

# Enabling Technologies for a Commercially Viable Fusion Power Plant

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# Bottom line up front

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- ▶ Evolving energy markets and experience of the nuclear industry point to strong constraints:
  - Reduced nameplate generation capacity (“few hundred MWe or less”)
  - Reduced overnight capital cost (“less than a few US\$B”)
  - Reduced size, complexity, O&M costs
  
- ▶ While recognizing there are areas of overlap, ARPA-E interested in exploring differences between present fusion-technology roadmap and technology needs of “lower-capital-cost fusion”
  - synergistic with but more aggressive than NAS recommendation #2

# Outline

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- ▶ ARPA-E, and framing fusion at ARPA-E
- ▶ Enabling technologies for a commercially viable fusion power plant

# What is ARPA-E?

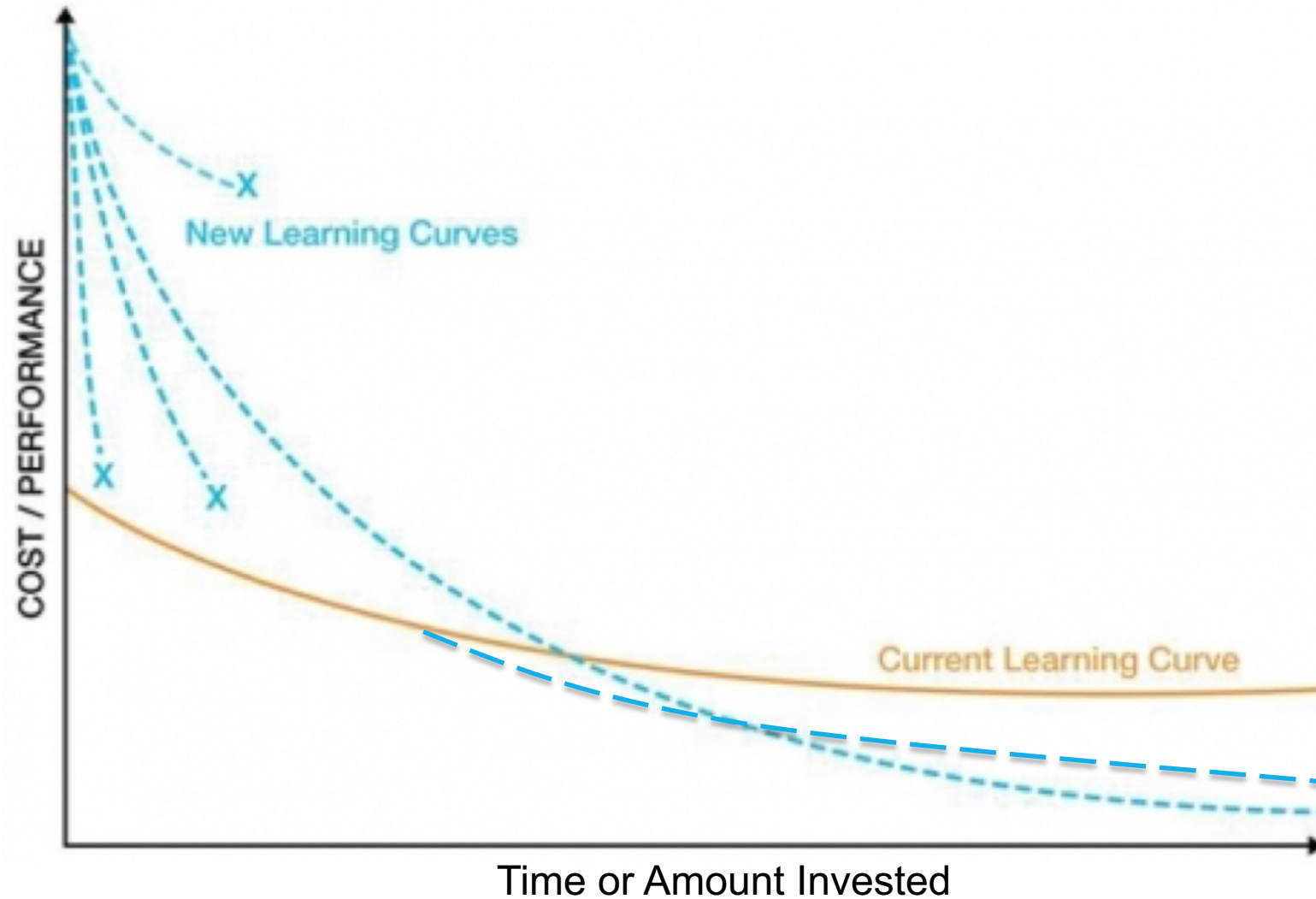
The Advanced Research Projects Agency-Energy (ARPA-E) is an agency within the U.S. Department of Energy that:

- ▶ Provides **Research and Development** funding for high-risk, high-reward, transformational ideas
- ▶ Focuses on technologies that could **fundamentally change** the way we get, use and store energy
- ▶ Accelerates energy innovations that will create a more secure, affordable, and sustainable **American energy future**

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



# ARPA-E funds transformative, off-roadmap energy R&D



# Framing the need for fusion

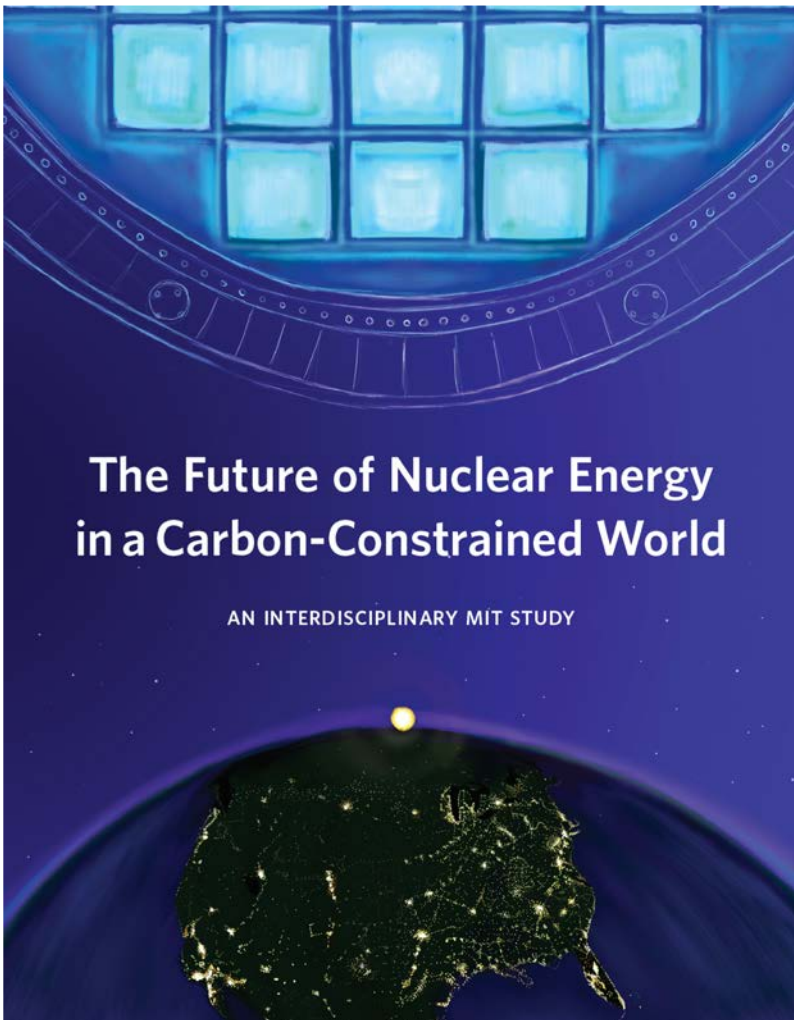
## Nearer term (mid-century)

- Risk mitigation for
  - getting to cost-effective, zero- and negative-emissions grid
  - tackling hard-to-decarbonize sectors (transportation fuels, industrial processes, etc.)
- Energy production near dense population centers

## Longer term (beyond)

- Meet substantial growth in worldwide energy needs
- Remove energy as a source of geopolitical conflict
- Change the way we generate and use energy, e.g.:
  - water desalinization
  - deep space travel and colonization
  - planetary defense

To have impact this century, fusion must learn from fission: (1) lower cost and complexity, (2) understand where the market is going, and (3) achieve regulatory certainty



ADVANCED NUCLEAR POWER PROGRAM

### MIT-Japan Study

### Future of Nuclear Power in a Low-Carbon World: The Need for Dispatchable Energy

**Charles Forsberg, Richard Lester, Nestor Sepulveda, and Geoffrey Haratyk**  
Massachusetts Institute of Technology, Department of Nuclear Science and Engineering; 77 Massachusetts Ave., Cambridge, MA 02139

**Akira Omoto and Tomihiro Taniguchi,**  
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**Ryoichi Komiya and Yasumasa Fujii**  
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**Kazuaki Matsui**  
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**Xing, L. Yan**  
Japan Atomic Energy Agency, 4002, Narita-cho, Ooarai, Higashi-Ibaraki-gun, Ibaraki-ken, Japan

**Tomofumi Shibata and Tomoko Murakami**  
Institute of Energy Economics Japan, Inui-Building, 1-13-1, Kachidoki, Cyoou-ku, Tokyo, Japan

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# Outline

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- ▶ ARPA-E, and framing fusion at ARPA-E
- ▶ Enabling technologies for a commercially viable fusion power plant



# **Request for Information (RFI) released May 5 (responses due tomorrow), to inform portion of a potential new fusion program**



**U.S. Department of Energy  
Advanced Research Projects Agency – Energy**

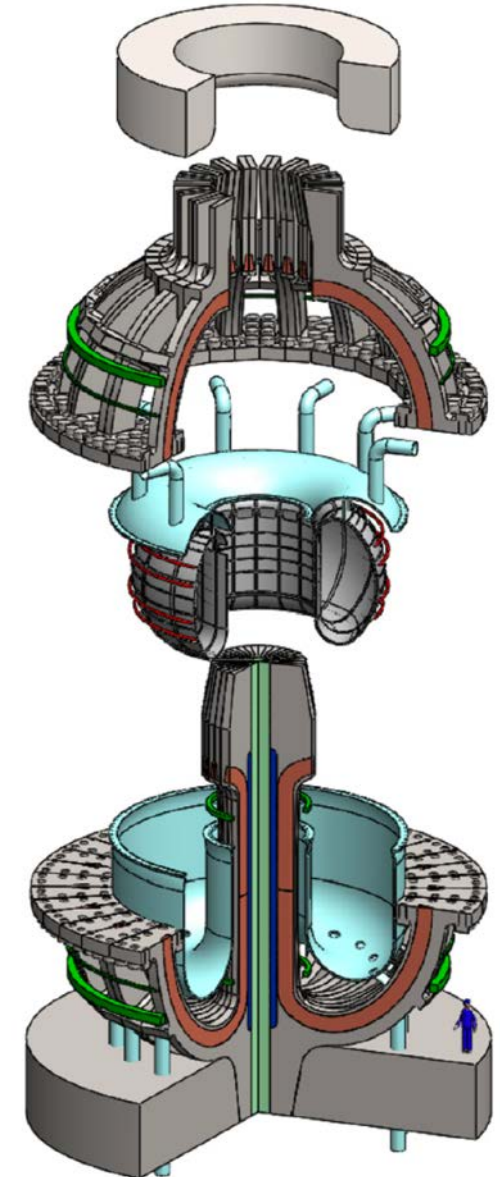
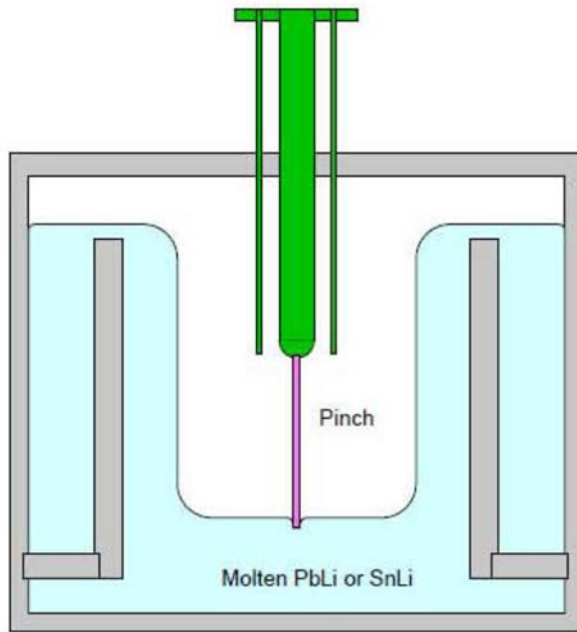
**Request for Information (RFI)**

**DE-FOA-0002131**

**on**

**Enabling Technologies for a Commercially Viable Fusion Power Plant**

# Areas of interest focus on common challenges of commercial fusion concepts



- Engage outside communities
- Fuel cycle (DT and advanced fuels) with emphasis on thick liquid blankets
- Minimize footprint and tritium inventory of tritium systems
- Accelerated subscale testing

- Compatibility with advanced power cycles
- Innovations to deal with particle/heat exhaust
- Exploit advances in power electronics

# A quick recruitment plug: Join the Team that is Transforming the Energy of Tomorrow

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- ✓ Stakeholder outreach

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- ✓ Organizational support

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