MEITNER

Modeling-Enhanced Innovations Trailblazing Nuclear Energy Reinvigoration

Overview of the MEITNER Program & FOA

Dr. Rachel Slaybaugh

Program Director, ARPA-E

Overview of Webinar

- About ARPA-E
- Program Motivation
- Program Overview
- Technologies of Interest
- Application Process & Anticipated Timeline
- **NOTE**: The contents of the MEITNER Funding Opportunity Announcement (FOA) are controlling. This slide presentation is a high-level summary only. The MEITNER FOA is available on ARPA-E's application portal, https://arpa-e-foa.energy.gov/

ARPA-E Mission

Mission: To overcome long-term and high-risk technological barriers in the development of energy technologies

Means:

- Identify and promote revolutionary advances in fundamental and applied sciences
- Translate scientific discoveries and cutting-edge inventions into technological innovations
- Accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty

What Makes an ARPA-E Project?

impact

- High impact on ARPA-E mission areas
- Credible path to market
- Large commercial application

transform

- Challenges what is possible
- Potential to disrupt existing learning curves
- Leaps beyond today's technologies

bridge

- Translates science into breakthrough technology
- Not researched or funded elsewhere
- Catalyzes new interest and investment

team

- Comprised of best-in-class people
- Cross-disciplinary skill sets
- Translation oriented

MEITNER Program Concept

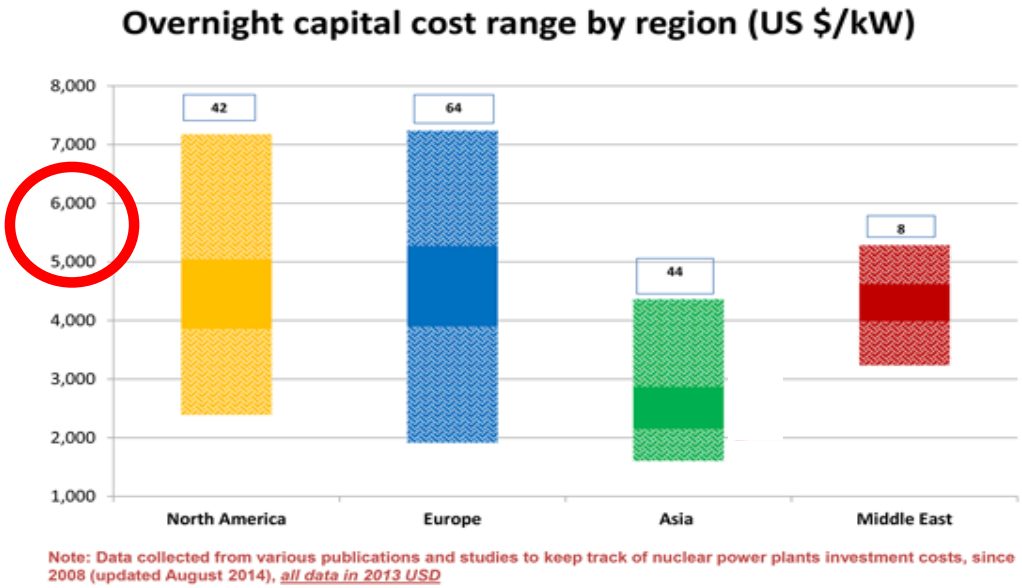
- ARPA-E is looking for *transformational technologies* that will enable advanced nuclear reactors to be commercially desirable products
- The new technologies will be evaluated in the context of a full advanced reactor plant design
- Modeling & Simulation, Subject Matter Experts, and Techno-Economic Analysis will feed back into the designs for integrated evaluation and strategic improvement
- Key experiments may also be done to strategically improve and/or demonstrate the technology
- **Result:** well-characterized reactors and technologies that can create a domestic supply chain

Motivation

- **Supposition:**
  - Advanced Nuclear Reactors can be commercially desirable products
- **Implication:**
  - If we can build and operate them so they are “walkaway” safe, quickly deployable, safeguardable, cost competitive, and relevant in a variety of markets
- **The Question:**

  What technologies can be developed to enable advanced reactors to meet these goals?

Motivation



- New build construction costs and times are large and unpredictable
- O&M is the bulk of operating cost

Avg. plant operating expenses (2015 $/MWh)

Plant Type	Operation	Maintenance	Fuel	Total
Nuclear	11.17	7.06	7.48	25.71
Fossil Steam	5.16	5.41	26.70	37.26
Gas Turbine	2.34	2.68	28.22	33.24

Motivation

- A substantial reduction of construction cost, O&M cost, and construction time is required
- Nuclear reactor plants are complex systems where many types and scales of technologies must work together seamlessly
- Design choices at each of those scales and for each of those technologies impact the rest of the system in terms of functionality, cost, and constructability
- ARPA-E is targeting development of enabling technologies that requires understanding the inter-relatedness of design choices

MEITNER Program

- **Goal:** Develop and demonstrate technologies that improve advanced reactor performance

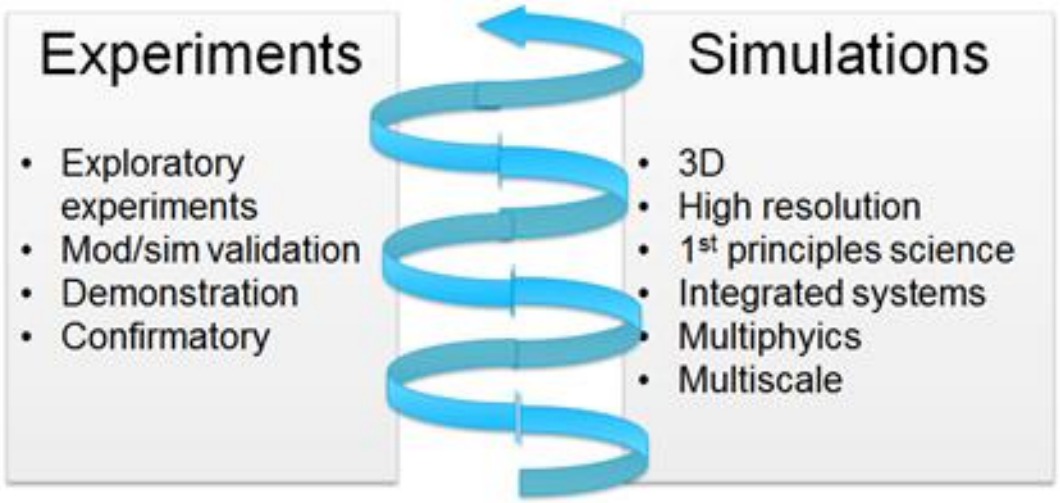
ID	Metric	Units	State-of-the-Art	With New Technology*
1	Overnight construction cost	$/$W_e$	2-7	
2	On-site construction time	Months	> 60	
3	Total staffing level (on-site & off-site)	FTE/GW_e	450-750	
4	Emergency planning zone (EPZ)	Miles	10 and 50	
5	Time before human response required for an accident	Days	3	
6	Onsite backup power	kW_e	> 0 kW	
7a	Ramp rate without steam bypass	power capacity/min	5%	
7b	Process heat temperature	ºC	N/A	

**Applicants are required to provide the projected performance based on the inclusion of their new technology into advanced reactors.*

MEITNER Resource Team

Awardees will leverage a separately-funded *Resource Team*

1. Modeling & Simulation
2. Subject Matter Experts
3. Techno-Economic Analysis

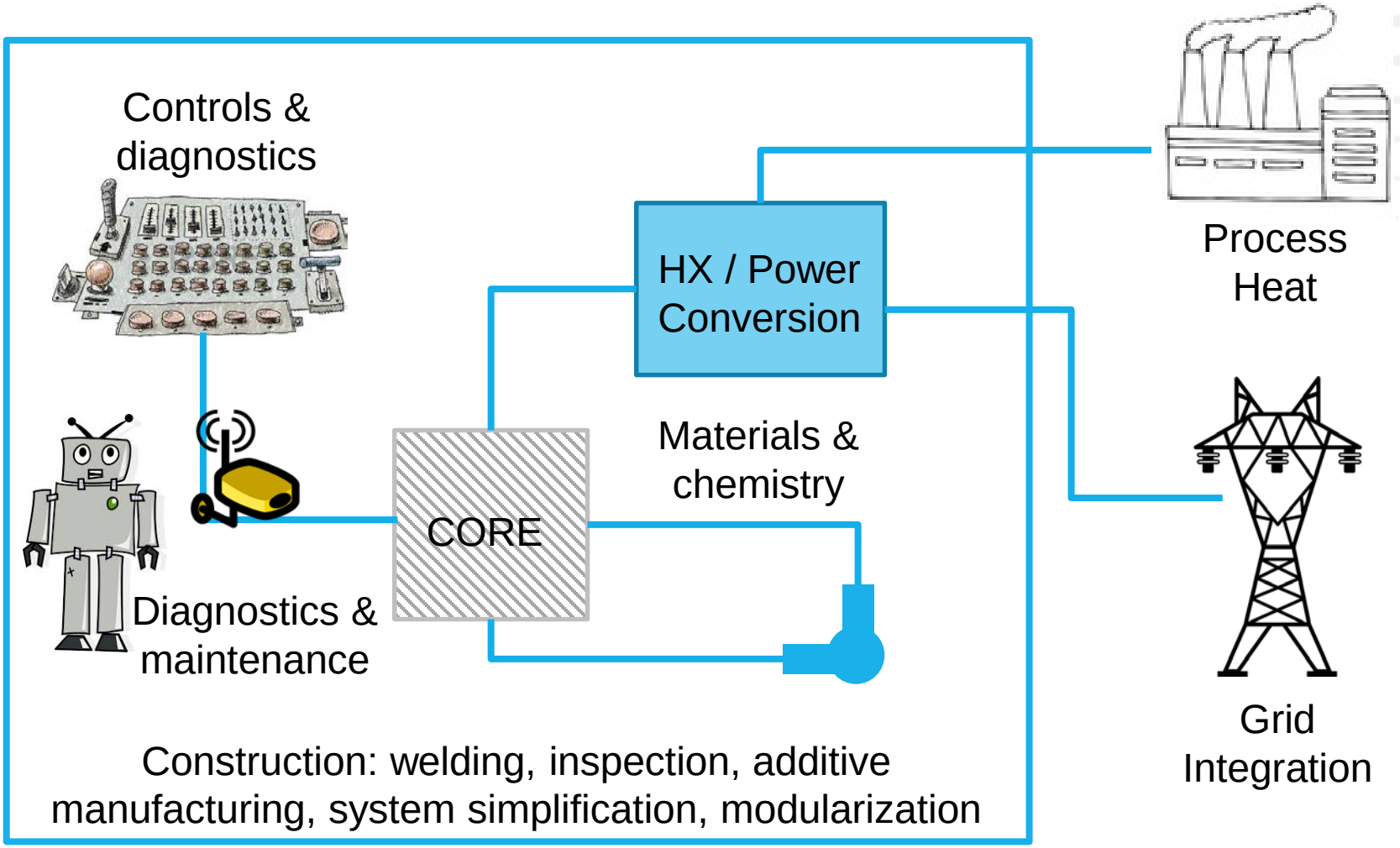


Result: detailed design and impact characterization, better experiment design, strategic technology improvement

Technologies of Interest

- Sensors, data analytics, advanced controls, machine learning, model-based fault detection, and secure networks
- Robotics
- Advanced construction and manufacturing techniques
- Dramatic simplifications to balance of plant
- Reactor-specific technologies that must be demonstrated, e.g. high-temperature materials, corrosion control, chemistry
- Systems that dramatically improve plant performance, e.g. power conversion, system efficiency
- Technologies to enable grid integration

Technologies of Interest



Application Process & CP Deadline

- Funding Opportunity Announcement (FOA) available on ARPA-E's application portal, https://arpa-e-foa.energy.gov/.

- Concept papers for MEITNER due **Monday, December 4, 2017** by 5:00pm EST

- Questions? Please email the ARPA-E Contracting Officer at ARPA-E-CO@hq.doe.gov
  - Deadline for questions on the MEITNER FOA Concept Papers are due November 24th at 5:00pm EST

U.S. DEPARTMENT OF
ENERGY

https://arpa-e.energy.gov