



Massachusetts  
Institute of  
Technology



Idaho National Laboratory



## **Workshop: Markets and Economic Requirements for Fission Batteries and Other Nuclear Systems**

January 13 and Jan 27, 2021: Two Webinars (10:00 to 1:00 Eastern)

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Fission batteries (FBs) are a new vision for nuclear power to address smaller markets in a low-carbon world. Fission batteries are defined by a set of attributes—not technology. There are five attributes. First, FBs must be cost competitive with other distributed energy sources (electricity and heat) used for a particular application. Second, FBs are developed in standardized sizes and power outputs to enable universal use and factory production at a manufacturing scale similar to jet engines and aircraft. Third, FBs are designed for easy installation, use and removal after use. This creates a competitive energy market where user is not an economic hostage to the supplier. Fourth, they are designed to operate securely and safely while unattended to provide demand-driven power. Last, the systems and technologies must have a high level of reliability to provide a long life and enable wide-scale deployment for multiple applications. These are aspirational goals. It is not known if FBs can be built.

Micro reactors and small modular reactors may have several of these attributes but not all of these attributes. The power output of the FB is not defined. There are proposals for FBs that vary from less than a megawatt to 100 MWt. For technical and market reasons, larger FBs are considered unlikely. The markets include heat to industrial and other customers. The industrial heat demand is more than twice the total electricity produced in the U.S. FBs may be used to produce electricity for specialty markets with special requirements such as ships and data centers with high reliability requirements. It is not expected that FBs will be competitive for the production of grid electricity. The workshop is to address several questions.

### **What is the Market for Fission Batteries?**

What is the total size of the market? What heat output is required for different sectors; that is, what would be the market size for units of 2, 5, 10, 25, 50, 75 and 100 MWt? What are the technical requirements (temperature of delivered heat, special requirements such as for marine applications, etc.). The expectation is that many customers would have multiple FBs to meet local demands and reliability goals. What is the commercial model—own or lease? What are the implications of the business model?

### **What is the Competition and at What Price?**

What is the competition: natural gas with no carbon constraints; natural gas with carbon tax, fossil fuels with carbon capture and sequestration, low-carbon hydrogen, biofuels and electricity? What is competitive at different facility heat demands? What are the regional differences in the price of different fuels? Some options such as electricity and hydrogen may have very large geographical differences in price.

### **What are the Reactor Requirements Driven by Economics and Markets?**

What do cost constraints imply in terms such as design choices such as power density and allowable uranium enrichments? What do the economic goals imply in terms of operations, maintenance and security—such as manpower levels? If high reliability heat is required, how many fission batteries are required to meet specific reliability goals?

**Workshop Open to Public; No Registration Fee;**

**Sponsors: MIT, Idaho National Laboratory, National University Consortium**



## **Agenda (10:00 to 1:00 Eastern)**

### **January 13, 2021 (Wednesday): Question and Answer after Each Speaker**

10:00: Charles Forsberg (MIT)/Andrew Foss (INL): Welcome

10:05: Youssef A. Ballout (INL): Fission Battery Initiative

10:15: Charles Forsberg (MIT): Defining Markets, the Competition and Economic Design Constraints for Fission Batteries

10:40: Andrew Foss (INL): Market Opportunities for Fission Batteries

11:05: Eric Ingersoll (Lucid Catalyst): Nuclear hydrogen futures: The Competition

11:30: Break

11:45: Gareth Burton (American Bureau of Shipping): Fission Battery Initiative Workshop: Maritime Perspective

12:10: Bruce Dale (Michigan State University): Liquid Biofuels Energy Markets

12:35: Roundtable and Discussion

### **January 27, 2021 (Wednesday): Question and Answer after Each Speaker**

10:00: Charles Forsberg/Andrew Foss: Welcome

10:05: Youssef A. Ballout (INL): Fission Battery Initiative

10:15: Jacopo Buongiorno (MIT). [Can Nuclear Batteries Be Economically Competitive In Large Markets?](#)

10:40: Paul E. Roege, P.E. (Partner, Creative Erg, LLC): The Resilience Value Proposition

11:05: Elina Teplinsky (Partner: Pillsbury Winthrop Shaw Pittman LLP): Legal feasibility of leasing of Fission Batteries

11:30: Break

11:45: Jerry Schwartz (American Forest & Paper Association): Pulp and Paper Industry Perspectives

12:15: John Parsons (MIT Sloan School of Management) Business Models: Enterprise Controls FB versus Large-scale Cogeneration with Multiple Heat Customers

12:35: Workshop Roundtable