Syracuse University
Office of Research Development

ARPA-E and OPEN Funding Opportunity

December 8, 2023

Portions of this presentation are excerpted from public presentations given by ARPA-E and by former ARPA-E POs.

Agenda

- Intro to ARPA-E as an agency
- Funding from ARPA-E
  - OPEN
  - Other funding
- Tips for ARPA-E concept papers
- Assistance from SyracuseCoE and Office of Research Development
- Panel discussion with ARPA-E PIs

What is ARPA-E?

- Advanced Research Projects Agency – Energy (ARPA-E)
- Launched in 2009 under the model of DARPA
- Stand-Alone funding agency within U.S. Department of Energy
- Advances high-potential, high-impact energy technologies that are too early for private-sector investment
- Focus on market-readiness/technology to market

REDUCE
imports

REDUCE
emissions

IMPROVE
efficiency

IMPROVE
radioactive waste
management

IMPROVE
energy infrastructure
resilience

arpa·e
CHANGING WHAT'S POSSIBLE

What Makes an ARPA-E Project?

IMPACT

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

TRANSFORM

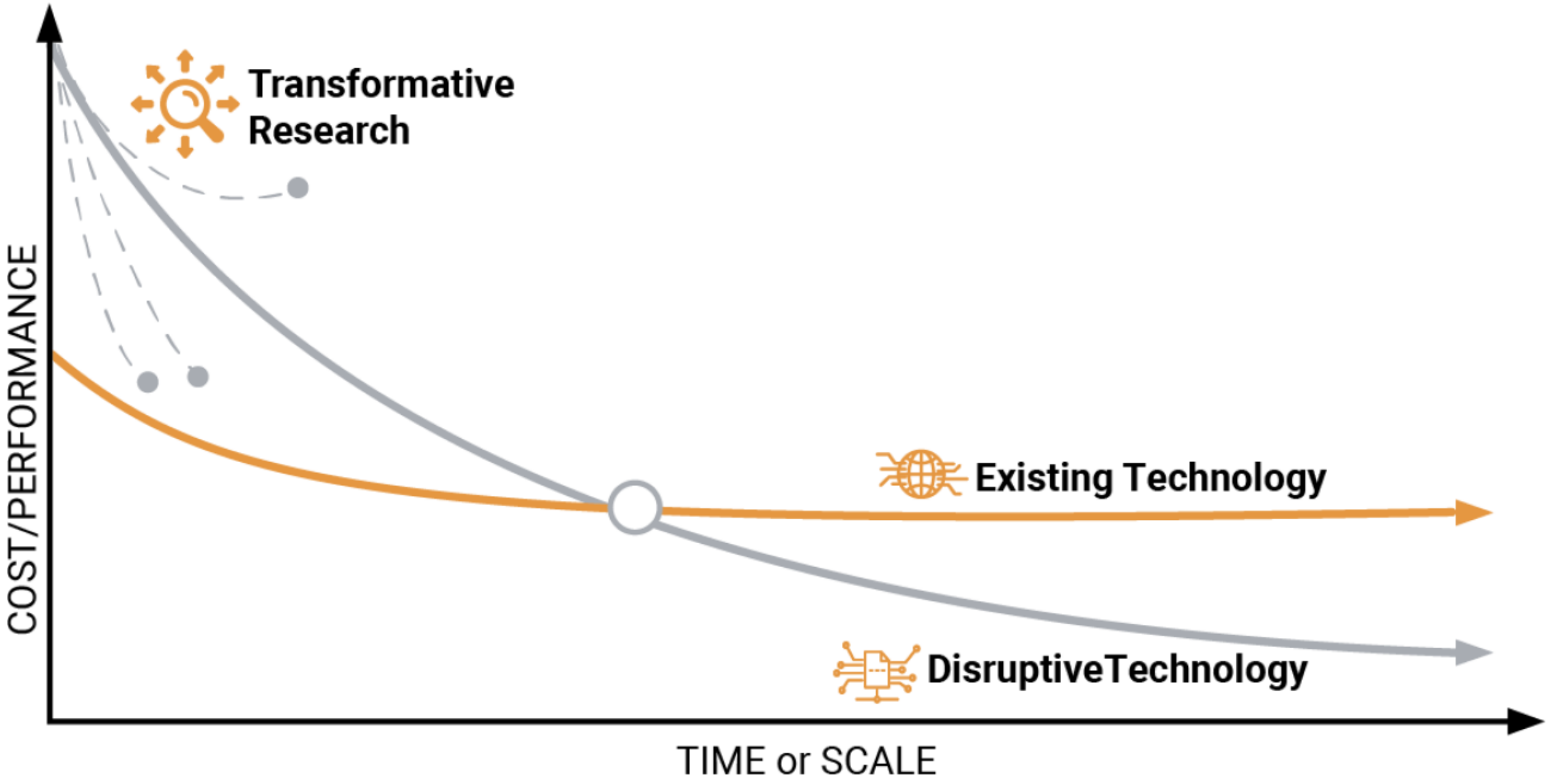
- Challenges what is possible
- Disrupts existing learning curves
- Leaps beyond today's technologies

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



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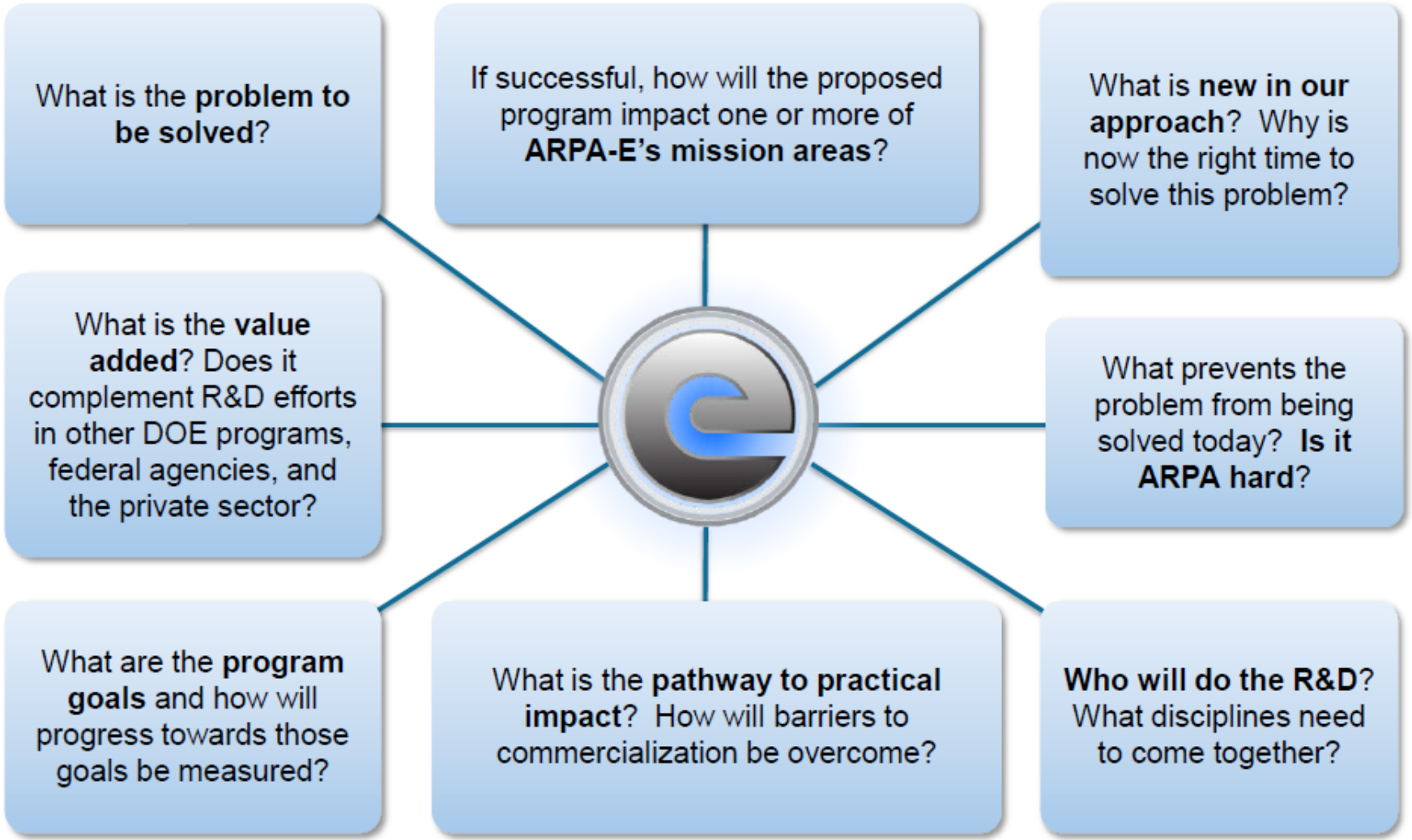
CHANGING WHAT'S POSSIBLE

ARPA-E Program Framing Questions

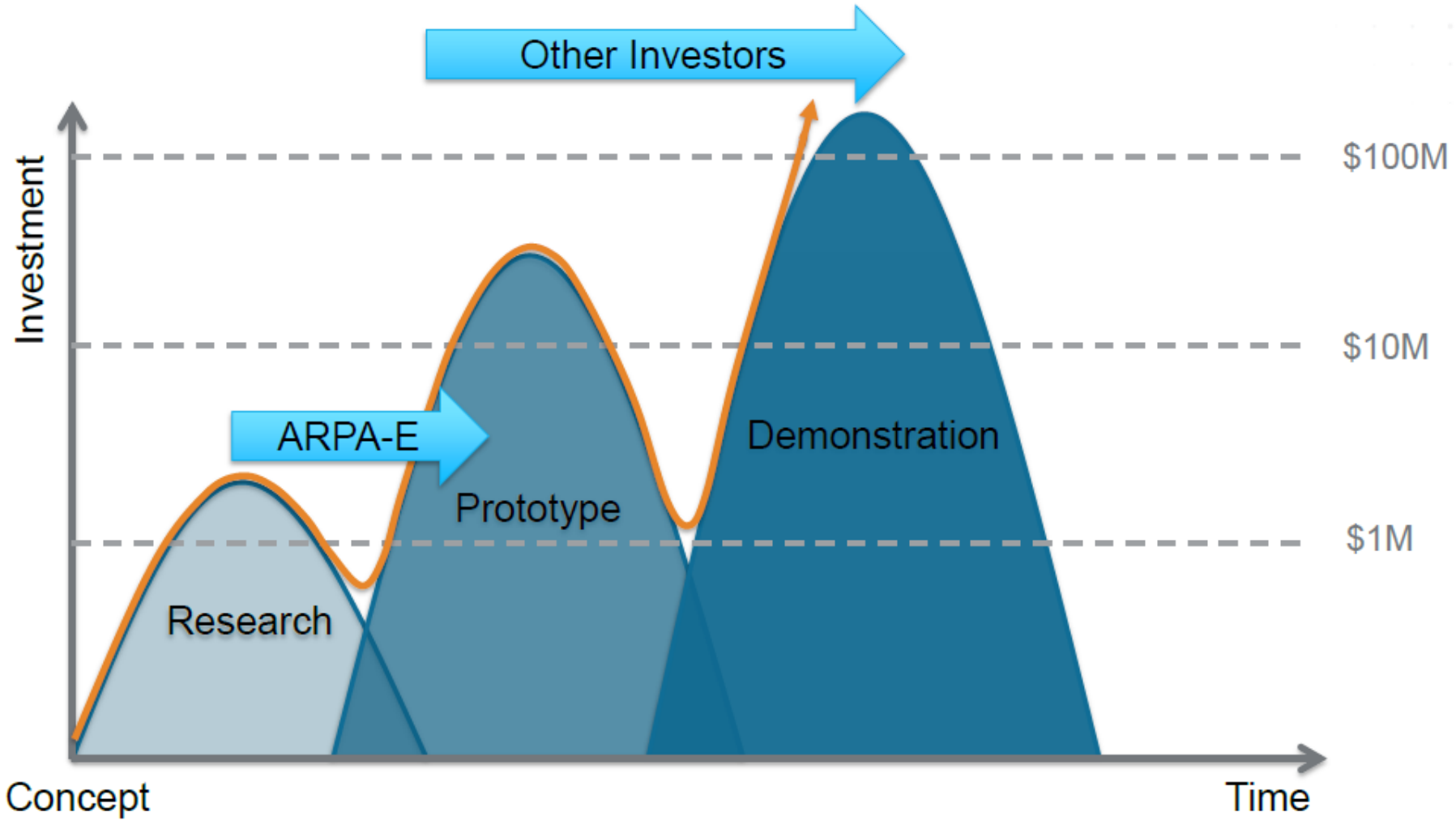


Adapted from the DARPA Heilmeier questions

If it works…

will it matter?

Energy Technology “Mountains of Opportunity”



How does ARPA-E fund research?

- OPEN Solicitations:$100 million+ of funding without a topic area. Every 3 years, 2024 is next year with scheduled OPEN.
- Topical Solicitations: Targeted topical area. Usually $20-40 million+ and 10-20 awards for 3 years.
- Exploratory: rolling / Periodic (seedling projects). 18-30 months, total of $10 million/topic.
- ….and some more funding mechanisms

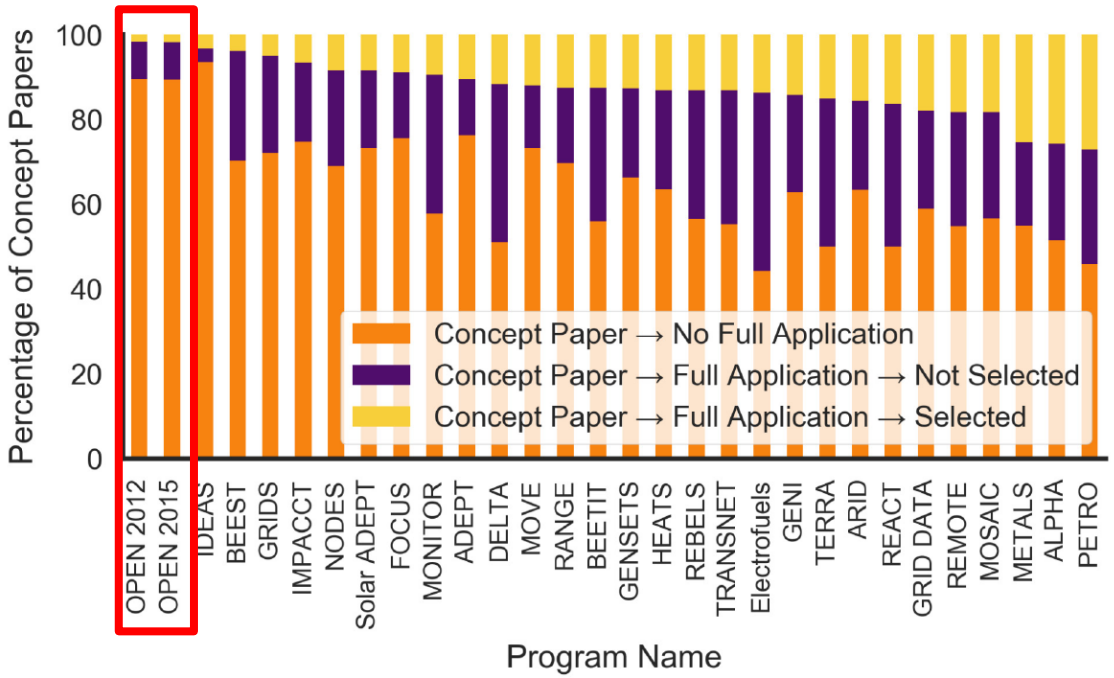
OPEN Program Overview

- $100 million+ funding
- 40-80 high-risk R&D projects
- Targeted to enable development of potentially disruptive new technologies across the full spectrum of energy applications
- $500,000 - $10 million for projects up to 3 years. Typical awards are $1.5-3.5M
- 4-page concept paper due 6-8 weeks after funding opportunity announcement is released
- Cost-share required (5% for university teams, more if you have for-profit partners)

Previous OPEN FOAs

Program Name	Number of Projects	Funding Amount ($ Million)	# Concept Papers
OPEN 2009	41	175.0	3,700
OPEN 2012	67	158.7	>4,000
OPEN 2015	38	125	>2,000
OPEN 2018	77	199	>2,600
OPEN 2021	68	175	unpublished

1-3% success rate



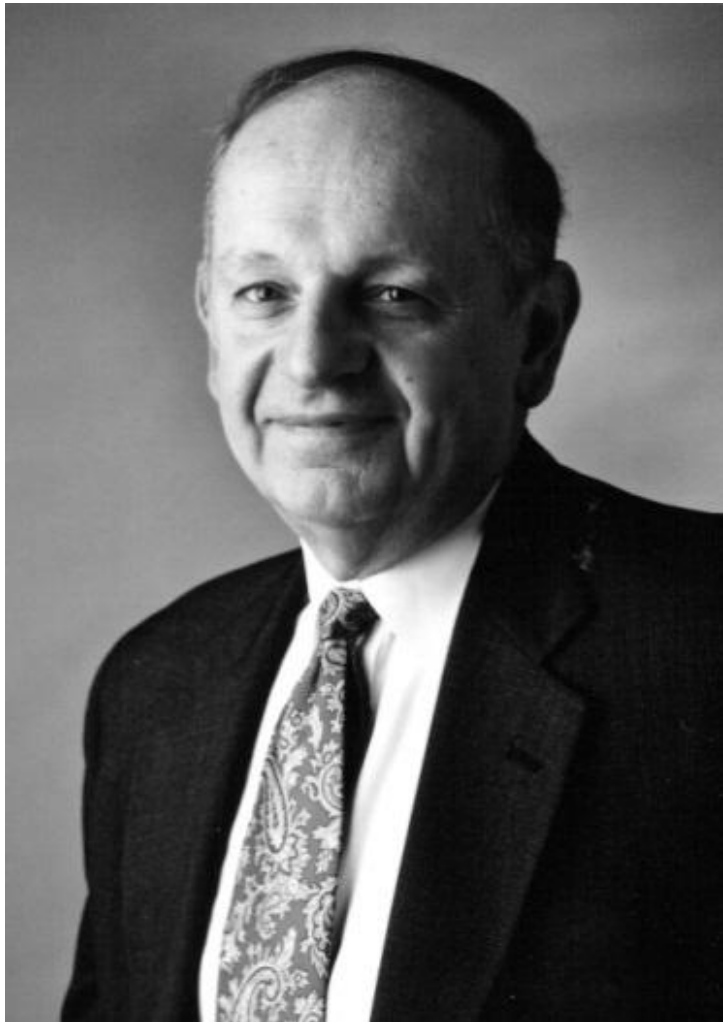
National Academies of Sciences, Engineering, and Medicine. 2017. *An Assessment of ARPA-E*. Washington, DC: The National Academies Press. https://doi.org/10.17226/24778.

Select OPEN Focus Areas

- Electricity generation by both conventional and renewable means
- Electricity transmission, storage, and distribution
- Energy efficiency for buildings, manufacturing and commerce, and personal use
- All aspects of transportation, including the production and distribution of both renewable and non-renewable fuels, electrification, and energy efficiency in transportation

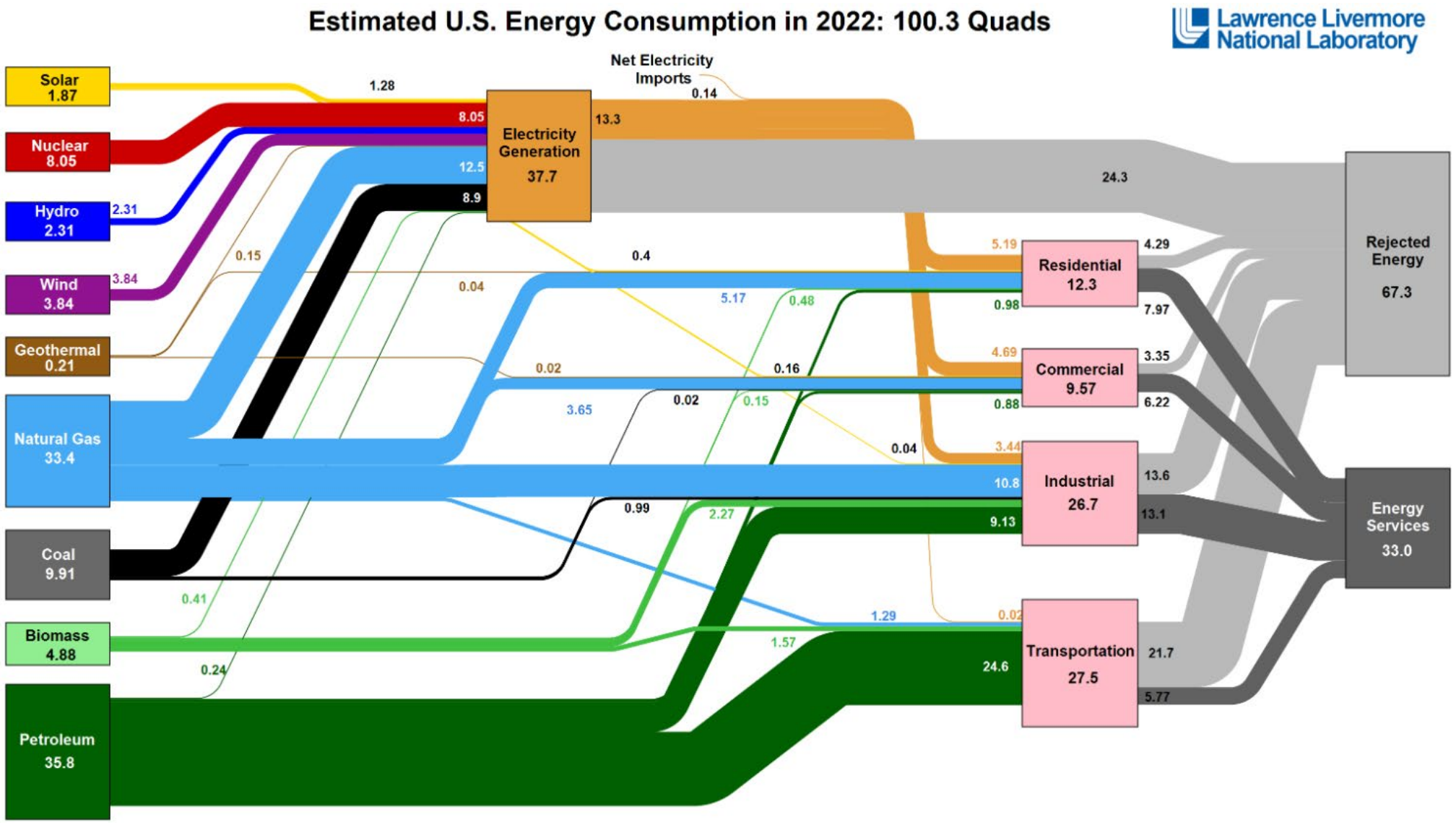
The Heilmeier Catechism

- What are you trying to do? Articulate your objectives with absolutely no jargon.
- How is it done today, and what are the limits of current practice?
- What's new in your approach and why do you think it will be successful?
- Who cares?
- If you're successful, what difference will it make?
- How much will it cost?
- How long will it take?
- What are the midterm and final "exams" to check for success?



George H. Heilmeier
DARPA Director (1975-1977)

Getting ARPA-E's attention



Source: LLNL; July 2023. Data based on DOE/EIA SEDS (2021).

Market-focus

- Your technology is cool
  - It addresses a significant energy issue
  - At scale, its cost & performance might displace or significantly improve the incumbent
  - It’s not an add-on to a well-developed technology area
- Is there a beachhead market of first-adopters that will interest venture capitalists or other follow-on investors?
  - Reaching scale can be very expensive
  - Who might pay for your technology to reach it?

The concept paper conundrum

- You've got 4 pages
- You need to show that your technology is interesting and that the concept is solid
- You need to preview the energy-technoeconomic case for government support of its research & development
- You need to describe a team that can achieve ambitious goals in about 3 years

Tips for Concept Papers

- Use the Heilmeier catechism to critique your project. You should consider annual impact on energy and cost of technology once deployed – some preliminary analysis of these should be given in the concept paper
- Draw a clear connection showing significant impact on one of ARPA-E's mission areas
- Communicate how approach is innovative and differentiated from commercial or emerging technologies
- First page needs a strong bottom line up front: a clear big idea. Program directors will each read 400 – 800 concept papers over 4 weeks.

Literature Example

Rechargeable Solid State Fluorine Ion Battery

We propose a rechargeable fluorine ion (F-ion) battery that uses a solid state fluorine ion conductor (e.g. $La_{0.9}Ba_{0.1}F_{2.9}$) with metal fluoride electrodes, such as the Ce//CuF_2 couple. Solid state F-ion batteries with electrodes such as Ce//CuF_2 electrodes have a theoretical energy density of 792 Wh/kg (2.9 V) that compares favorably to state-of-the-art Li-ion batteries such as LiC_6//CoO_2 at 568 Wh/kg (3.6 V). To date, we have demonstrated that the Ce//BiF_3 electrode couple is rechargeable (Figure 2). Several key challenges remain in demonstrating the viability of a F-ion battery including: 1) decreasing electrolyte resistance losses, 2) increasing electrode material utilizations, and 3) maintaining capacity over long cycle life. In the proposed work these challenges will be addressed by 1) decreasing the electrolyte thickness and doping the electrolyte to increase conductivity, 2) engineering electrode microstructure to better utilize electrode material; and 3) selecting optimal electrode materials for enhanced cyclability.

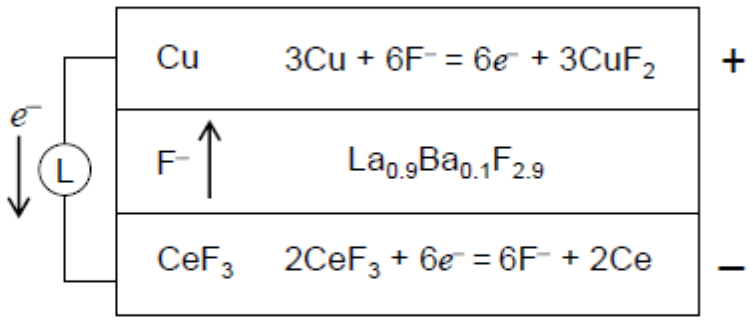


Figure 1. Diagram F-ion battery with Ce//CuF_2 electrodes.

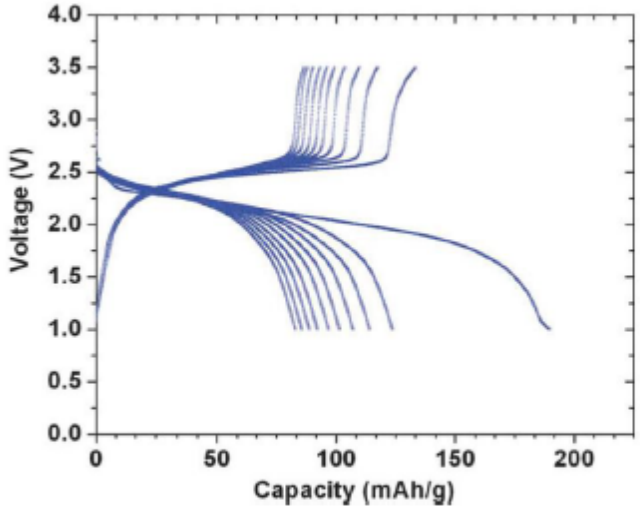


Figure 2. Preliminary charge-discharge cycles at 10 um/cm² and 150 °C of a Ce//BiF_3 cell.

Reference: MA Reddy, M Fichtner. *J. Mater. Chem.* 21:17059, 2011

Other Opportunities

- IGNIITE 2024 – ~$500k award, 20 awards, 24 months. Within 8 years of PhD
- SPARKS – up to $500k, 18 months, proof-of-concept research

Syracuse University
Center of Excellence in
Environmental & Energy Systems

SyracuseCoE: Services for Faculty Researchers

The SyracuseCoE team can help you with:

- Identifying potential industry and/or community collaborators and advisors
- Connecting with SyracuseCoE associated faculty members and labs
- Accessing SyracuseCoE LEED Platinum facilities as a research and demonstration testbed
- Assembling “red team reviews” with external stakeholders for near-final proposals
- Engaging SyracuseCoE SMEs and communications staff for project support and post-award outreach

For more information, contact: Tammy Rosanio (tlrosani@syr.edu) or Jianshun “Jensen” Zhang (jszhang@syr.edu)

Office of Research Development

- Chetna Chianese is available to meet with you to discuss the idea.
- Provide one outline/concept review, one concept paper review
- For concept papers encouraged to move to a full proposal, more support is available

Panel Discussion