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# Nuclear Innovation Conference

## The Time is Now: Implications for Nuclear “A Mandate to Innovate”

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Chief Technology Officer

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# About Westinghouse

Approximately

**9,000**  
Employees

Locations in

**19**  
Countries

Comprised of

**6**

Business Units

AMERICAS OPERATING PLANT SERVICES

EMEA OPERATING PLANT SERVICES

ASIA OPERATING PLANT SERVICES

ENERGY SYSTEMS

ENVIRONMENTAL SERVICES

PARTS

More Than

**70**  
Facilities

Our Technology  
Generates Nearly

**50%**

Of the World's  
Nuclear Power

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# AP1000<sup>®</sup> Overview

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# AP1000® Overview



Delivering on  
130 Years of  
Innovation

Sanmen 1, a Westinghouse AP1000 technology, received a perfect score by the World Association of Nuclear Operators (WANO)\*

*\*WANO assesses nuclear power plants in terms of nuclear safety, power generation, effectiveness, equipment reliability, etc.*



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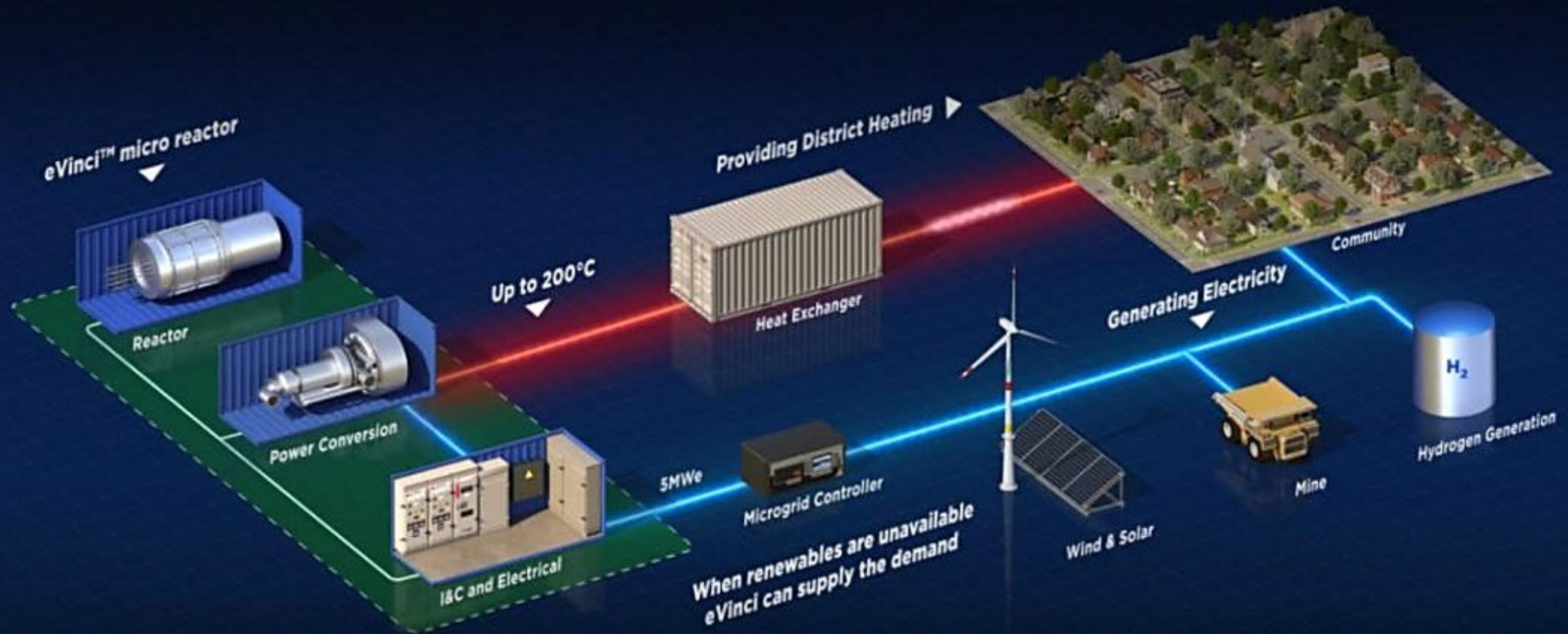
# eVinci™ Microreactor

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# Revolutionary Technology



# The eVinci™ microreactor will revolutionize availability of carbon-free heat and electricity

## Primary missions:

- Provide competitive and resilient power to targeted markets with superior reliability and minimal maintenance
- Size allows for transportability - allowing rapid installation and elimination of on-site fuel handling and storage

## Development status:

- Progressing through development and testing program
- Engaged with multiple early adopters
- Pre-licensing engagements with US NRC and CNSC Vendor Design Review



# eVinci™ microreactor

## Key Features



## Nuclear battery designed for reliable electricity and heat generation

### Technical Capabilities

- 5 MW<sub>e</sub> with ~7MW<sub>th</sub> @ 350°F waste heat
- ~13.5MW<sub>th</sub> @ >1300°F heat only
- Effective cogeneration (power & heat) nuclear battery
- Minimum 8-year refueling cycle
- Transportable for ease of installation and elimination of spent fuel storage on site
- Cost-competitive plant lifecycle
- Minimal onsite personnel
- Mature technology, manufacturing, and regulatory readiness
- High-speed load following capability

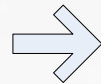
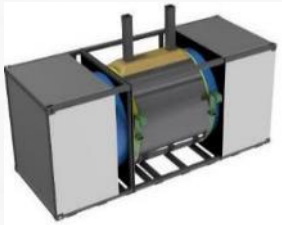


# eVinci™ microreactor

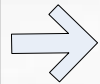
## Deployment & Licensing

Test Reactor for Safety Feature Performance Demonstration

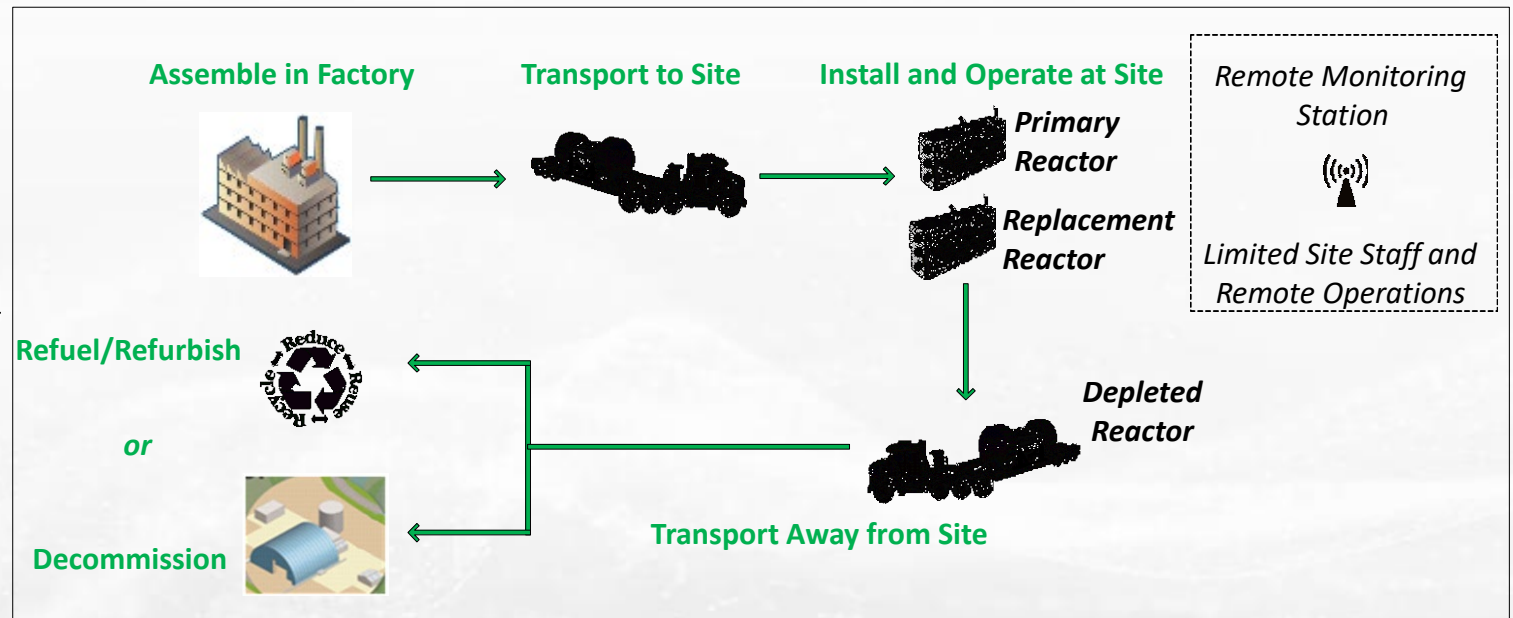
Test Reactor - Testing, data collection, and analysis



Standard Design Certification per 10 CFR Part 52 Subpart B



### eVinci Microreactor Deployment



**Westinghouse has > 70 years of extensive global nuclear design and licensing experience**

# Lead Fast Reactor (LFR) Westinghouse's Next Generation of High-Capacity Nuclear Power Plants



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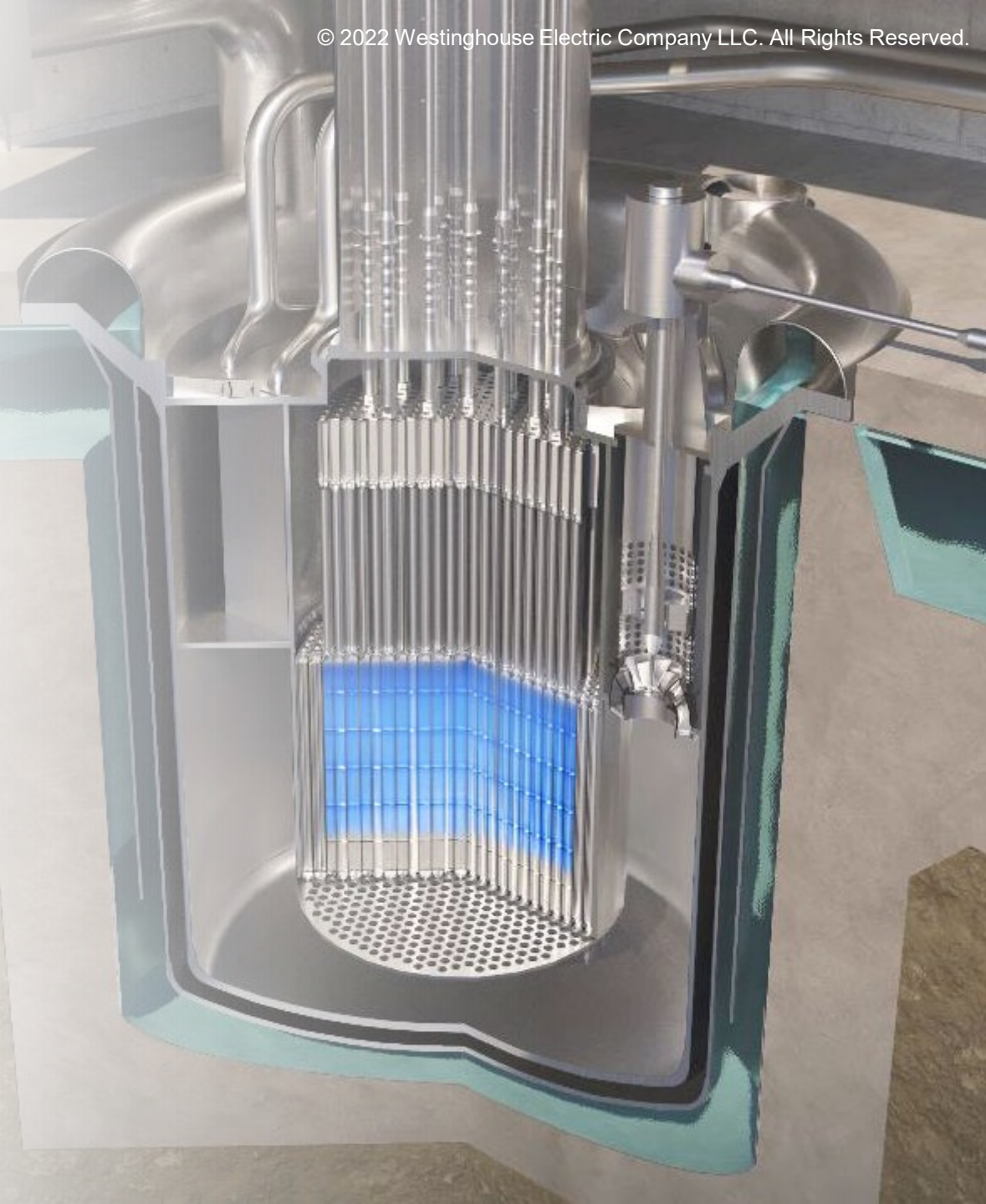
## Westinghouse continues to develop LFR as its Next Generation of high-capacity nuclear power plants

### Primary missions:

- Economic competitiveness even in the most challenging global markets
- Versatility in applications, based on customer needs

### Development status:

- Near completion of conceptual design
- Eight state-of-the-art lead-based test facilities being erected in the United Kingdom
- Pre-licensing engagement ongoing with UK Regulators
- Domestic and international collaborations to best complement capabilities





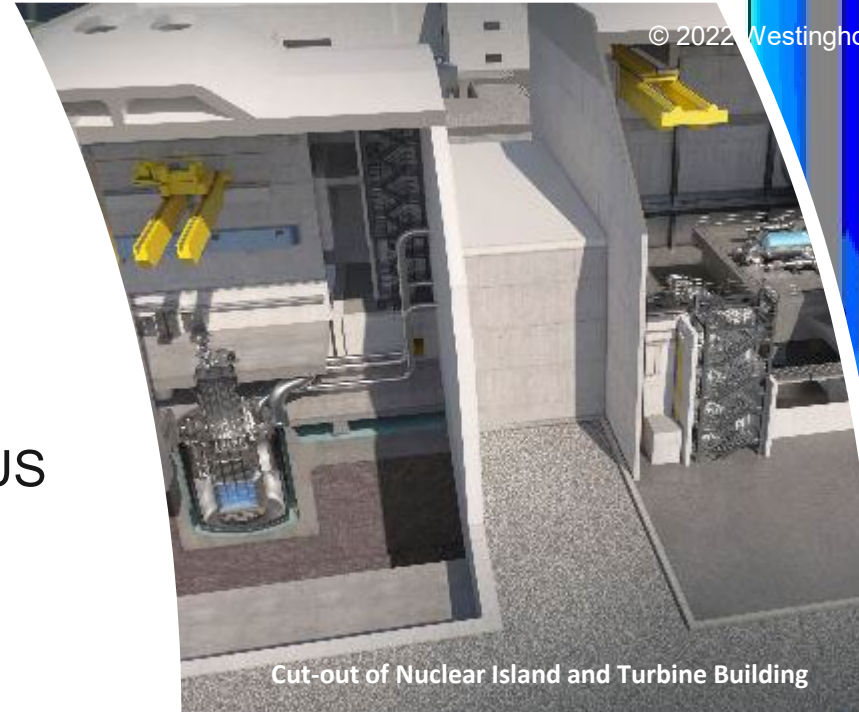
## Westinghouse LFR's key attributes:

- Competitiveness and enhanced passive safety *together*
- Flexible electricity through adoption of energy storage system
- Enhanced siteability, with no need for vicinity of water bodies
- Fuel cycle flexibility typical of fast reactors
- Experienced developer, with selected collaborations to best complement capabilities
- Staged approach to development, starting with lower temperature to accelerate technology demonstration

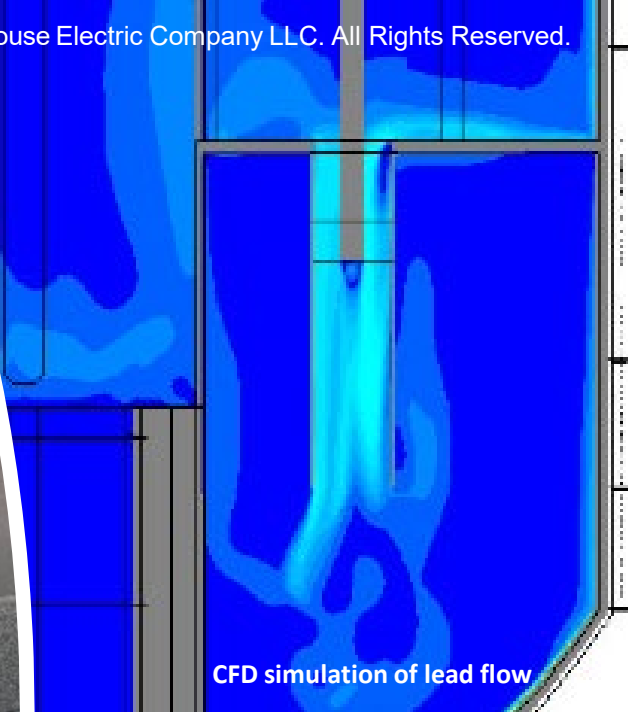
Reactor power	~450 MW <sub>e</sub> Net
Efficiency	~47%
Primary / secondary coolant	Liquid lead/Supercritical water
Neutron spectrum	Fast
Configuration	Independent unit for single (450 MW <sub>e</sub> ) or two-unit (900 MW <sub>e</sub> ) site
Ultimate heat sink	Atmosphere. No water bodies needed
Reference fuel cycle	Open
Fuel type	Oxide (Phase 1); Uranium Nitride (Phase 2)
Cycle length and refueling scheme	8-15 years; direct-to-cask refueling
Operating pressure, MPa	0.1 (primary)/~34 (secondary)
Lead coolant min/max temperature, °C	390 / 530 (Phase 1); 390 / 650 (Phase 2)

## LFR Development Activities: Highlights

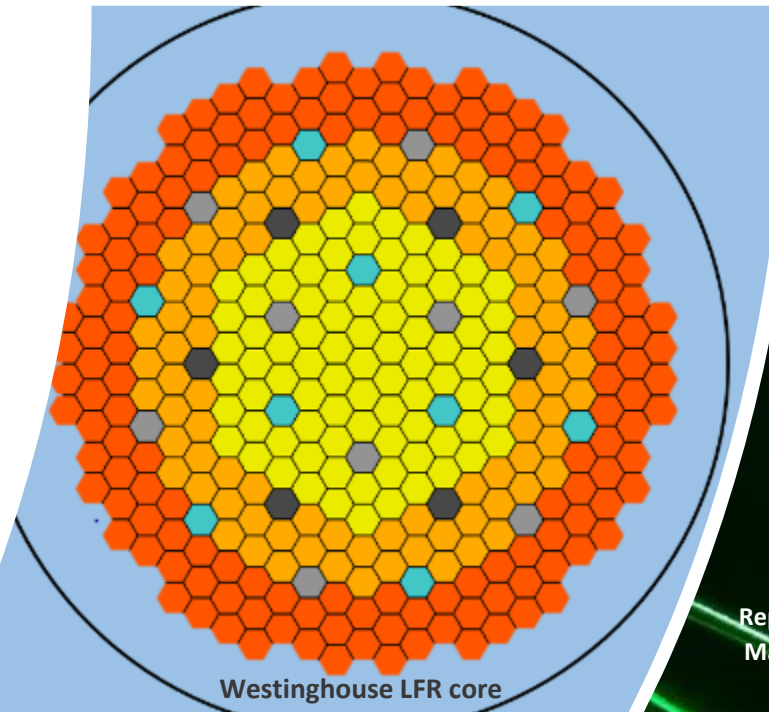
- The Westinghouse LFR is a global program
- Collaborations are pursued primarily in the US and UK/Europe
- United States collaborations:
  - National Laboratories. Multiple Technology Commercialization Fund programs with Argonne
  - Universities, primarily experimental
  - Synergies with Westinghouse's Accident Tolerant Fuel and High Energy Fuel Programs (e.g., uranium nitride)
- United Kingdom/European collaborations:
  - Eight state-of-the-art test facilities being set up at various UK organizations to demonstrate Westinghouse LFR's features



Cut-out of Nuclear Island and Turbine Building



CFD simulation of lead flow



Westinghouse LFR core



Representative LFR bundle configuration being tested at Matched Index of Refraction test facility at Texas A&M. Courtesy of Texas A&M

# LFR Testing Program in the United Kingdom

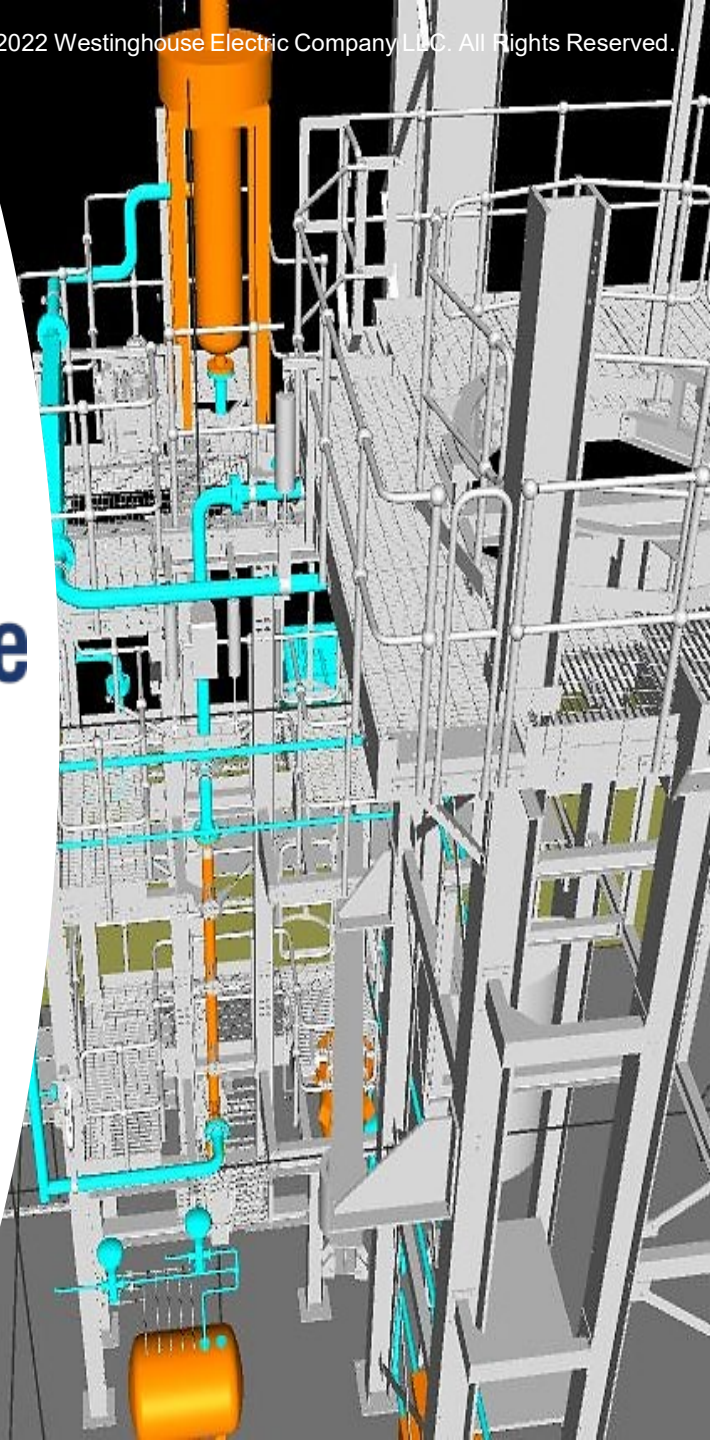
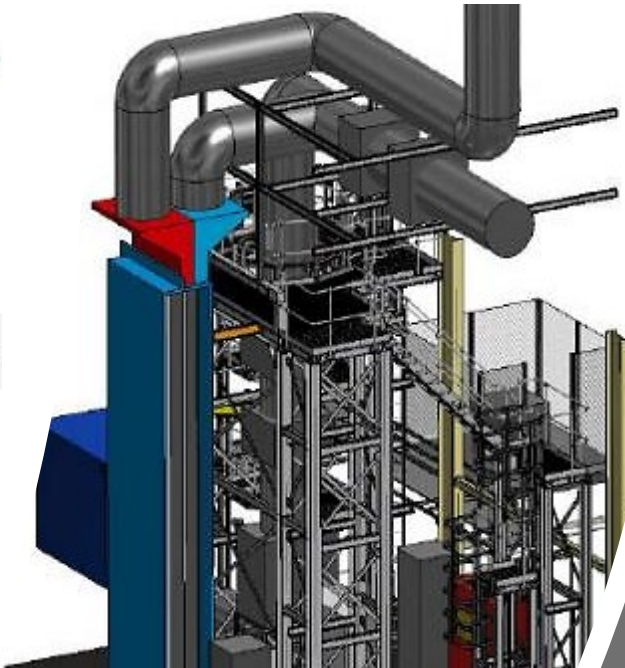
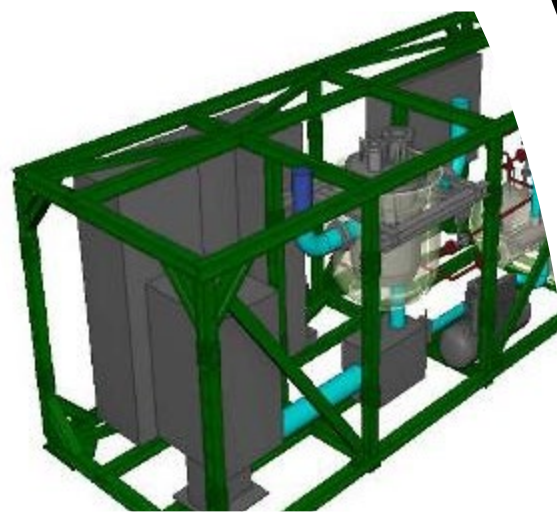
Supported by the UK Government

Eight LFR test rigs being erected at:

- Westinghouse: Springfields, UK
- Ansaldo Nuclear: Wolverhampton, UK
- Jacobs: Warrington, UK
- University of Bangor, UK
- Fuel development at National Nuclear Laboratory and Univ. of Manchester, UK

...to demonstrate key materials, components, systems and phenomena of the Westinghouse LFR

Start of testing: Summer 2022



# Conclusion

## *Continued Focus on Innovative Technologies*

- eVinci™ microreactor: A transportable and scalable design with completely passive cooling system
- Lead Fast Reactor: Uniquely combines a step-change in economics, enhanced safety, and fuel cycle flexibility
- Delivering next-generation products and services



Westinghouse eVinci microreactor rendering



Westinghouse LFR rendering

# Thank You



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