



ARPA-E Technology to Market: Changing What's Possible

David Henshall
Deputy Director of Commercialization
David.Henshall@hq.doe.gov

NAS Webinar
September 15, 2015

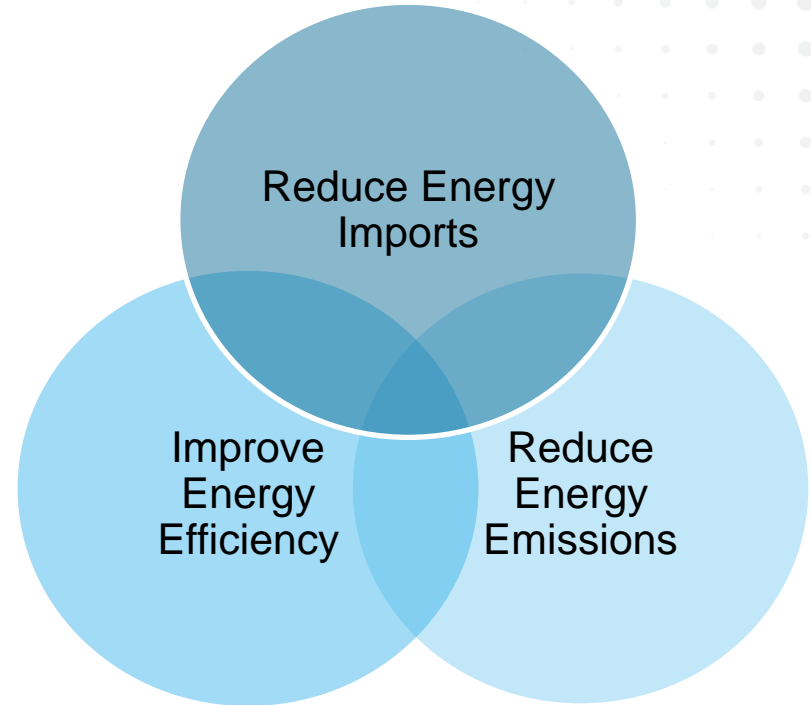


ARPA-E Mission

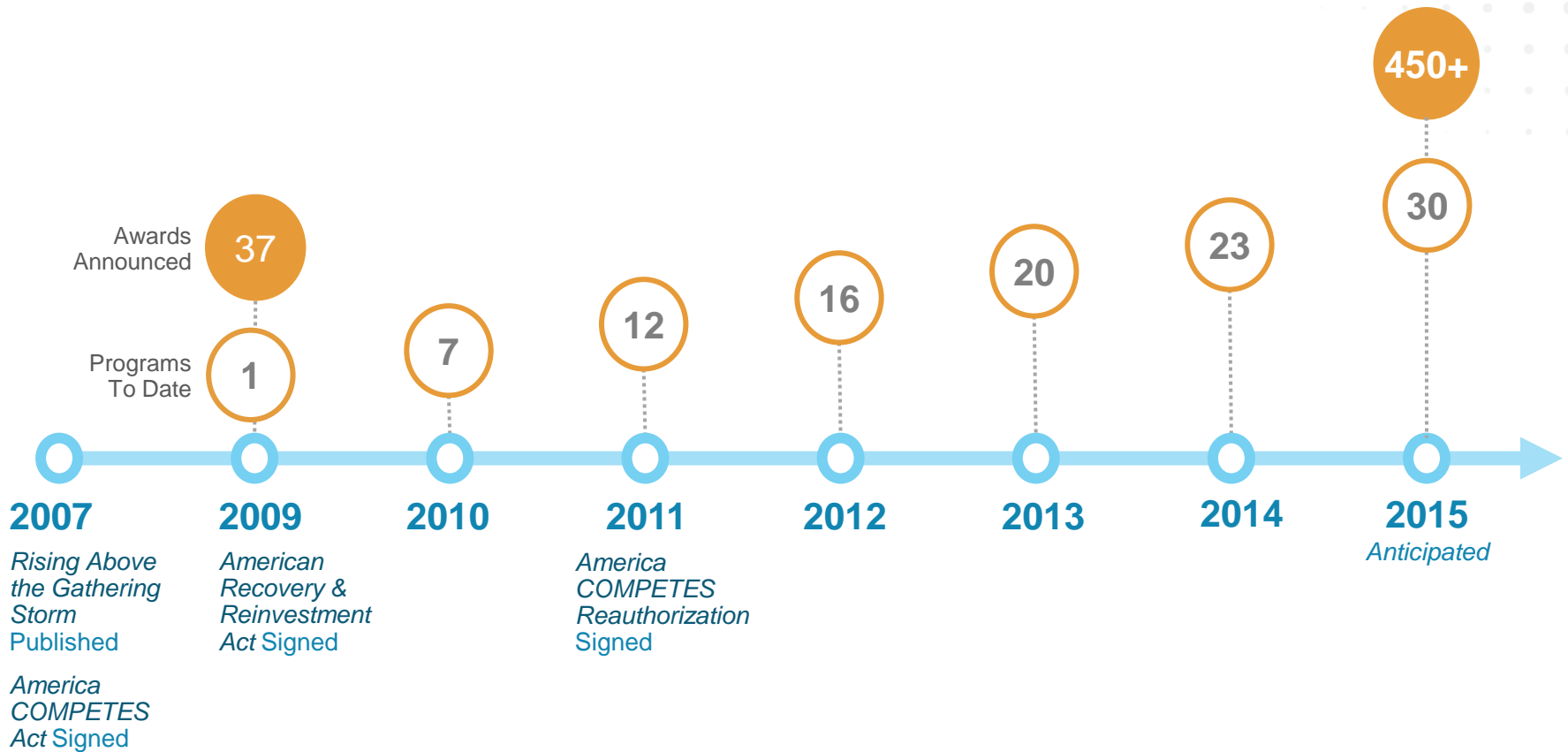
Goals: Ensure America's:

- Energy Security
- Energy Sustainability
- Economic Security
- Technological Lead in Advanced Energy Technologies

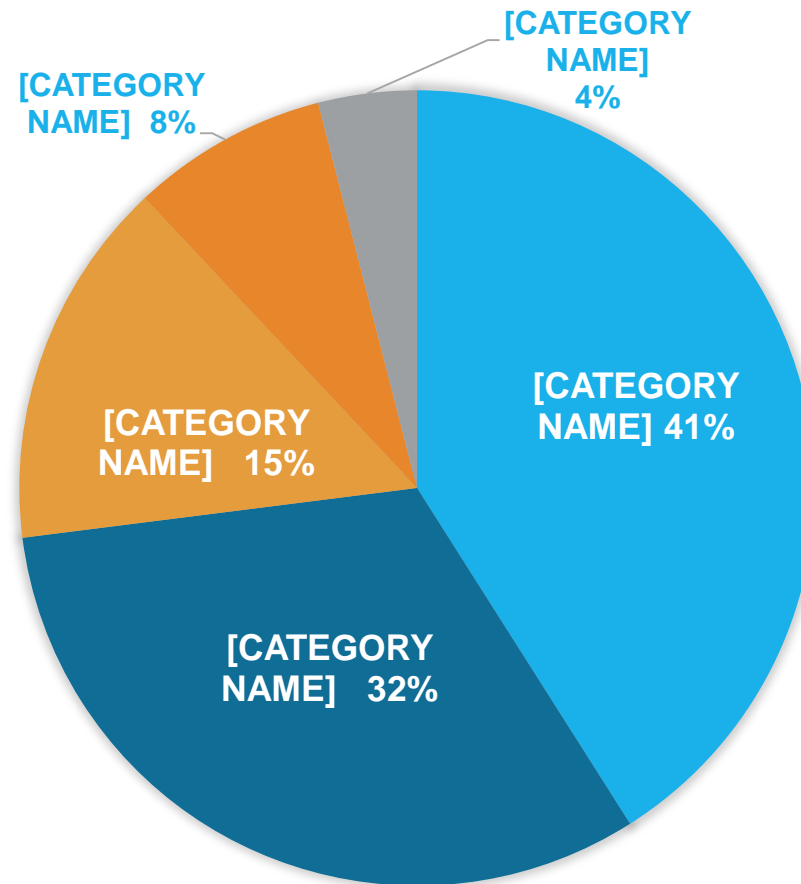
Mission: Catalyze the development of early stage transformational, high-impact energy technologies that could provide dramatic benefits



ARPA-E's History



ARPA-E Project Portfolio by Lead Organization



Built on DARPA foundation

ARPA-E Additions	Fully in-house contracting	Fellows as creative resource	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	
Unique to DARPA	Staged prototype demonstrations	Large-scale systems integration	Primary “customer” (DoD)

Market is Fundamentally Different

DARPA

HIGH VALUE
APPLICATIONS



DEDICATED
CUSTOMER



ARPA-E

COMMODITY
APPLICATIONS



OPEN MARKET



Technology to Market at ARPA-E is Created

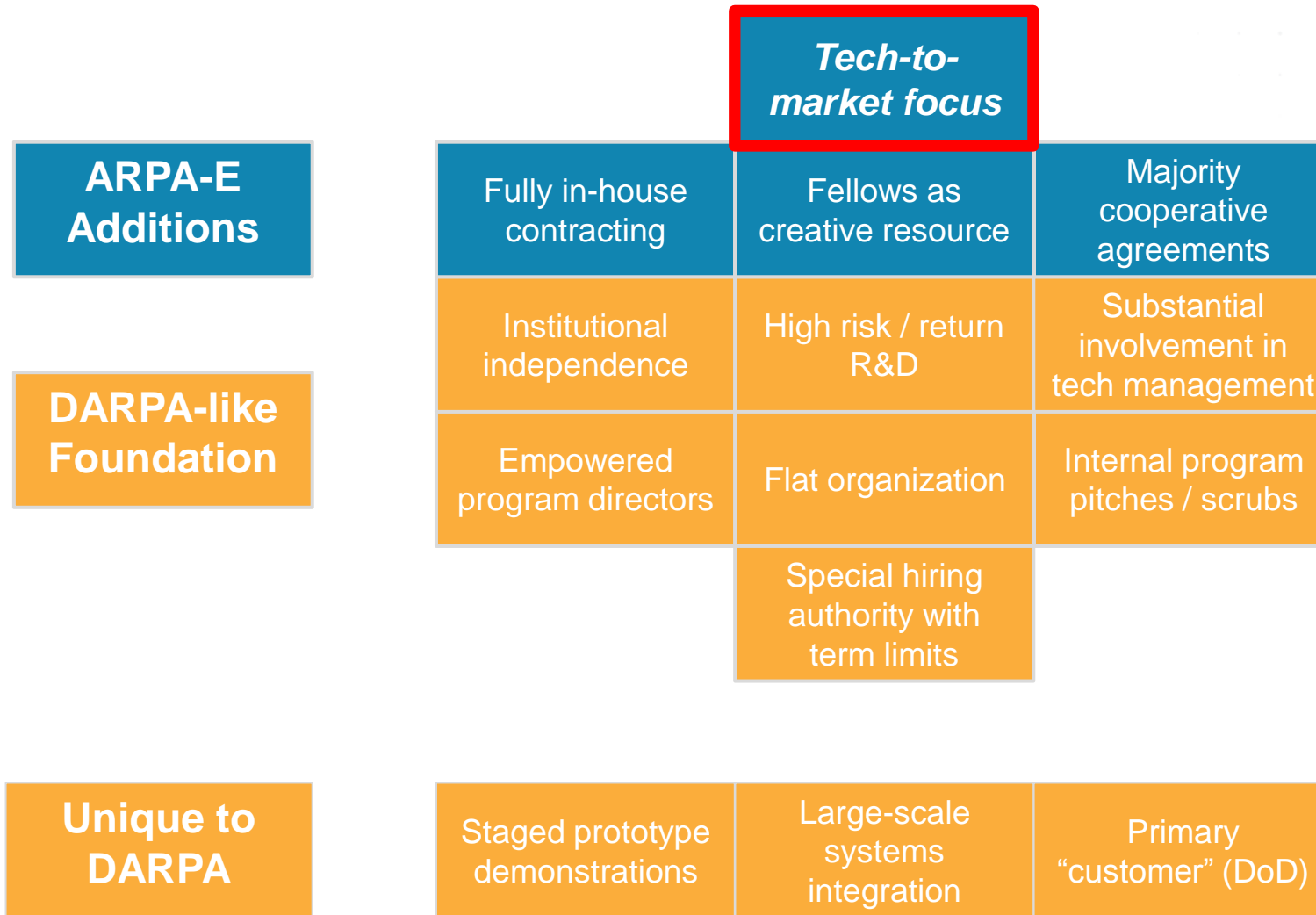
America COMPETES Reauthorization Act of 2010 is signed

“IN GENERAL- The goals of ARPA-E shall be--

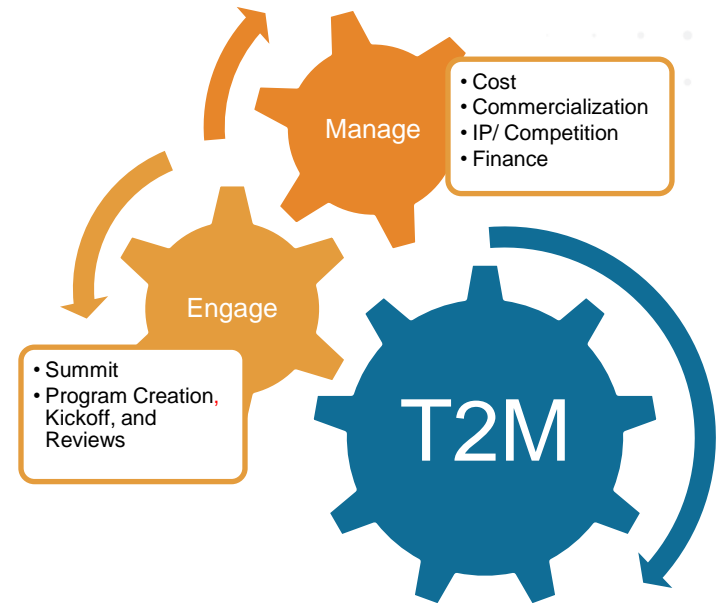
- A. *to enhance the economic and energy security of the United States through the development of energy technologies that result in
 - i. *reductions of imports of energy from foreign sources;*
 - ii. *reductions of energy-related emissions, including greenhouse gases; and*
 - iii. *improvement in the energy efficiency of all economic sectors; and**
- B. *to ensure that the United States maintains a technological lead in **developing and deploying advanced energy technologies.***



Built on DARPA foundation, and evolving...



Tech to Market Team



Constant feedback between engagement and management efforts brings value to ARPA-E awardees

What does it do?

What problem
does it solve?

Who will buy this?

What is the adoption
process and what are
the barriers?

If it works...

will it matter?

How long
will it take
to develop?

Why is it possible
now but wasn't
before?

What are the risks
and payoffs?

How much will it cost
to develop? To
produce?

Tech to Market Approach



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



Finance

Engage third-party financiers to support continuity of technology development towards the market

Tech to Market Approach



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



Finance

Engage third-party financiers to support continuity of technology development towards the market

Tech-to-Market Plan Elements



Projects are required to create and execute a Tech-to-Market Plan

Project Milestones



Negotiation and Setting of T2M Milestones

- ▶ Awardees are required to have T2M milestones along with technical milestones



Ongoing Management of T2M Activity

- ▶ Frequent discussions with awardees
- ▶ Content includes milestone review, market observations, advising, ideation, and analysis of opportunities



Team Approach:

- ▶ Participation from PD's, Tech SETA's, other T2M Advisors

Tech to Market Approach



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



Finance

Engage third-party financiers to support continuity of technology development towards the market

IP and Competitor Analysis

Evaluation of the IP landscape
in and around your technology?



What IP do you own?



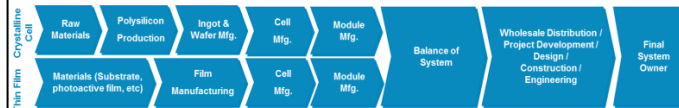
What IP do you expect to create?



What limits could your competition
create?

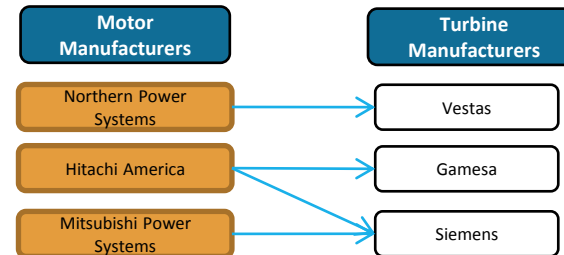
Market Knowledge Throughout Program Lifecycle

Value Chain Analysis



Describes the **sequence of activities** current used to serve the market; useful for identifying entry points

Partnerships Analysis



Defines **number and strength** (JV, supply agreement) of relationships between parties

Competitive Analysis



Illuminates the **competitive pressures** that exist in the market

Market Requirements

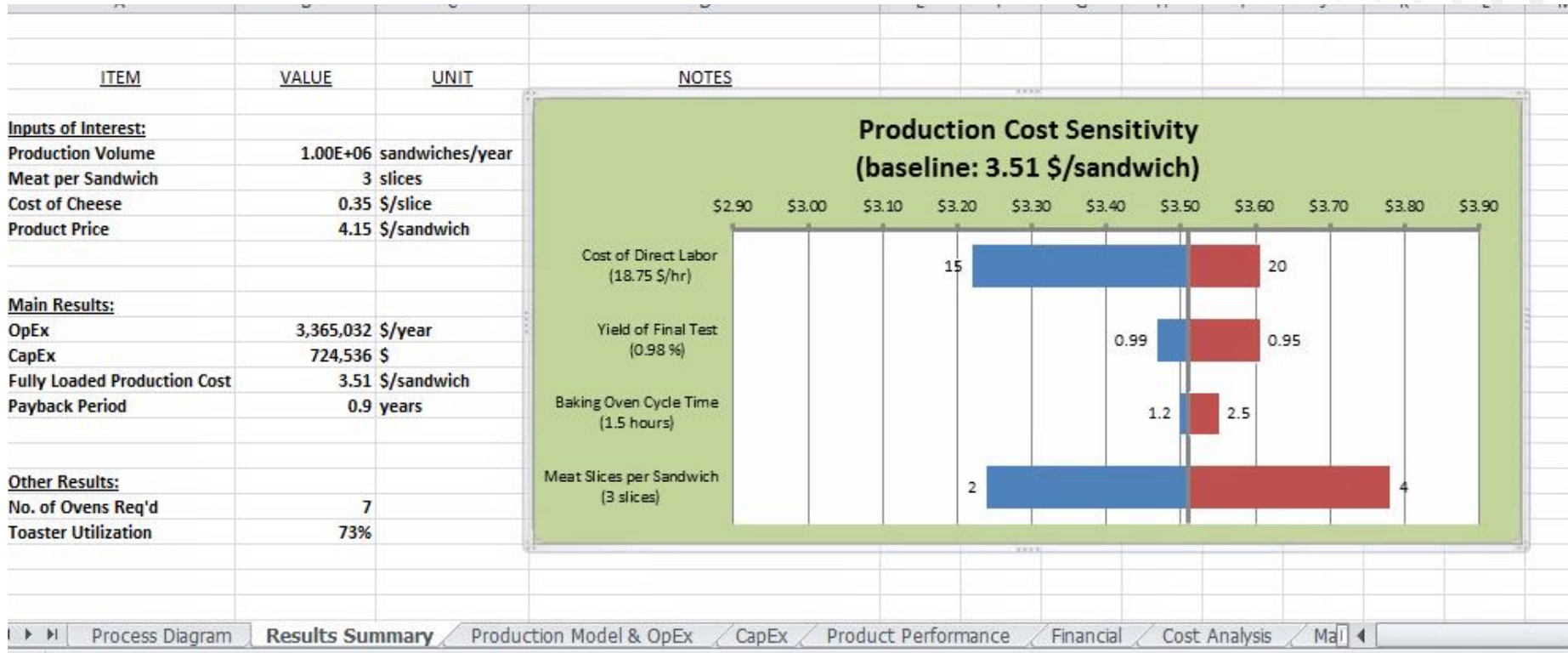
Defines:

- Minimal performance requirements for adoption,
- Performance requirements to unseat the incumbent
- Necessary product channels
- Intermediate Markets

Product Market Hypothesis

Value Proposition	Features	Problem	Customer Segment
	Channel	Revenue Model	
Market		External Risks	Key Performance Indicators

Techno-Economic Modeling



Partner Discovery and Engagement

Researcher

Hey check out my new product! It will be effective and inexpensive (when we scale).



What they hear:

Check out my unreliable gadget that we're cooking up in the lab and trying to figure out what we can do with it!

Potential Investor, Business Partner

Interesting!



What they really mean:

Interesting idea, but what does it do? Why is it better? How long will it take to develop? How much return can I make on an investment?

Tech to Market Approach



Manage

Manage project teams' T2M efforts through T2M plans and jointly developed milestones



Advise

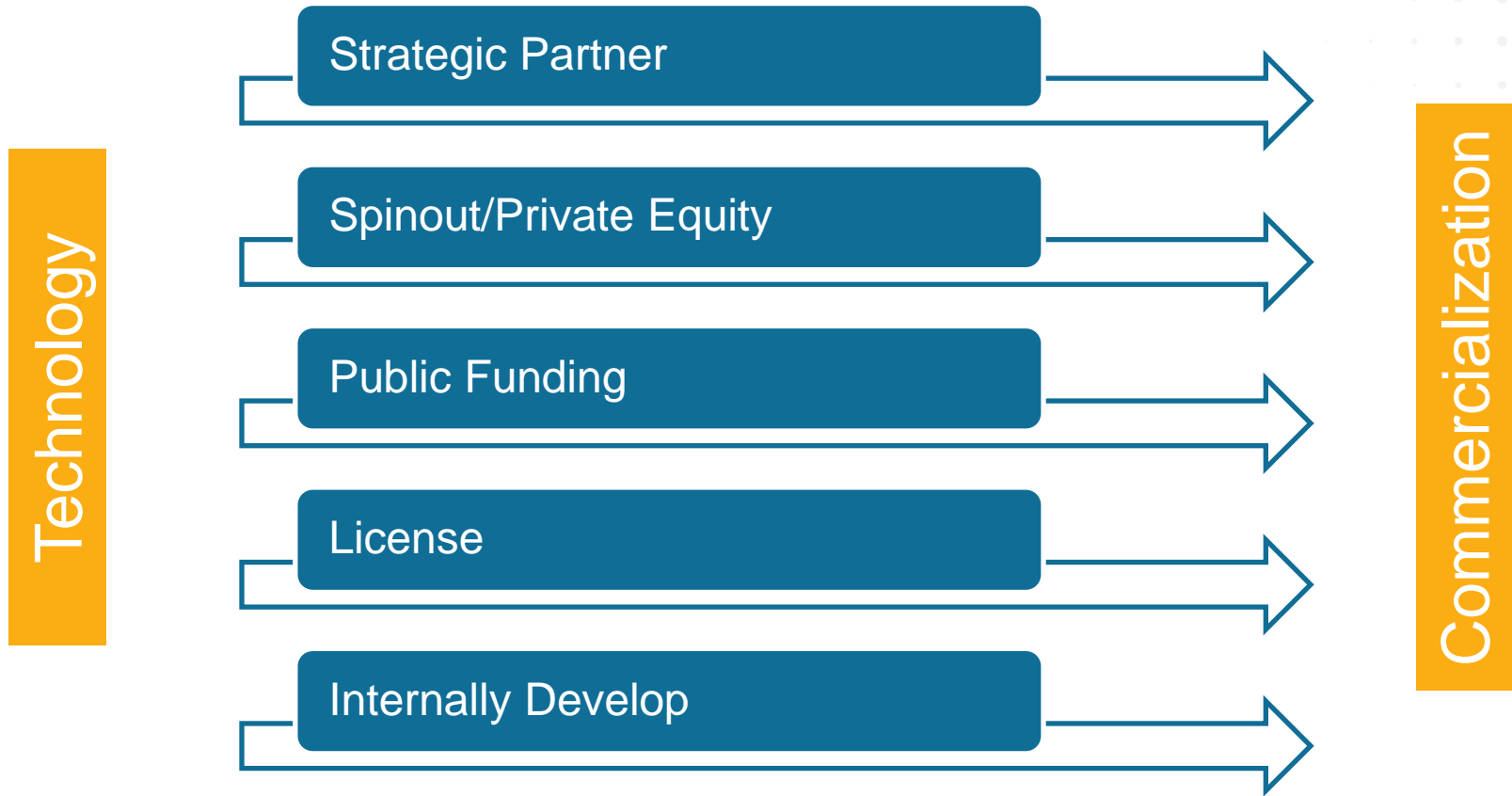
Support project teams with skills & knowledge to align technology with market needs



Finance

Engage third-party financiers to support continuity of technology development towards the market

Finance Models



Program Kickoff and Review Meetings

- ▶ Technology showcase and networking sessions
- ▶ Build new community of ARPA-E awardees, investors, customers, other government agencies
- ▶ Potential investors and strategic partners observe progress throughout program lifecycle
- ▶ Build relationships to advance commercialization beyond ARPA-E funding



arpa·e energy innovation summit



Technology
Showcase



Inspiring
Keynotes



Effective
Networking

Feb. 29- Mar. 2, 2016 | Washington, DC
www.arpae-summit.com

Department of Defense Funding

▶ Model Theory:

- ARPA-E project graduates with a clean handoff to direct interest funding from the military for the next stage

▶ What we've seen:

1. DOD provides parallel funding to a project team for adjacent technology while ARPA-E continues to fund
2. ARPA-E alumni project gets picked up as a subcontractor to a system-level program led by major defense contractor

Measuring ARPA-E's Success



Deploying Advanced Energy Technologies

Partnerships with Gov't Agencies



37 government projects

Products in the Marketplace



7 products with commercial sales

New Company Formation



30 new companies formed

Follow-on Funding



35 projects have attracted \$850M+ from the private sector

Learning from the ARPA-E T2M Model

WHAT WORKS

- ▶ **People:** Hiring people with technology and market skills in each market/technology
- ▶ **Partnerships:** Key stakeholder engagement maps drive relationships for kick-offs and annual meetings (building relationships takes time)
- ▶ **Plan and pivot:** T2M Plan and Milestones are important
- ▶ **Engagement:** Project's T2M team is engaged from program formation
- ▶ **Goals:** Thinking from the end changes the conversation
- ▶ **Starting early:** Techno-economic analyses start early and evolve
- ▶ **Unique:** Each project is unique and action must adjust to dynamic environment

WHAT ARE THE CHALLENGES

- ▶ The right T2M POC for each project is essential
- ▶ Finding the right match for post ARPA-E financing



U.S. DEPARTMENT OF
ENERGY

www.arpa-e.energy.gov

David.Henshall@hq.doe.gov