Overview and Update on the Advanced Research Projects Agency-Energy (ARPA-E)

Eric Rohlfing
Deputy Director for Technology
In 2007, The National Academies recommended Congress establish an
Advanced Research Projects Agency within the U.S. Department of Energy

<table>
<thead>
<tr>
<th>Year</th>
<th>Programs To Date</th>
<th>Awards Announced</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>1</td>
<td>37</td>
<td>$400M (Recovery Act)</td>
</tr>
<tr>
<td>2009</td>
<td>7</td>
<td></td>
<td>$180M (FY11)</td>
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<tr>
<td>2010</td>
<td>12</td>
<td></td>
<td>$275M (FY12)</td>
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<tr>
<td>2011</td>
<td>16</td>
<td></td>
<td>$251M (FY13)</td>
</tr>
<tr>
<td>2012</td>
<td>20</td>
<td></td>
<td>$280M (FY14)</td>
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<tr>
<td>2013</td>
<td>23</td>
<td></td>
<td>$280M (FY15)</td>
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<tr>
<td>2014</td>
<td>32</td>
<td></td>
<td>$291M (FY16)</td>
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<tr>
<td>2015</td>
<td>39</td>
<td></td>
<td>$280M (FY15)</td>
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<tr>
<td>2016</td>
<td>500+</td>
<td></td>
<td>$280M (FY14)</td>
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<tr>
<td>2017</td>
<td></td>
<td></td>
<td>$306M (FY17)</td>
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</tbody>
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America COMPETES Act Signed

American Recovery & Reinvestment Act Signed

Rising Above the Gathering Storm Published

Coming soon

$275 Million (FY2012)
$280 Million (FY2015)
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
Built on DARPA foundation, but with key differences…

**ARPA-E Additions**

- **Fully in-house contracting**
- **Fellows as creative resource**
- **Tech-to-Market focus**
- **Majority cooperative agreements**

**DARPA-like Foundation**

- **Institutional Independence**
- **High risk/return R&D**
- **Substantial involvement in tech management**

- **Empowered program directors**
- **Flat organization**
- **Internal program pitches/scrubs**

- **Special hiring authority with term limits (3–4 years)**
- **Flexible and nimble response to changing technology opportunities**
Developing ARPA-E Focused Programs

PROGRAM DEVELOPMENT CYCLE

ESTABLISH

Project Selection

Contract Negotiations & Awards

Ongoing Technical Review

EXECUTE

Project Handoff

Transition Toward Market Adoption

ENVISION

Program Conception (Idea/Vision)

ENGAGE

Workshop

Program Approval

You are here!

EVALUATE

Proposal Rebuttal

Merit Review of Proposals

FOA Development & Issuance

ARPA-E Program Directors

You are here!
What is the **problem to be solved**?

What is the **value added**? Does it complement R&D efforts in other DOE programs, federal agencies, and the private sector?

What are the **program goals** and how will progress towards those goals be measured?

If successful, how will the proposed program impact one or more of ARPA-E’s mission areas?

What is the **pathway to practical impact**? How will barriers to commercialization be overcome?

What is new in our **approach**? Why is now the right time to solve this problem?

What prevents the problem from being solved today? **Is it ARPA hard?**

Who will do the R&D? What disciplines need to come together?

Adapted from the DARPA Heilmeier questions
**Focused** programs prioritize R&D topics by their potential to make a significant difference in ARPA-E’s mission space.

- Size of the potential impact
- Technical opportunities for transformation
- Portfolio of projects with different approaches

**OPEN** programs support the development of potentially disruptive new technologies across the full spectrum of energy applications.

- Complement focused programs
- Support innovative “one off” projects
- Provide a “snapshot” of energy R&D
ARPA-E Program Portfolio

- **ELECTRICITY GENERATION & DELIVERY**
  - MOSAIC
  - GENSETS
  - IONICS
  - ALPHA
  - NODES
  - GRID DATA
  - REBELS
  - FOCUS
  - CHARGES
  - GRIDS
  - GENI
  - HEATS
  - SOLAR ADEPT
  - IMPACCT

- **EFFICIENCY**
  - SENSOR
  - CIRCUITS
  - PNDIODES
  - ENLITENED
  - SHIELD
  - ROOTS
  - MONITOR
  - ARID
  - DELTA
  - SWITCHES
  - METALS
  - REACT
  - ADEPT
  - BEETIT
  - REACT

- **TRANSPORTATION**
  - MARINER
  - REFUEL
  - NEXTCAR
  - TRANSNET
  - TERRA
  - RANGE
  - REMOTE
  - ELECTROFUELS
  - AMPED
  - BEEST

OPEN 2009, 2012, & 2015 Solicitations Complement Focused Programs
ARPA-E Current & Planned FOAs

‣ Innovative Natural-gas Technologies for Efficiency Gain in Reliable and Affordable Thermochemical Electricity-Generation (INTEGRATE)
  – Develop natural gas-fueled distributed electric generation systems that offer fuel to electric power conversion efficiencies in excess of 70%.

‣ Modeling Enhanced Innovations Trailblazing Nuclear Energy Reinvigoration (MEITNER)
  – Advance innovative concepts for advanced (non-LWR) nuclear power plants that can achieve commercial viability by taking an integrated, system-level, safety-through-design approach.

‣ OPEN 2018
  – Coming soon.....teaming partner list currently posted on ARPA-E funding portal (https://arpa-e-foa.energy.gov/ )
Tech to Market: Preparing Teams for Success

**Scope**
Support creation of highly innovative, commercially-relevant programs

**Manage**
Manage project teams’ T2M efforts through T2M plans and jointly developed milestones

**Advise**
Support project teams with skills & knowledge to align technology with market needs

**Partnerships**
Engage third-party investors and partners to support technology development towards the market
Energy Technology “Mountains of Opportunity”

- **Research**
- **Prototype**
- **Demonstration**

**Investment**
- $1M
- $10M
- $100M

**Time**
- **Concept**
- **ARPA-E**
- **Other Investors**
ARPA-E Impact Indicators

Since 2009 ARPA-E has provided $1.5 billion in R&D funding to more than 580 projects.

- 74 projects have attracted more than $1.8 billion in private-sector follow-on funding
- 56 projects have formed new companies
- 68 projects have partnered with other government agencies to further development
- 208 patents issued by U.S. Patent and Trademark Office
- 1,328 peer-reviewed journal articles from ARPA-E projects
- 1,493 reported subject invention disclosures

As of February 2017
Assessing ARPA-E’s Impact

ARPA-E’s Impact Assessments evaluate the technical and commercial advancements of a sampling of projects.

Download Volume I & II on ARPA-E’s Website
National Academies of Science Assessment

Overview:

‣ NAS launched in 2015 a congressionally mandated study of ARPA-E and its progress in achieving its statutory mission and goals

‣ The final report issued in June 2017 included 18 findings and 14 recommendations

Key Conclusions:

‣ Active project management organizational model is effective

‣ ARPA-E has funded research that no other funder was supporting at the time

‣ Agency has successfully focused on high risk, potentially transformational technologies and overlooked “off-roadmap” opportunities

“There are clear indicators that ARPA-E is making progress toward achieving its statutory mission and goals...ARPA-E has the ability to make significant contributions to energy R&D that likely would not take place absent the agency’s activities.” - NAS Assessment
Why Work at ARPA-E?

CONTRIBUTE TO A BETTER ENERGY FUTURE
Work towards creating a more efficient, more secure energy future

WORK IN DIVERSE TECH AREAS
Work with a diversity of energy issues and explore new fields

JOIN OUR INNOVATIVE STARTUP-LIKE CULTURE
ARPA-E is a fast-paced, action-oriented Agency

COLLABORATE WITH OTHER EXPERTS
Work with experts from different disciplines who are devoted to creating a better energy future

If you are interested in applying or learning more, please email arpa-e-jobs@hq.doe.gov.
“The CEO of my company asked if he hadn’t given me a big enough sandbox to play in. I told him ARPA-E offered me a beach.” —Joe Cornelius, ARPA-E Program Director
Fellows Are Early-Career Innovators

“The only problem with this job is figuring out a next step that can possibly measure up to it.”
—Dr. Ashwin Salvi, Fellow
This is the premier event that showcases America’s future energy technologies.

energy innovation summit

www.ARPAE-Summit.com