



CHANGING WHAT'S POSSIBLE

# Powertrain Workshop – Technology to Market Overview

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# § 16538: ARPA-E's Statute – T2M Mandates

## Mission

- “translating scientific discoveries and cutting-edge inventions into technological innovations”

## Responsibilities

- “identifying mechanisms for commercial application of successful energy technology development projects”

## Awards

- “at least 5 percent of the amount shall be used for technology transfer and outreach activities”

# Market Engagement: *Understanding The Market*

## Getting past the Standard Interaction

Hey check out my super-expensive, unreliable gadget that we cooked up in lab and have no idea what to do with!

What they hear:

Hey - check out my new powertrain system that can solve all your problems!

Lab Researcher

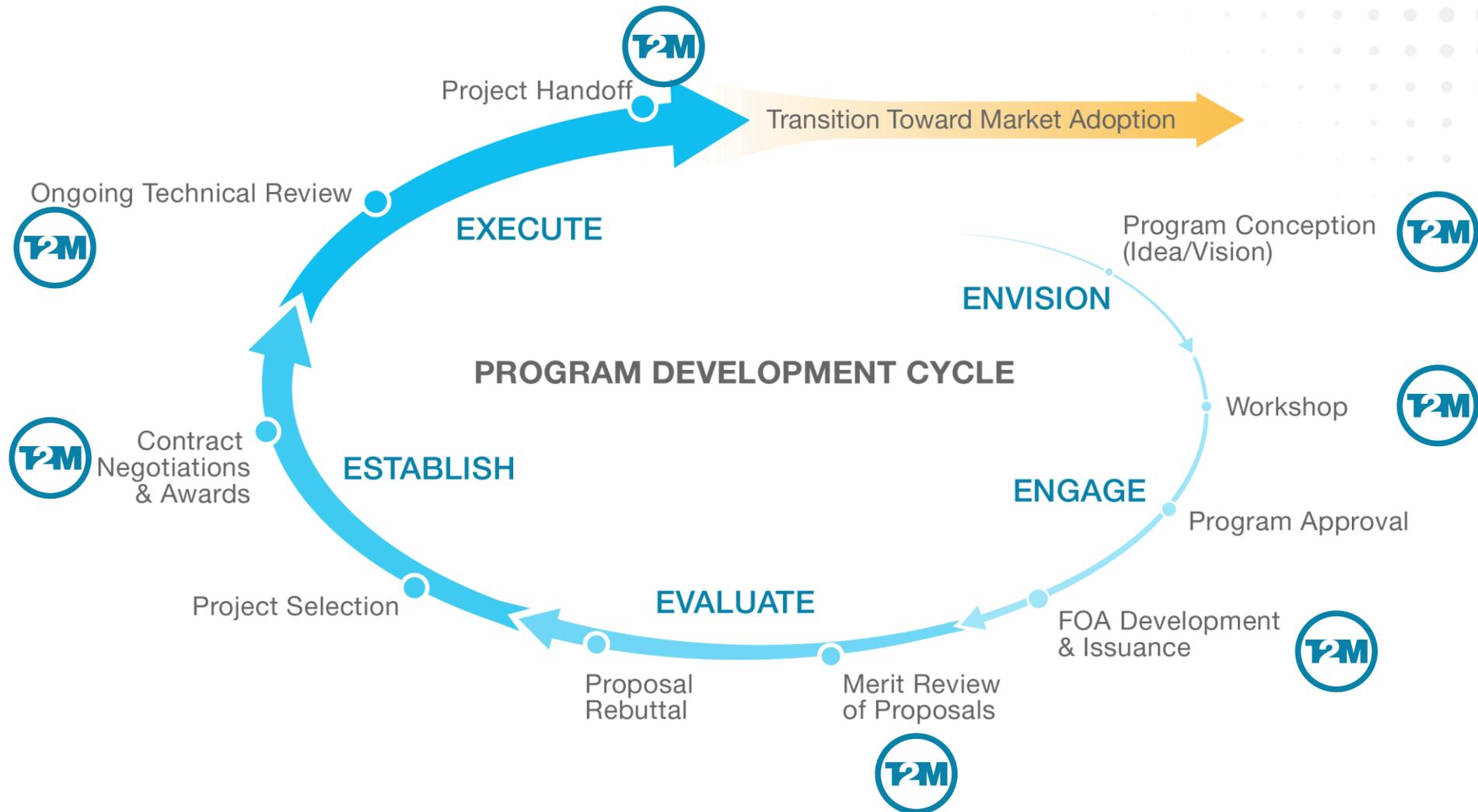
I'm trying to be polite. Actually, you haven't told me enough to have any clue of how interesting this is for me. I need to know: 1) Does it work? 2) What specific problem does it solve? And 3) How much does it cost?

What they really mean:

Interesting!

Strategic Partner / Investor

# At what points does T2M engage?



# T2M Guiding Principle

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If it works...

*will it matter?*

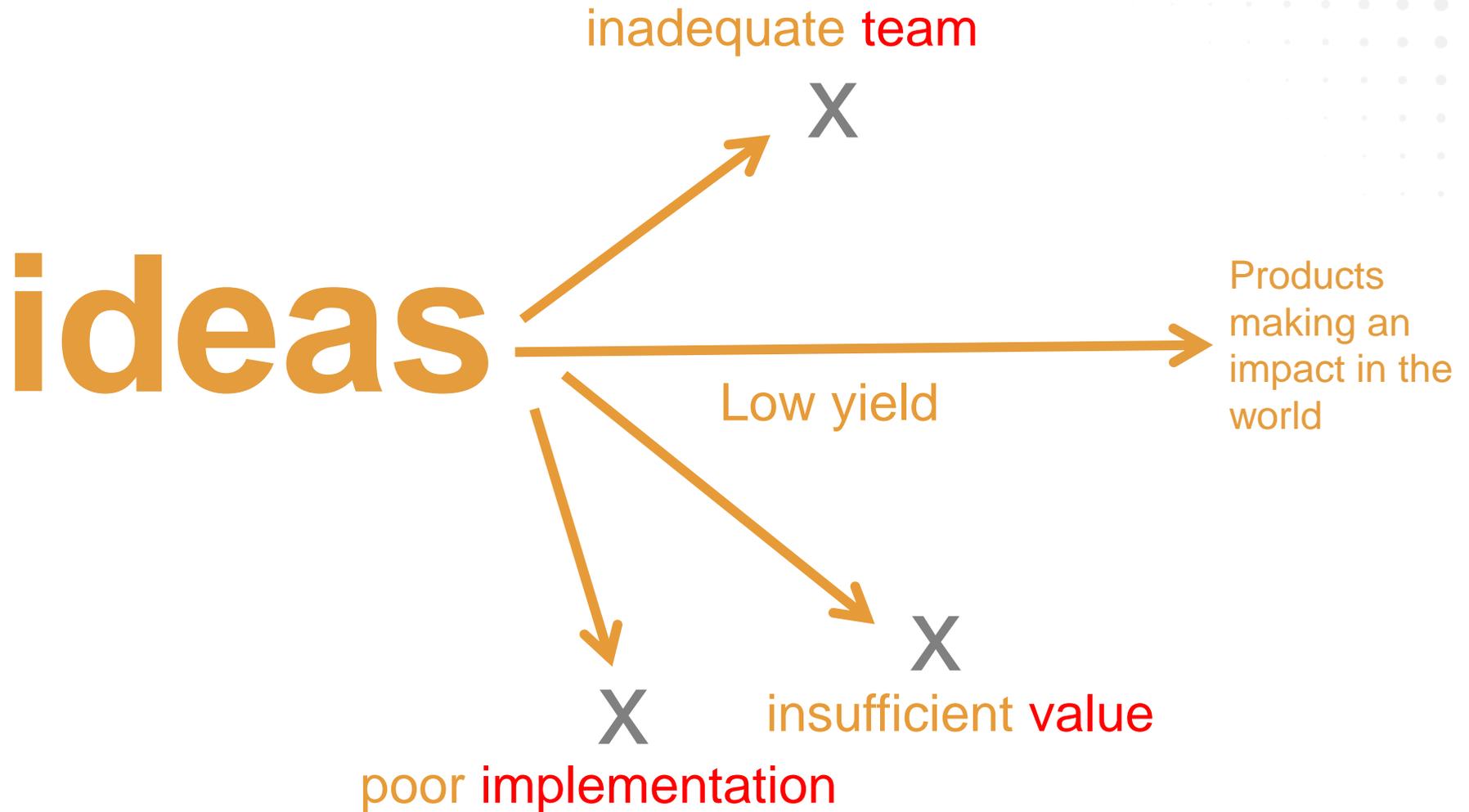
# Measuring ARPA-E's Success



## MOVING TECHNOLOGY TOWARD MARKET

- ▶ Partnerships with other government agencies
  - 37 government projects
- ▶ New company formation
  - 30 new companies formed
- ▶ Established company relationships
- ▶ New communities
- ▶ Products in the marketplace
  - 7 products with commercial sales
- ▶ Follow-on Funding
  - 35 projects have attracted more than \$850 million from the private sector

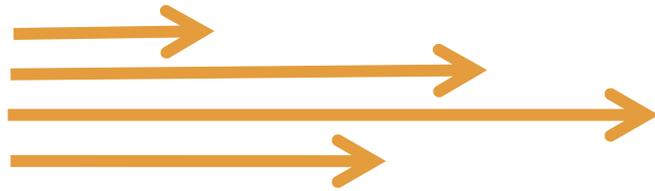
# Improving the Yield



# Changing the Model

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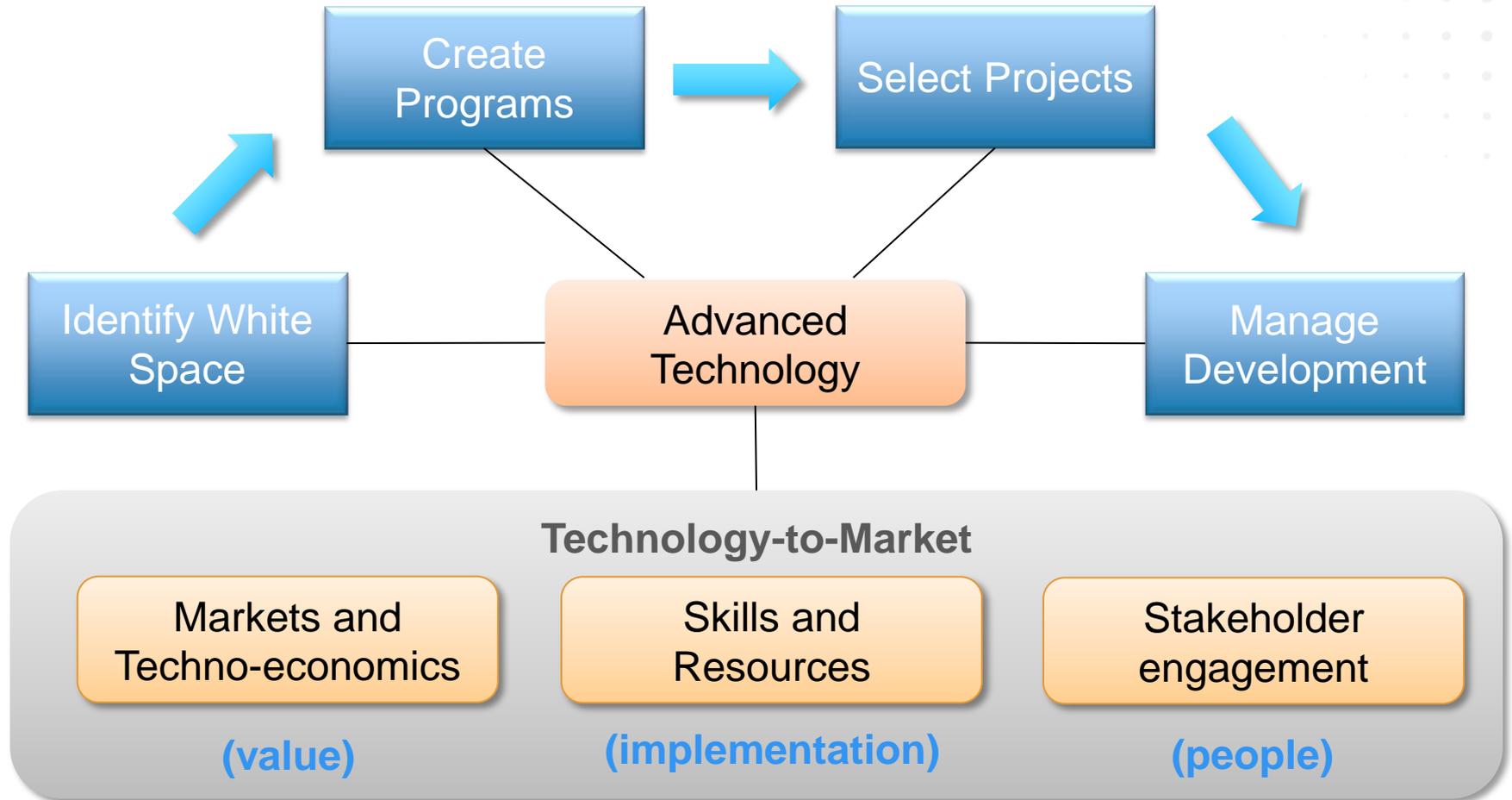
ideas



Products  
making an  
impact in the  
world

- + value
- + team
- + implementation

# Changing the Model



# What we require from you

PROJECT TASKS	YEAR 1				YEAR 2				YEAR 3			
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
A. Update T2M Plan	◆											
B. Advisory relationships established			◆									
C. Conduct Market Assessment				◆								
D. Preliminary cost-performance model					◆							
E. Revise T2M Plan						◆						
F. Define manufacturing, scale-up, and supply chain risks							◆					
G. Define/develop cost-down plan; Revise T2M plan- Identify next stage partners								◆				
H. Identify potential partners and business options									◆			
I. Refine Cost-Performance Model										◆		
J. Complete economic viability assessment; define go-to-market strategy, complete pitch deck(s), and engage next stage partners											◆	
k. Next Stage Partner/Funding secured												◆

# T2M Plan

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- ▶ Overall Transition Plan
- ▶ Intellectual Property Strategy
- ▶ Manufacturing and Scalability
- ▶ Next Stage Funding
- ▶ Team Development
- ▶ ARPA-E Assistance



# IP Analysis

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- ▶ *What is your evaluation of the IP landscape surrounding your technology?*
  - *What IP do you own?*
  - *What about your competitors? Can they limit what you want to do?*
  - *What IP do you expect to create?*

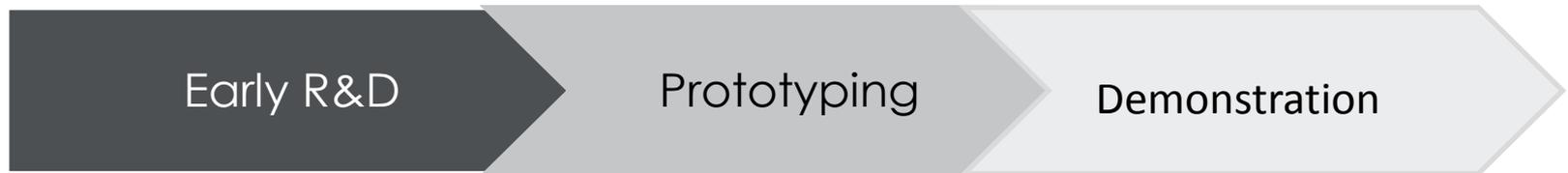
# Techno-economic modeling

## ▸ Expectations

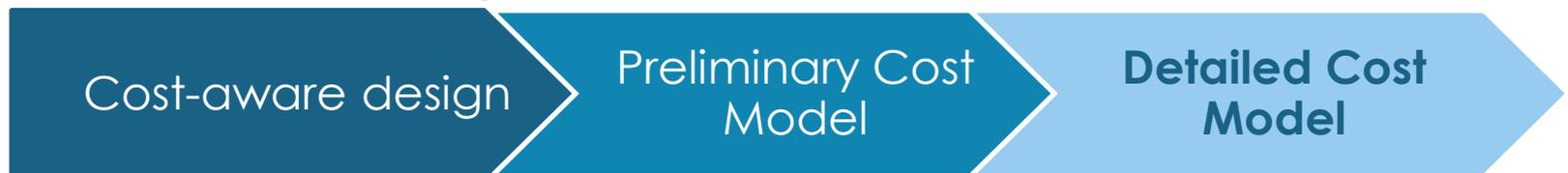
- Customers do *not* expect a perfect cost model
- Customers do need reason to believe value outweigh costs

## ▸ Work in Phases as Technology Develops

### Technology Development



### Cost-Performance Analysis



# Economic Modeling for Technology

## Full Company Financial Model

Cash flow, dynamics of ramping production and varying sales, investments timing

Similar information for other projects competing for resources

## Production Cost Model

Determine resources required for at-scale production

Tabulate material/component flow, labor & energy use, equipment, etc

## *Basic Materials & Process*

Bill of Materials (BOM) – list of “ingredients”

Simple block diagram of production steps

**Most early-stage companies begin with a basic form of “Production Cost Model”**

# Customer/Partner Engagement Plan

## Natural Gas Producers

ExxonMobil  
 Chesapeake Energy  
 Anadarko  
 Southwestern Energy Co.  
 Devon Energy  
 ConocoPhillips  
 BP  
 Cabot Oil & Gas  
 BHP Billiton  
 Encana  
 Chevron  
 EQT Resources  
 Royal Dutch Shell  
 WPX Energy Inc.  
 EOG Resources  
 Occidental  
 Range Resources  
 Antero Resources  
 Apache  
 Ultra Petroleum

## Processing/Gathering Companies

DCP Midstream  
 Enterprise Product Partners  
 Williams Companies Inc.  
 Targa Resources  
 MarkWest Energy Partners  
 Encana  
 Crosstex Energy Services (EnLink)  
 Western Gas  
 Shell Oil Company  
 Devon Energy

## Natural Gas Pipeline Companies

Northern Natural Gas  
 Tennessee Gas Pipeline  
 El Paso Natural Gas (Kinder Morgan)  
 Columbia Gas Transmission  
 Texas Eastern Transmission (Spectra)  
 Transcontinental Gas Pipeline Corp.  
 Natural Gas Pipeline (Kinder Morgan)  
 ANR Pipeline (TransCanada)  
 Southern Natural Gas (Kinder Morgan)  
 Gulf South Pipeline

## Natural Gas Utilities

Southern California Gas  
 Pacific Gas & Electric  
 Atmos Energy Corporation  
 Nicor Gas / AGL Resources  
 Southwest Gas Corporation  
 Consumers Energy Company  
 Public Service Electric & Gas  
 Public Service Co. of Colorado  
 Michigan Consolidated Gas Company  
 Columbia Gas  
 Piedmont Natural Gas  
 The Brooklyn Union Gas  
 Washington Gas Light Company  
 Questar Gas Company  
 San Diego Gas & Electric  
 Consolidated Edison New York  
 Oklahoma Natural Gas Co.  
 Centerpoint Energy  
 Central Illinois Public Service Co.  
 People's Gas Light & Coke

## EPA-Recognized Service Providers

- Apogee Scientific Inc.
- A.R.T. Airborne Natural Gas Leak Detection
- Arkoma Well Analysis and Consulting
- Auburn Environmental
- Boreal Laser Inc.
- COMM Engineering USA
- Contek Solutions, LLC
- First Climate, LLC
- FLIR
- Fluenta Inc.
- Gas Recovery Specialists
- Heath Consultants Incorporated
- Hoerbiger
- Hy-Bon Engineering Company
- Insight Emissions Management
- KJ Environmental Mgt.
- Leak Finder, Inc.
- Platinum Vapor Control
- SCV Environmental
- Smart Environmental Technologies
- Southern Research Institute
- TTE International Inc
- Unico, Inc
- Valerus
- Whirlwind Methane Recovery Systems

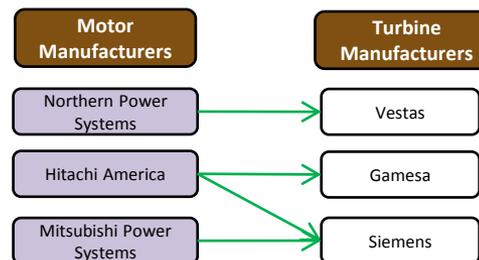
# Market Assessment

## 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

# Market Strategy

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

# What we do for you

## INFORM

Provide awardees with market knowledge to inform their technology

Provide resources on commercialization best practices

Assist awardees in tracking down specific information to overcome knowledge gaps

## CONNECT

Identify and connect awardees to strategic opportunities and valuable resources

Maintain and cultivate a strong network across industry

Identify and make connections as appropriate

## ADVOCATE

Present and highlight ARPA-E projects and technologies to stakeholders across the ecosystem

Identify, highlight and work to mitigate shared commercialization obstacles (regulatory, ecosystem, standards, etc)

# Skills and Resources



- Matthew Nordan, Venrock, “Demystifying Money”
- Steve Blank “The Scientific Method of Customer Engagement”
- Dave Merkoski, Greenstart, “Telling Your Story”
- Michael Ward, Morrison Foerster, “Energy Innovation and IP Strategy”
- Etc.



Curriculum-based program designed to educate early stage technology developers on business model development and the value of customer discovery

# arpa·e energy innovation summit



**Feb. 22-24, 2016 Washington, D.C.**

# Observations

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Thinking from the End  
Is Critical

The Frame Matters

Embracing Information  
Is Essential

Relationships  
Take Time

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# Thanks!

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