INL/CON-24-79411-Revision-0

Microreactors for a Changing Energy Landscape

July 2024

Kristy Diane Yancey Spencer, Leah Crider, Lauren Lathem, Sandra Sloan, Morgan Smith

Changing the World's Energy Future

Idaho National Laboratory

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Idaho National Laboratory
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Prepared for the
U.S. Department of Energy
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U.S. Women in Nuclear

Microreactors for a Changing Energy Landscape

TECHNICAL TRACK

WEDNESDAY, JULY 24, 2:30 – 3:15 PM

Microreactors for a Changing Energy Landscape

Leah Crider
Vice President, Commercial Operations eVinci Westinghouse Electric Company

Lauren Lathem
Advanced Nuclear Program Manager Southern Company

Sandra Sloan
Senior Advisor, Product Development
BWX Technologies

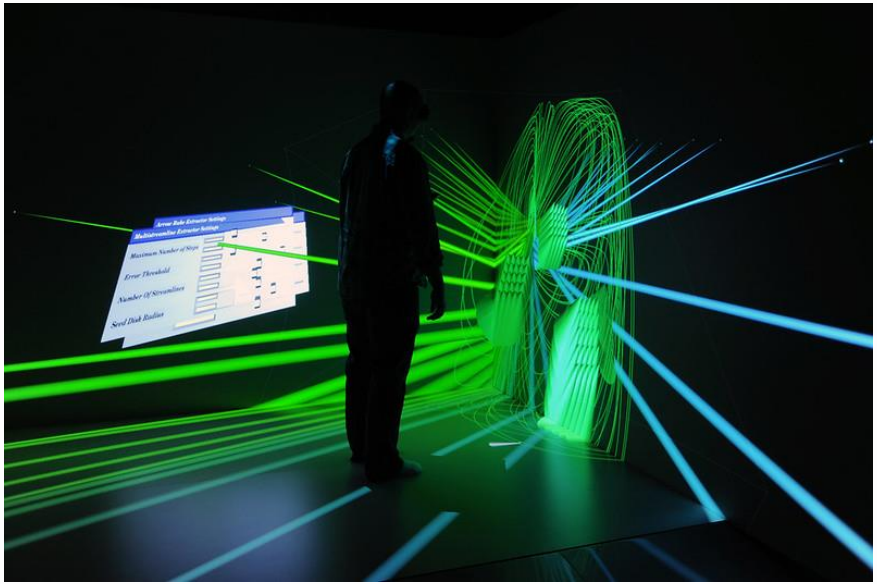
Microreactors for a Changing Energy Landscape

Moderator:
Dr. Kristina Spencer
Idaho National Laboratory

Facilitator:
Morgan Smith
Purdue University School of Engineering

Microreactors for a Changing Energy Landscape

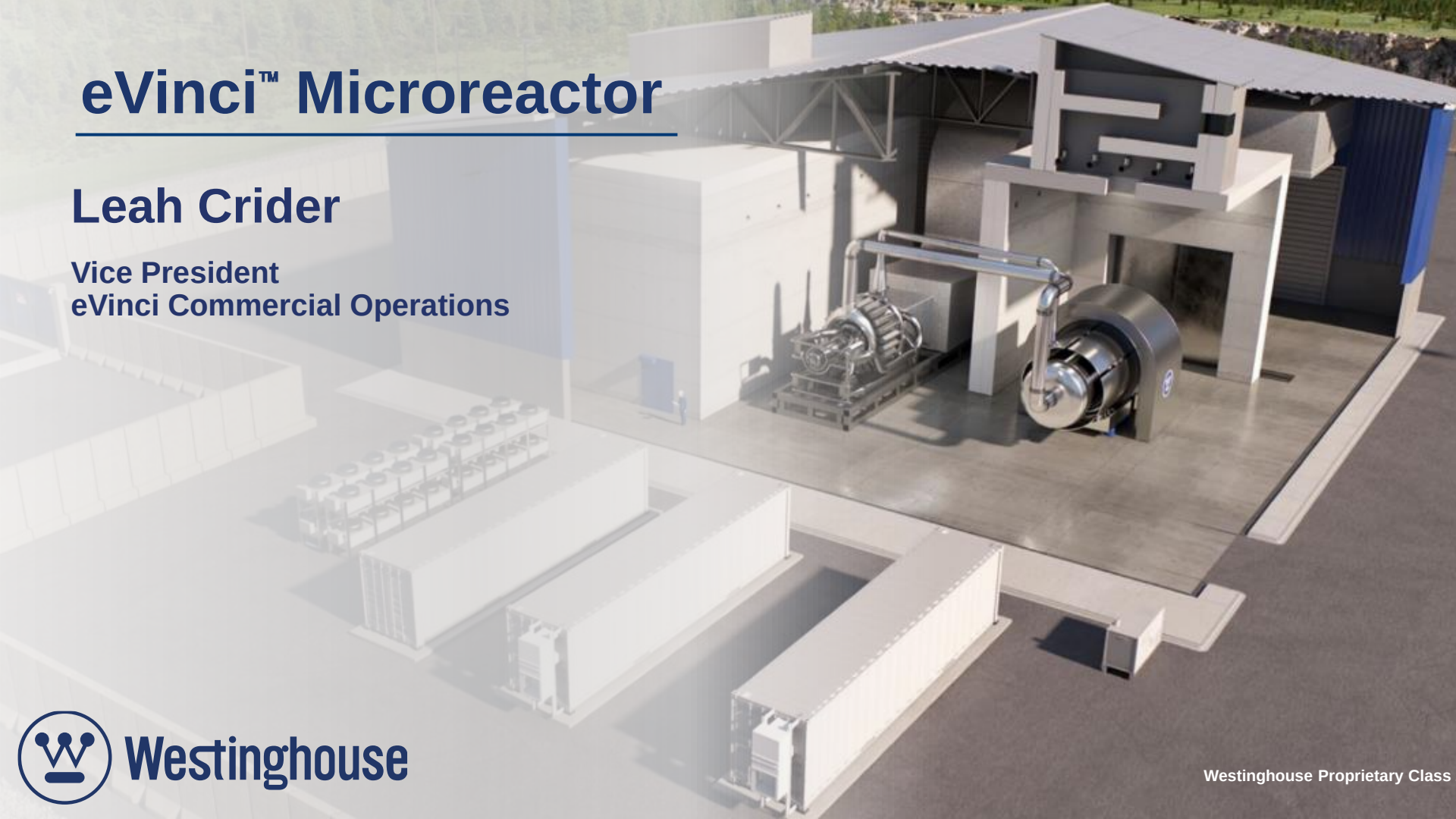
- “Right-sized” and scalable, roughly 1 to 50 MW
- Rapid deployment
- Self-regulating
- Reliable and resilient
- Can be integrated with other energy sources
- NRC or DOE authorized as appropriate.



CAVE Computer Modeling of an Advanced Reactor

📷: Idaho National Laboratory

eVinci™ Microreactor

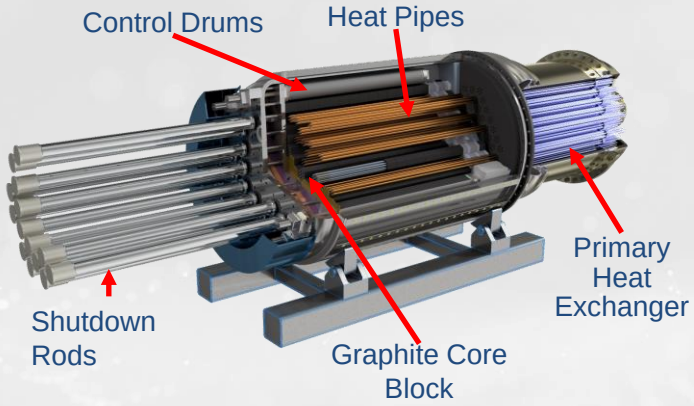


Leah Crider

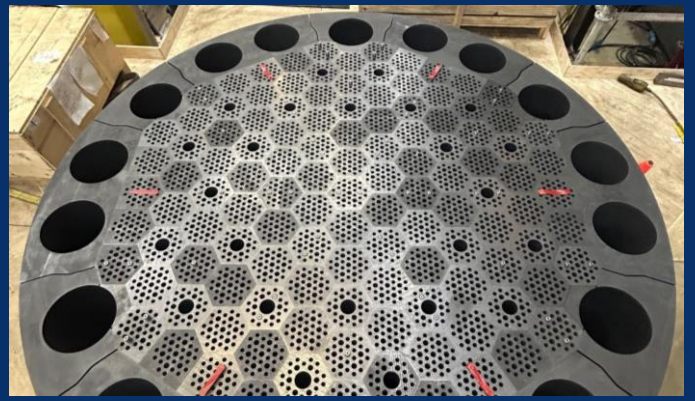
Vice President
eVinci Commercial Operations

Westinghouse

The eVinci™ Microreactor



- 5 MWe + ~8MWth (15MWth)
- Heat Pipe Technology to transfer heat out of the core; translates to safety advantages
- Autonomous Control Capability
- 8+ years before refueling
- Transportable for ease of installation and removal
- Idaho National Lab DOME testing on track
- Development supported by government and private industry contracts
- AstroVinci Space Reactor in development for satellite and surface applications



Top: Full-Size Graphite Core Block
Bottom: 4 ft Heat Pipe Testing

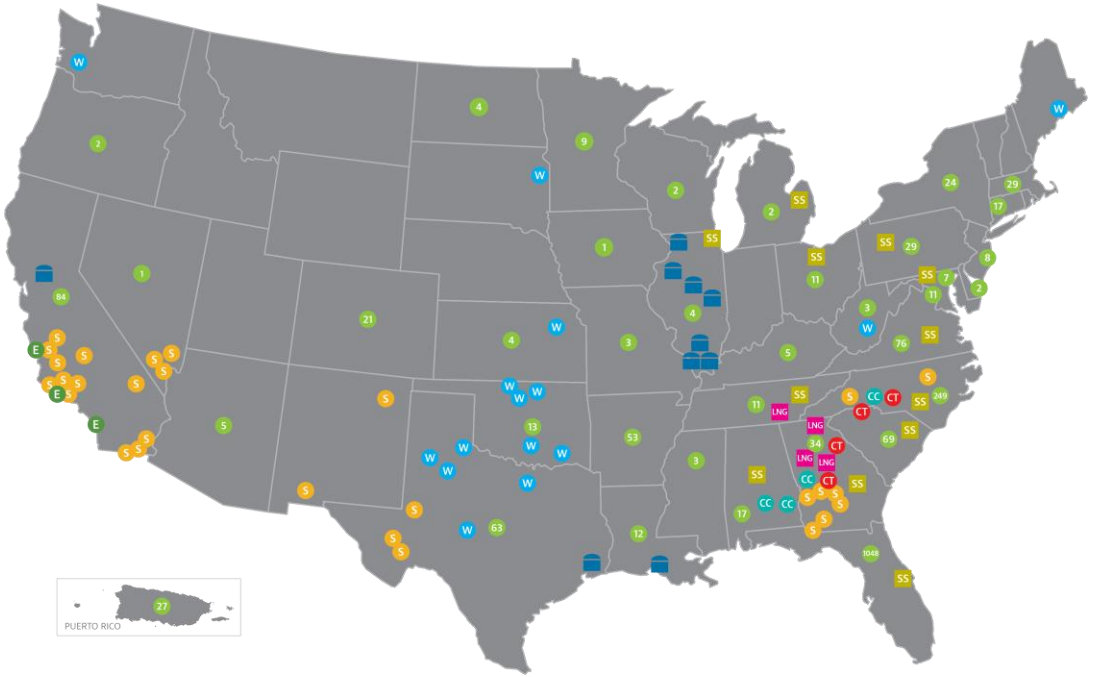
Westinghouse

Southern Company

Lauren Lathem
Advanced Nuclear Program Manager

Service territories
- Electric
- Gas

Gas pipelines
- Southern Natural Gas
- Southern Company Gas
- Pipeline projects



Southern Power
- Combined-cycle facility
- Peaking facility
- Solar facility
- Wind facility
- Energy storage

[1] Southern Company Gas
- LNG facilities
- SouthStar
- Natural gas storage

PowerSecure
- Owned and/or managed sites per state

Capabilities in **50 States**

7
Electric & Natural Gas Utilities

9 Million
Customers

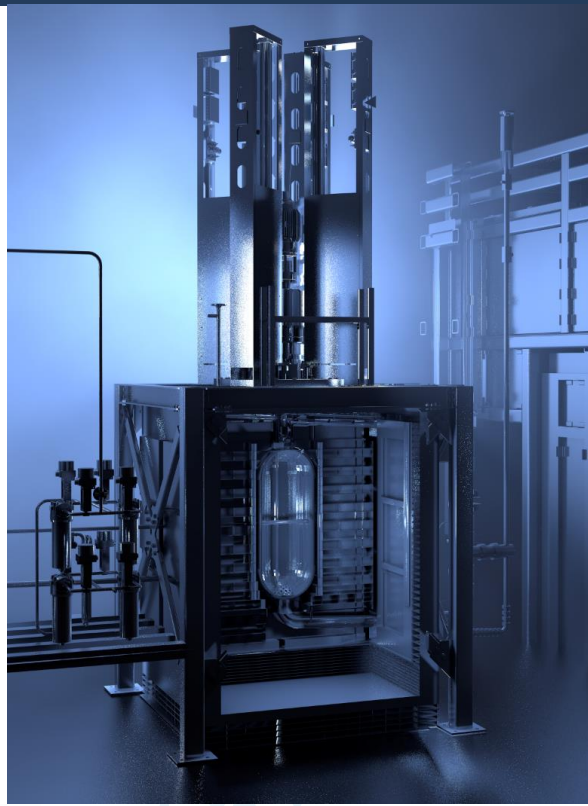
Approximately **28,000**
Employees

Approximately **42,000 MW**
of Generating Capacity

The Molten Chloride Reactor Experiment (MCRE) lays the foundation for a molten salt reactor deployment

MCRE MOLTEN CHLORIDE REACTOR EXPERIMENT

MCRE Mission Statement: To measure key reactor physics phenomena and test hypotheses about Molten Chloride Fast Reactor (MCFR) behavior, to reduce uncertainty and provide foundational knowledge to support the development of the MCFR Demonstration Reactor (MCFR-D).



Objective 1 Safely **achieve criticality** with the first fast spectrum molten salt fueled reactor

Objective 2 Experimentally determine **reactor physics and kinetics parameters** to reduce uncertainty and gather data

Objective 3 Demonstrate the **fuel** loading, fuel salt sampling/analysis, offloading, and general **handling strategy** for chloride fuel salt

Objective 4 Initiate development of industry **supply chain** for key molten salt components operated in a high temperature and radioactive environment

Objective 5 Collect operational/testing data to lay foundation for an operating license for MCFR-D under a risk-informed performance-based **(RIPB) licensing framework**

TerraPower EPRI INL Idaho National Laboratory orano CORE-POWER NRIC National Reactor Innovation Center 3M Southern Company

Subject to DOE Cooperative Agreement No. DE-NE0009045







People Strong
INNOVATION DRIVEN

NYSE: BWXT

BWXT
BWX Technologies, Inc.

Microreactor Deployment Landscape

Sandra M. Sloan
Senior Advisor, Product Development
July 24, 2024
U.S. WIN Conference

Microreactor Technologies

Project Pele: Prototype Demonstration of a Passively Safe Transportable Microreactor

❖ Military Operations
❖ Humanitarian Assistance

- HALEU TRISO reactor will produce ~1-5 MWe of electrical power for 3+ years
- Black-start capable
- Rapidly deployed
- Rapidly decamped
- Minimal environmental footprint
- Transportable by truck, rail, ship, and C-17
- Size and weight constraints on reactor system
- Pilot fielding at Idaho National Lab in 2026

BWXT Advanced Nuclear Reactor (BANR): Commercial Solution

- 50 MWth per reactor, scalable to site needs
- Heat, electricity or co-generation
- High-temperature gas-cooled (HTGR)
- High density, BWXT-fabricated fuel enables 5+ year refueling cycles
- Passive, inherent safety features
- Modular for road transportation and rapid installation

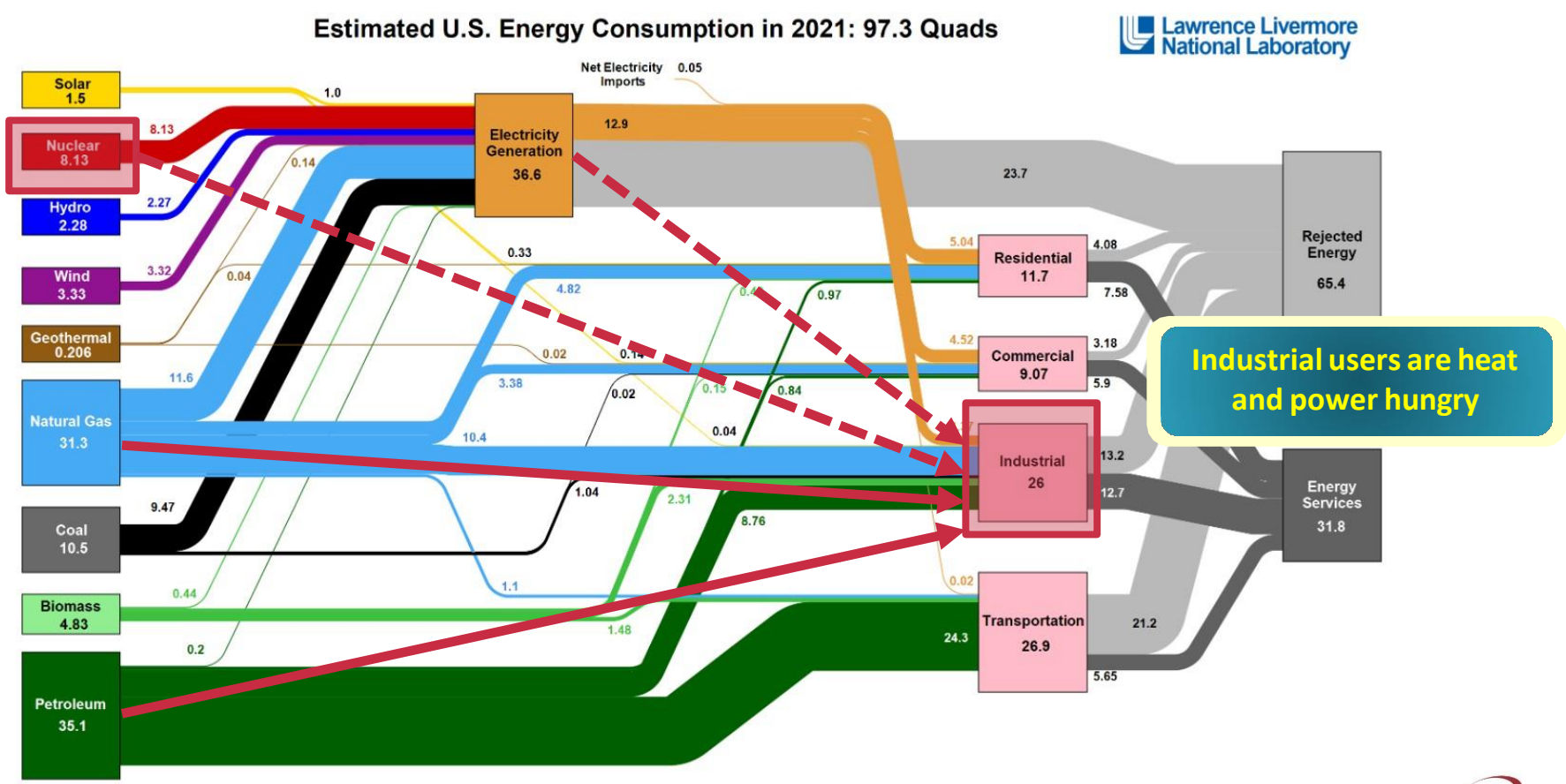
❖ Remote mining
❖ Data centers
❖ Oil & gas sites

WEA Project Phase 1 (under contract)	WEA Project Phase 2 (under contract)	WEA Project Phase 3 (notional)
• Microreactor design • Supply Chain assessment • Licensing roadmap	• Lead unit conceptual design • Supply Chain demo & QA evaluation • Regulatory Engagement Plan	• Complete design • Site preparation, licensing • Build & demonstration

DOE Advanced Reactor Demonstration Program (ARDP)

- ✓ Technology development & architecture
- ✓ Enhanced fuel form for longer core life and higher core power
- ✓ Advanced sensors for semi-autonomous controls
- ✓ Commercialization & supply chain development

Market: There's a Significant Demand for Clean Energy



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Coffee Break

