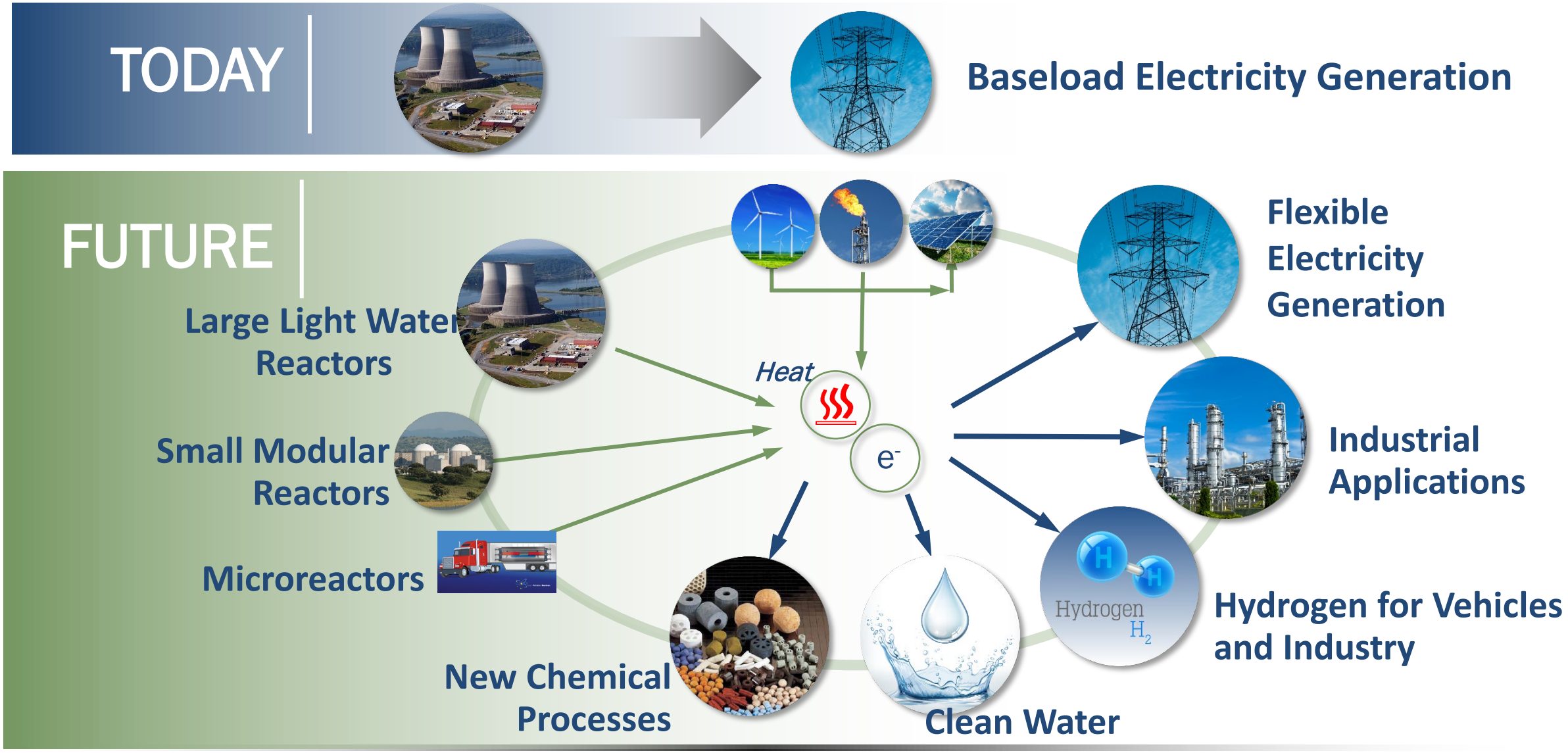
- Investments in clean energy technologies will ensure the U.S. is the global leader in research, development, and deployment of critical energy technologies to combat the climate crisis, create good-paying union jobs, and strengthen our communities in all pockets of America.

Nuclear Avoids the Most Carbon

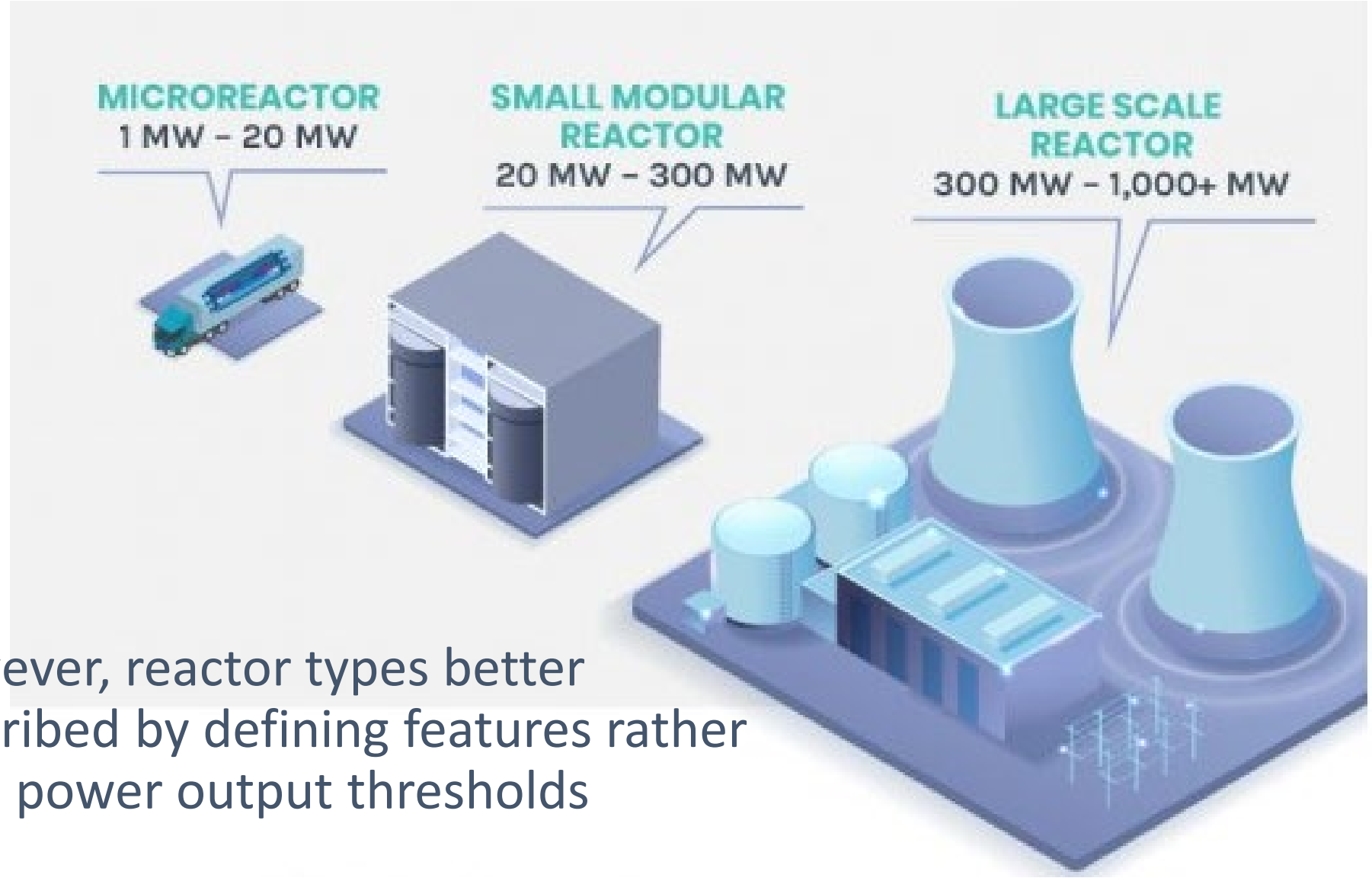


Clean. Reliable. Nuclear.

Advanced Reactors: Integrated Grid for Net-zero Future



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



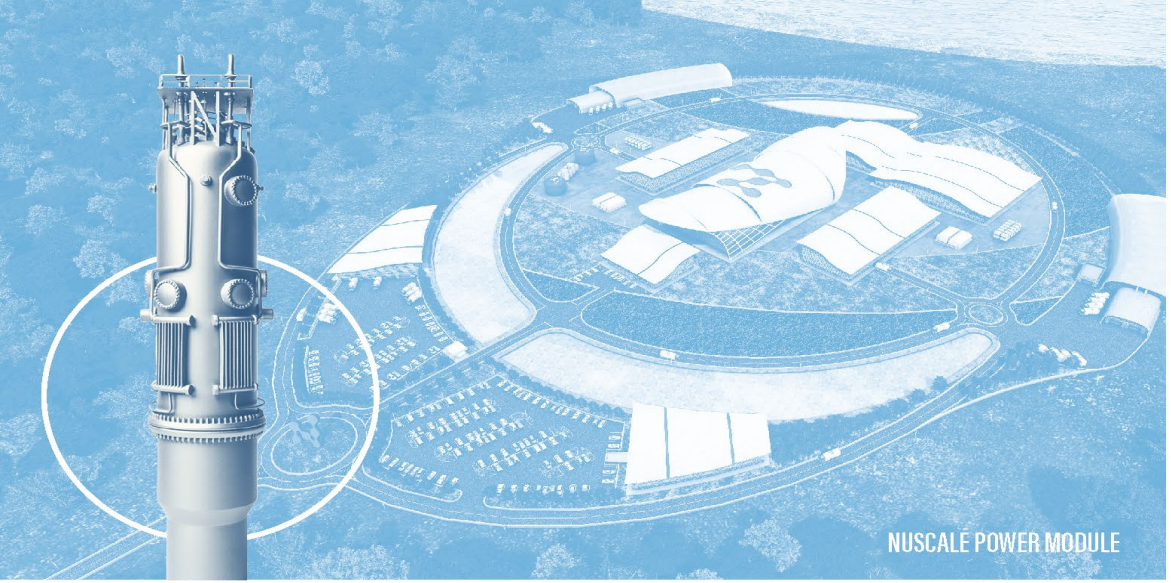
However, reactor types better described by defining features rather than power output thresholds

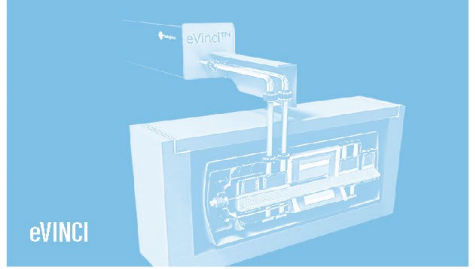
Defining Features

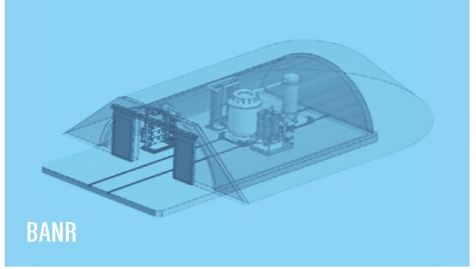
- **Larger Scaled Conventional Reactors - upper-hundreds to 1000+ MWe range**
  - **Large output for carbon-free baseload power generation**
  - Require substantial on-site preparation, construction, and assembly prior to operation
- **Small Modular Reactors – tens to mid-hundreds MWe range**
  - **Siting and operational flexibility** – load following and non-electric applications
  - **Factory fabricated** major plant components and systems that can be readily transported
  - Limited on-site preparation and **reduced construction times**
  - Shared control rooms, balance-of-plant – **increased operational efficiencies** and cost savings
  - Additional reactor modules **can be added incrementally** as demand for energy increases.
- **Microreactors – one to tens of megawatts-electric (MWe) range**
  - **Factory fabricated** with highly integrated systems
  - Readily **transportable nearly fully assembled** to operating site by truck, rail, aircraft, or ship
  - **Minimal on-site preparation** is required prior to operation
  - Employ **passively safe** operating and fuel designs
  - Semi-autonomous control with remote monitoring features with **minimal on-site staffing**
  - Long intervals without refueling (e.g., 10 years)
  - Developers exploring both mobile and fixed location designs

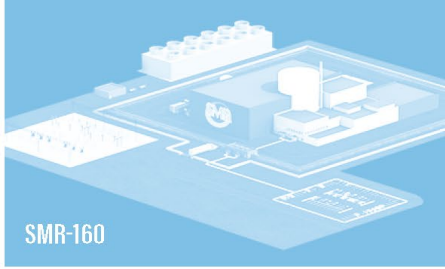
Use Cases and Market Drivers

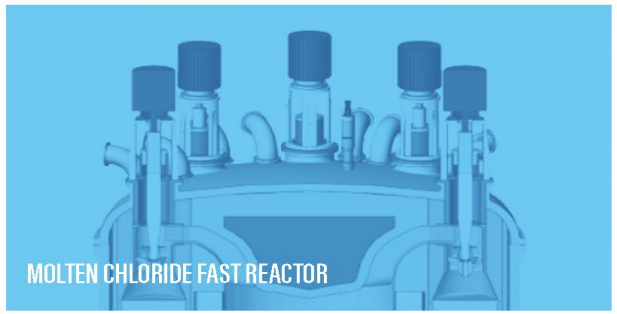
Courtesy of Third Way #NuclearReimagined

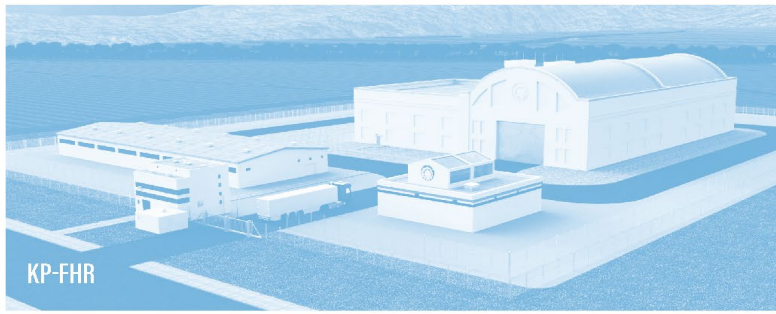












ADVANCED NUCLEAR TECHNOLOGY

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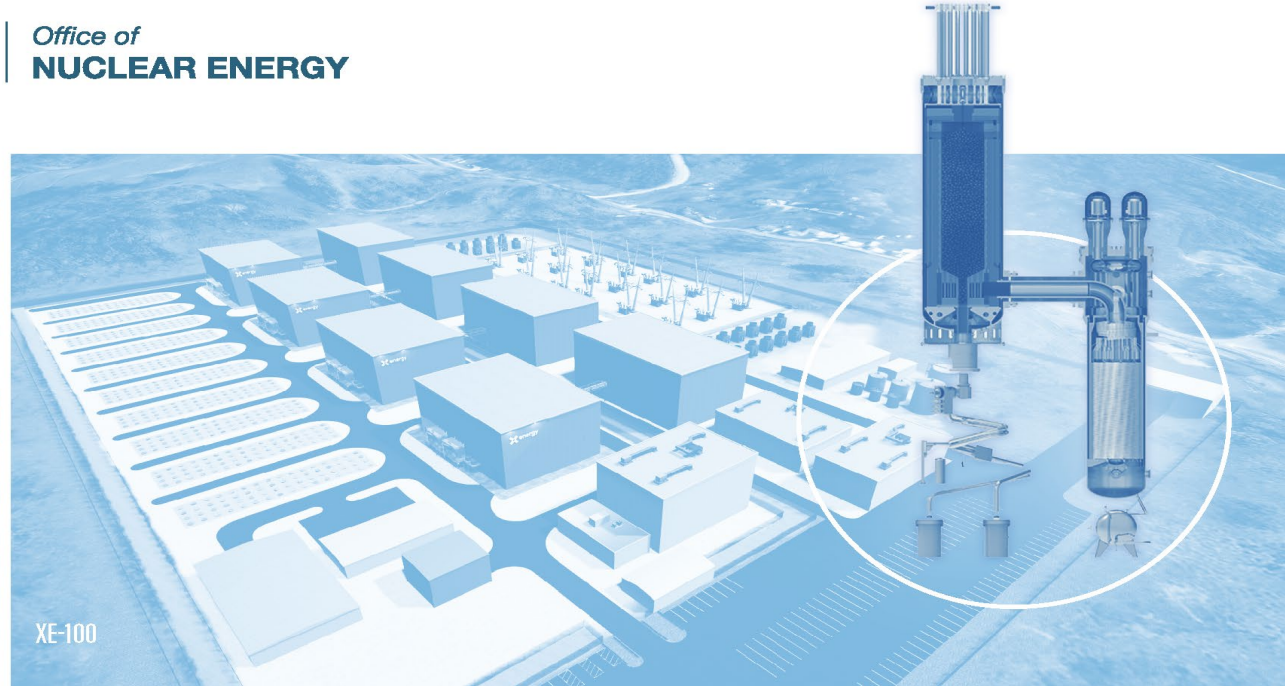


Small Modular Reactors

Ready to Deploy Within This Decade

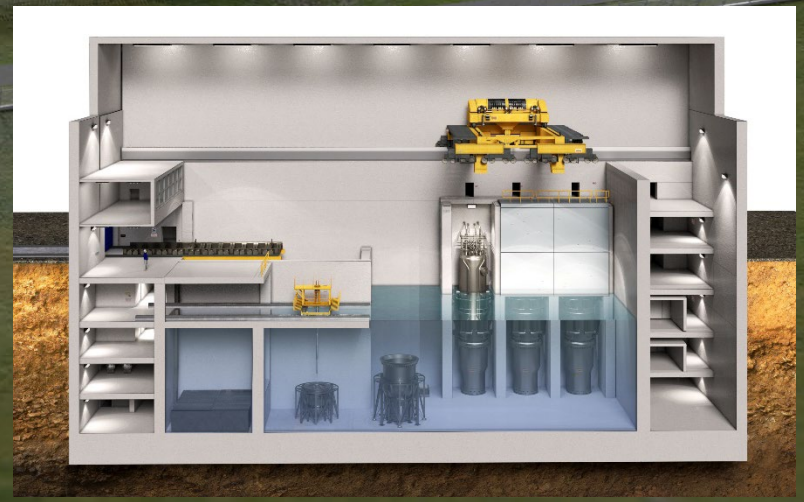
- Enhanced Passive Safety
- Improved Construction and Operation Costs
- Siting Flexibility
- Integrated Energy Uses

Courtesy of NuScale Power, LLC

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 Natrium 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

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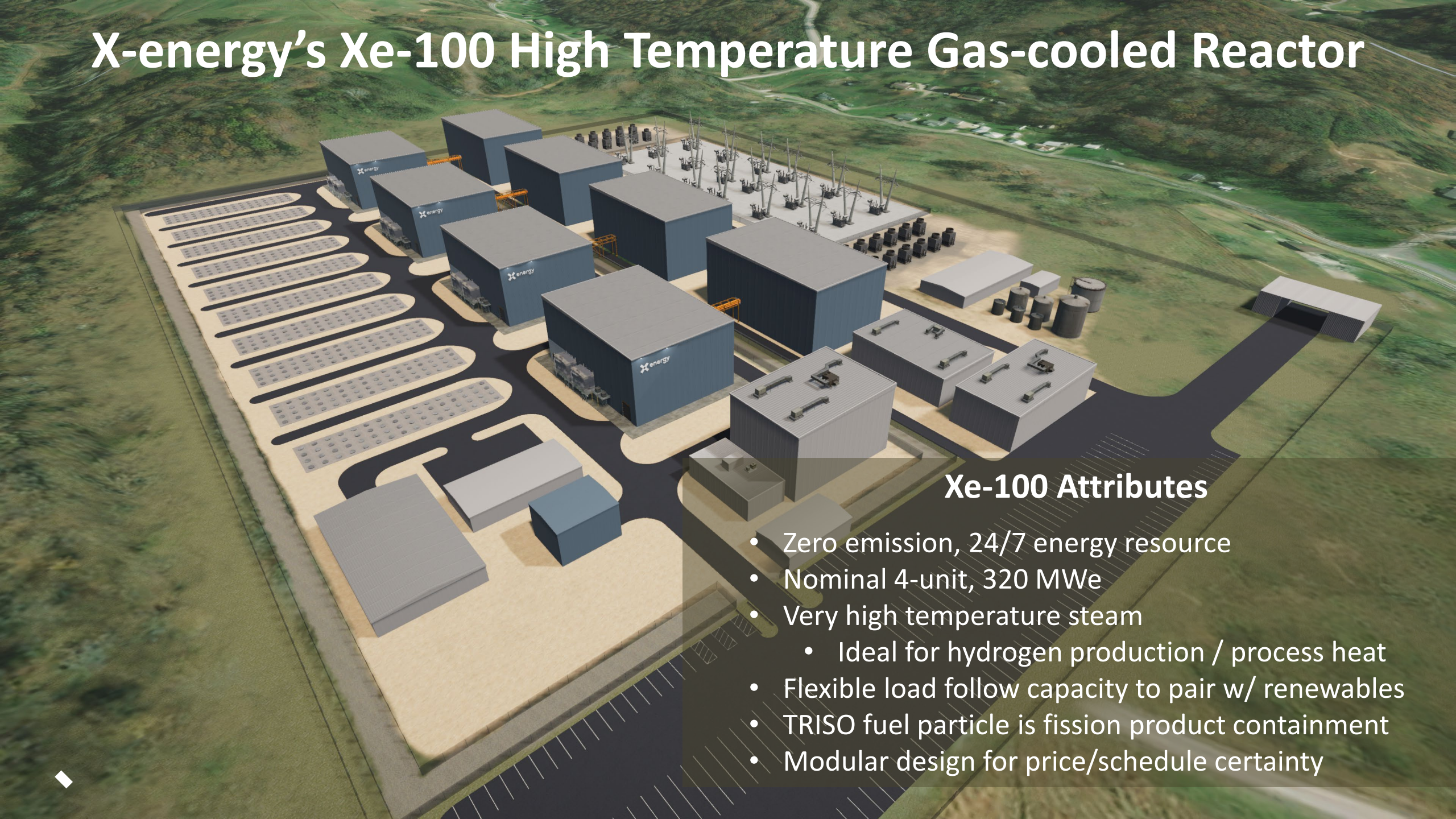
X-energy's Xe-100 High Temperature Gas-cooled Reactor



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

Key Thoughts to Absorb…

- **Nuclear energy is essential for achieving a net-zero economy**
- **Nuclear energy is our largest source of clean energy:**
  - About 20% of our electricity and more than half of our carbon-free electricity
- **Advanced reactors are:**
  - **Flexible** – can load follow, integrate with renewables, siting flexiblity
  - **Economic to build** – reduced footprint, factory fabrication
  - **Economic to operate** – enhanced passive safety, reduced operations staff
  - **Resilient** – can operate independent of the grid, black-start capability
  - Beyond electricity, **can help decarbonize** broader sectors of economy
  - **Community-based** – can repower retiring coal sites, high quality jobs


Thank you!
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