The ARPA-E Mission

Catalyze and support the development of transformational, high-impact energy technologies

Ensure America’s

• National Security
• Economic Security
• Energy Security
• Technological Lead
ARPA-E Program Framing Questions

What is the problem to be solved?

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

What is the current state of R&D? How is the proposed program a transformative and disruptive approach?

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

What happens at the conclusion of the program? What are the barriers to commercialization and how might these problems be overcome?

Why is now the right time to solve this problem?

What research communities need to be brought together?

Adapted from the DARPA Heilmeier questions
If it works…

will it matter?
Creating New Learning Curves

TIME OR SCALE

COST / PERFORMANCE

Transformative Research

Existing Technology

Disruptive Technology
Developing ARPA-E Programs

PROGRAM DEVELOPMENT CYCLE

ARPA-E Program Directors

EXECUTE

ESTABLISH

ENVISION

ENGAGE

EVALUATE

Transition Toward Market Adoption

Project Handoff

Ongoing Technical Review

Contract Negotiations & Awards

Project Selection

Proposal Rebuttal

Merit Review of Proposals

Program Conception (Idea/Vision)

Workshop

Program Approval

FOA Development & Issuance
Changing the Model

Create Programs → Select Projects

Identify White Space
Advanced Technology
Manage Development

Technology-to-Market
Markets and Techno-economics (value)
Skills and Resources (implementation)
Stakeholder engagement (people)
The ARPA-E Portfolio

As of January 2015, ARPA-E has funded over 400 projects, investing $1.1 billion across 25 focused programs and open funding solicitations

**Stationary Energy Technologies**
- Solar ADEPT
- GRIDS
- IMPACCT
- BEETIT
- GENI
- FOCUS
- REBELS
- DELTA
- MONITOR

**Transportation Energy Technologies**
- BEEST
- PETRO
- Electrofuels
- MOVE
- RANGE
- REMOTE

**Stationary & Transportation Energy Technologies**
- ADEPT
- HEATS
- SBIR/STTR
- AMPED
- REACT
- METALS
- SWITCHES

**Open**
- OPEN 2009
- OPEN 2012
- IDEAS
Active Funding Opportunities

- OPEN 2015
- Advance Research in Dry-cooling (ARID)
- Micro-scale Optimized Solar-cell Arrays with Integrated Concentration (MOSAIC)
- Transportation Energy Resources from Renewable Agriculture (TERRA)
- Accelerating Low-Cost Plasma Heating and Assembly (ALPHA)
- Traveler Response Architecture using Novel Signaling for Network Efficiency in Transportation (TRANSNET)
- GENerators for Small Electrical and Thermal Systems (GENSETS)
- Network Optimized Distributed Energy Systems (NODES)
**Focus**
Advanced Technologies Solar Energy

**Mission**
Develop technologies to advance solar energy beyond current photovoltaic (PV) and concentrated solar power (CSP) technologies to ensure solar power remains a consistent, cost-effective renewable energy option.

<table>
<thead>
<tr>
<th>Program Director</th>
<th>Dr. Howard Branz</th>
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<tr>
<td>Year</td>
<td>2013</td>
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<tr>
<td>Projects</td>
<td>12</td>
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<tr>
<td>Investment</td>
<td>$30 Million</td>
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**Goals**
Develop two distinct technology options to deliver low-cost, high-efficiency solar energy on demand:

- (1) **New hybrid solar energy converters** to turn sunlight into electricity for immediate use, while also producing heat that can be stored at low cost for later use (using the entire solar spectrum more efficiently than PV or CSP technologies)
- (2) **New hybrid energy storage systems** that accept heat and electricity from variable solar sources to deliver electricity when needed

**Highlights**
- Coming soon!
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
MOVE
NATURAL GAS FOR CARS

Mission

Develop (1) cost-effective ways to power passenger cars and other light duty vehicles and (2) quick-filling at-home refueling stations.

Goals

• 5-yr payback for light duty natural gas vehicles (NG is $1.50/gallon of gas equivalent, gasoline $3.50/gallon)
• Conformable tanks with energy density = CNG
• Convenient, low-cost at-home refueling

Approaches

Approach 1: Low pressure storage (< 500 psi)
• Sorbent materials with energy density equal to CNG

Approach 2: High pressure storage (3,600 psi)
• High strength, conformable tanks with low cost compression

Program Director | Dr. Dane Boysen
Year | 2012
Projects | 13
Total Investment | $30 Million
AMPED
ENERGY STORAGE SYSTEMS

Mission
Develop advanced sensing, control, and power management technologies that redefine the way we think about battery management.

Goals
• Improve lifetime and valuation of battery
• Safe, rapid charging batteries
• Enable hybrid and secondary use applications
• Increase battery utilization without changes to the battery itself through adaptive management, sensing, modeling and power electronics

Highlights
• Radical sensor integration to allow real-time measurement
• Novel diagnostic and state determination through non-electronic signals
• Adaptive model and power electronic architecture approaches

Program Director: Dr. Ilan Gur
Year: 2012
Projects: 14
Total Investment: $30.2 Million
OPEN 2012: 66 Projects, 24 States, 11 Areas

2 Advanced Vehicles
2 Water
13 Advanced Fuels
3 Building Efficiency
2 Stationary Generation
9 Grid Modernization
10 Renewable Power
8 Stationary Energy Storage
4 Carbon Capture
5 Thermal Energy Storage
7 Transportation Storage
Measuring ARPA-E’s Success

MOVING TECHNOLOGY TOWARD MARKET

- More than 37 partnerships with other government agencies
- More than 30 new companies formed
- 34 Projects have attracted more than $850 million in private-sector follow-on funding after ARPA-E’s investment of $135 million
- Established company relationships and developed new communities
- Several technologies now in products in the marketplace

BREAKTHROUGH ACHIEVEMENTS

- Technology breakthroughs
- Patents
- Publications

OPERATIONAL EXCELLENCE

- Expedited program development and project selection
- Aggressive performance metrics
Help change the world by winning an ARPA-E award
Top 5 Tips for Writing a Competitive Proposal

1. Read the Funding Opportunity Announcement (FOA)
2. Demonstrate impact
3. Describe the technology
4. Compare to state of art
5. Identify challenges and solutions
Top 5 Tips for Writing a Competitive Proposal

1. Read the Funding Opportunity Announcement (FOA)
   - Motivation for the program
   - Program objectives
   - Technical categories of interest
   - Technical performance targets

2. Demonstrate impact

3. Describe technology

4. Compare to state of art

5. Identify challenges and solutions

Read the FOA! Then read it again, carefully.
Top 5 Tips for Writing a Competitive Proposal

1. Read the Funding Opportunity Announcement (FOA)

2. Demonstrate impact

3. Describe technology

4. Compare to state of art

5. Identify challenges and solutions

- How does it impact ARPA-E mission areas?
- What problem are you trying to solve?

Reduce Imports

Improve Efficiency

Reduce Emissions

Your first question should not be “will it work?”

“If it works, will it matter?”
Top 5 Tips for Writing a Competitive Proposal

1. Read the Funding Opportunity Announcement (FOA)

2. Demonstrate impact

3. **Describe technology**
   - How does it work? Describe with minimal jargon.
   - What’s new in your approach?
   - Why do you think it will be successful?

4. Compare to state of art

5. Identify challenges and solutions
Top 5 Tips for Writing a Competitive Proposal

1. Read the Funding Opportunity Announcement (FOA)
2. Demonstrate impact
3. Describe technology
4. Compare to state of art
5. Identify challenges and solutions

- How is it done today?
- Why are today’s solutions insufficient?
- How does your solution represent a dramatic improvement?

Diagram:

- Risk: bad investment, incremental
- Reward: ARPA-E, private sector
Top 5 Tips for Writing a Competitive Proposal

1. Read the Funding Opportunity Announcement (FOA)
2. Demonstrate impact
3. Describe technology
4. Compare to state of art
5. Identify challenges and solutions

- What is the challenge to developing your specific technology? Why is it hard?
- What approaches will you take to overcoming these challenges?

Why should we fund you?

Provide **key insight/unique approach** to solve a problem where others failed