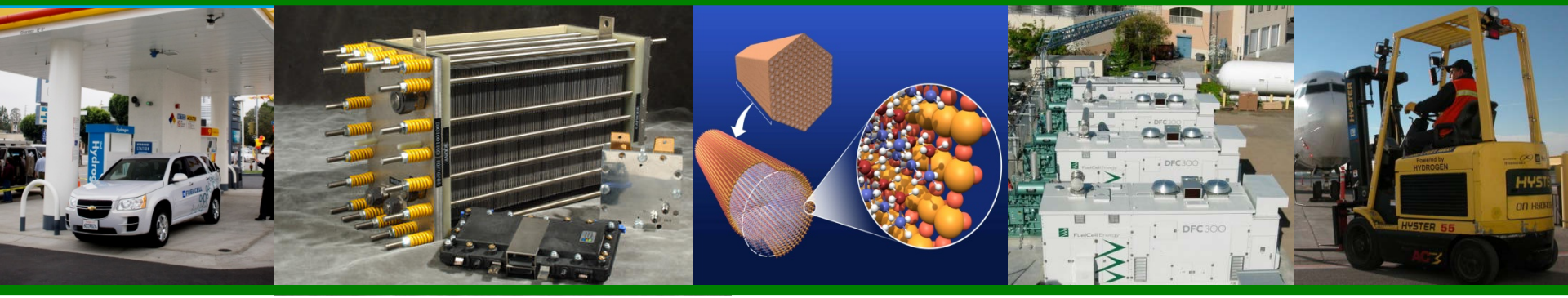
U.S. DEPARTMENT OF ENERGY



# Market Transformation
# - Plenary Presentation -

*Pete Devlin*

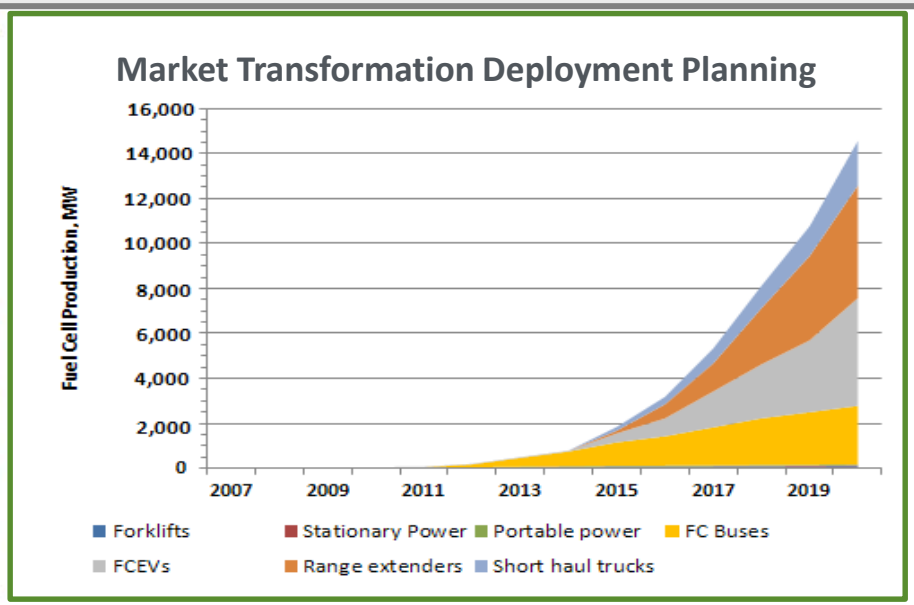
***2016 Annual Merit Review and Peer Evaluation Meeting***
***June 6 - 10, 2016***

# Goals and Objectives for Market Transformation



## Objectives

- Increase fuel cell markets by developing and deploying various applications and increase hydrogen fuel demand.
- Catalyze key implementation projects and partnerships with federal, state, and local governments and other stakeholders.
- Develop technical-economic analysis and business cases associated with early markets and infrastructure.


http://www.navigantresearch.com/research/

***GOALS: Accelerate technology utilization growth for domestically produced hydrogen and fuel cell systems. Lower fuel cell life cycle costs by reducing deployment barriers.***

# Challenges

- To test emerging applications at the Technology Readiness Level (TRLs) 7-10 level to expand user and servicing expertise

TRL #7 Operational Environment System Demonstration → TRL #8 Pre-commercial System Demonstration → TRL #9 Ready for Commercial Deployment → TRL #10 Program Management & Market Development/ Support Activities

- To test new technology applications in user operating conditions to establish baseline energy efficiency and reliability performance and determine commercial viability

**Examples:**

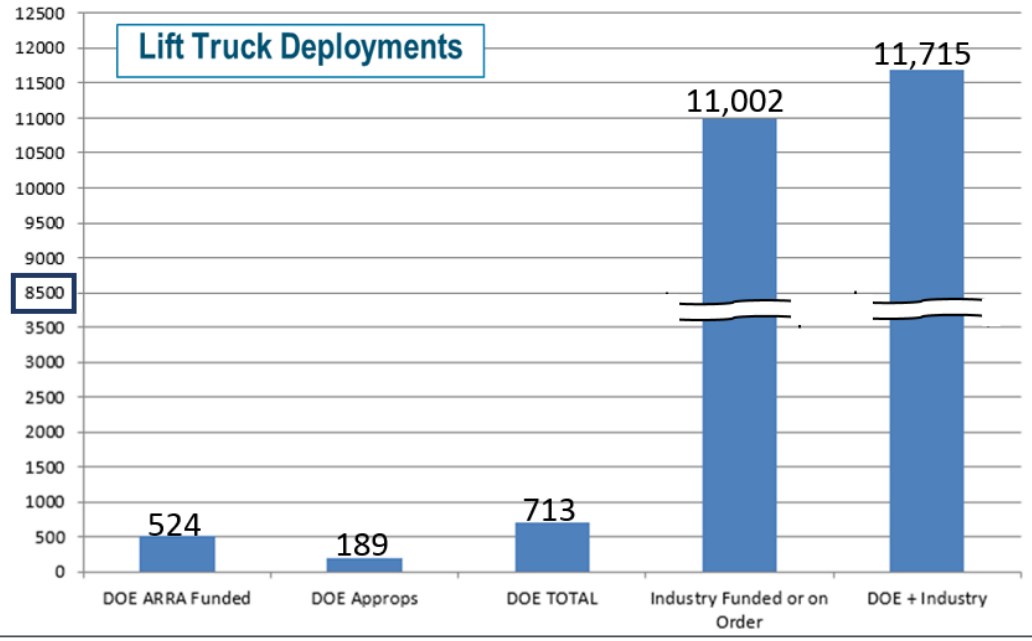
***A 1-kW fuel cell system providing power for this FAA radio tower near Chicago***

(Photo courtesy of ReliOn/Plug Power)


***Material Handling Equipment at work in U.S. airports***
(Photo courtesy of Hydrogenics)

# Market Transformation Deployments



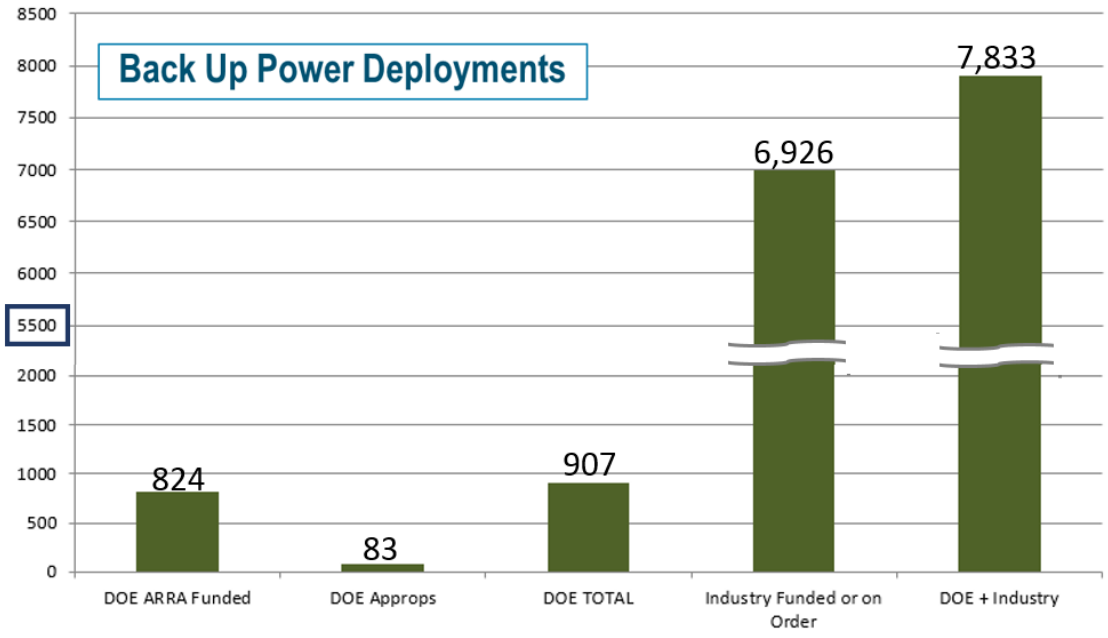



The successful deployment of 713 DOE fuel cell material handling units has led to over 11,000 industry purchased and on order units with no DOE funding.

***32% increase from prior total (8,340)****

The funding of 907 DOE fuel cell back up power systems has led to nearly 7,000 industry installations and on-order backup power units with no DOE funding.

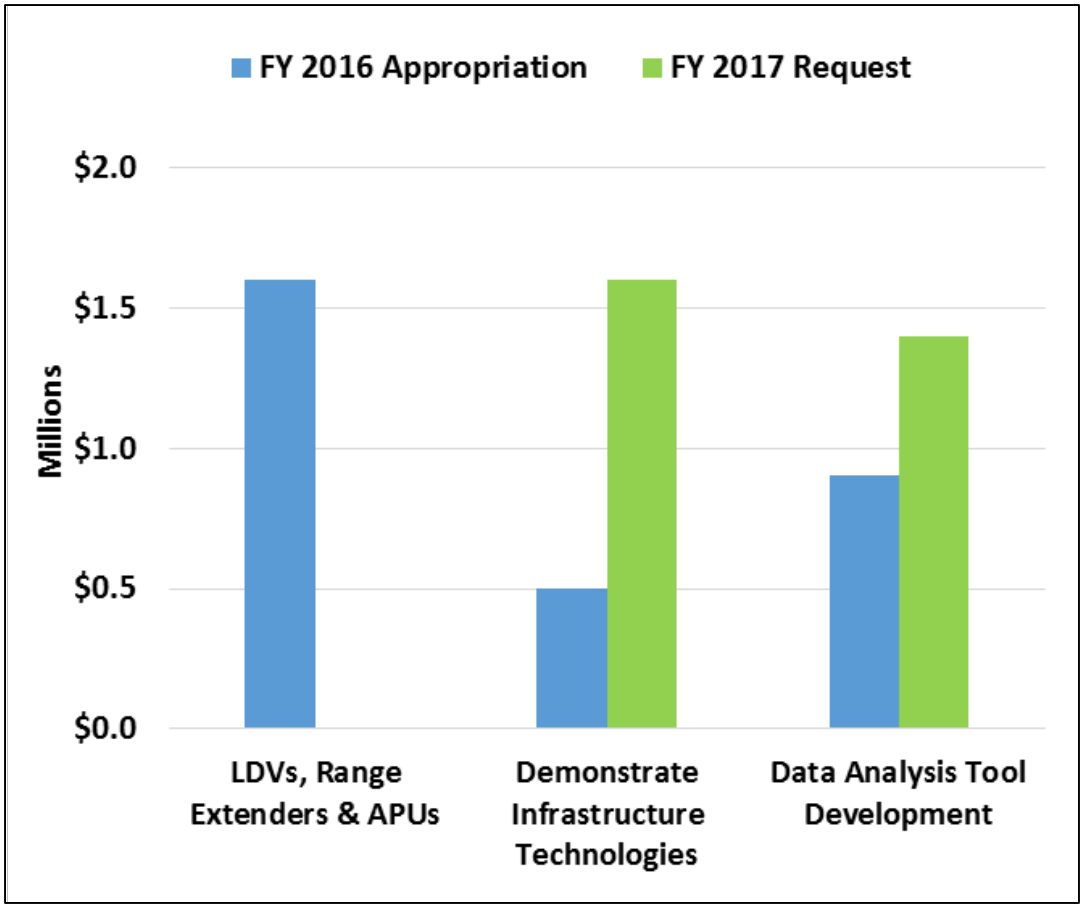
***24% increase from prior year total (5,568)****




* Pending data records updates

# Market Transformation Budget

**FY 2016 Appropriation = $3.0 M**
**FY 2017 Request = $3.0 M**




## EMPHASIS

- Conduct airport cargo tow tractor demonstration and analyze business case
- Conduct LDV range extenders and truck APU projects
- Conduct infrastructure technology demonstrations
- Develop tools and business cases with total transportation solutions

# Highlights

**BEV-FC to extend range for commercial vehicle applications being initiated**


**Airport cargo tow tractor fleet demo results:**

- 1,831 fills
- Over 22,000 runtime hours
- 41,168 starts


**Maritime pierside power (100 kW) demonstration completed:**

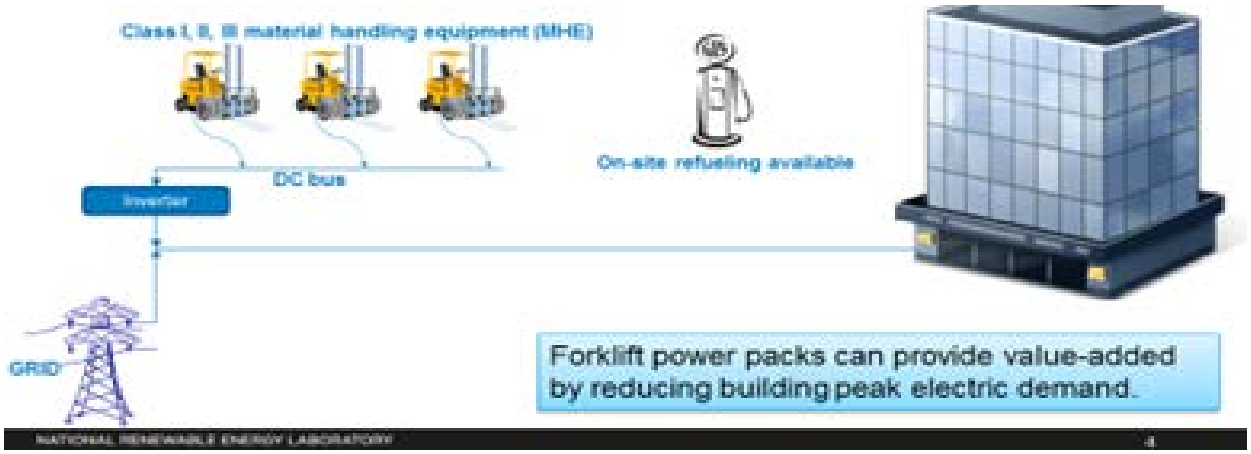
- 6 months operations
- 450 kgs H2 fuel dispensed

# Highlights

**BEV-FC MDV parcel delivery truck for added range being developed and demonstrated**


**Designed and conducted techno-econ analysis for fuel cell bucket truck**

**Analyzed business case scenario using idle fuel cell lift trucks or cargo tractors for peak shaving has potential business case**

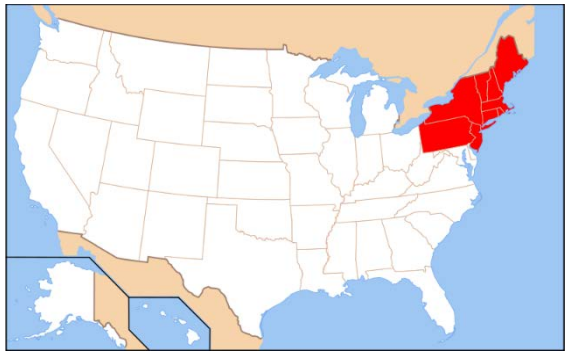



Webinar link: http://energy.gov/eere/fuelcells/downloads/webinar-analysis-using-fuel-cell-material-handling-equipment-shaving-peak

# Highlights

- **Renewable H2 Station in Hawaii**
  - Conducted NFPA-2 workshop on-site, obtained plan approval, permits, and construction underway for 8/16 completion


- **Site Specific Technical Economic Analyses**
  - Hawaii, Connecticut, Massachusetts, New York
  - Showed potential business cases



- **North East States Infrastructure Technical Assistance**
  - Conducted education webinar for New York City Department of Citywide Administrative Services
  - Conducted market transformation and safety classes in New York City, Long Island, and Boston with over 100 state and local fire and building code officials
  - Educated on market transformation and safety fire marshals and code officials in Connecticut, Massachusetts, New Jersey, New York, and Rhode Island

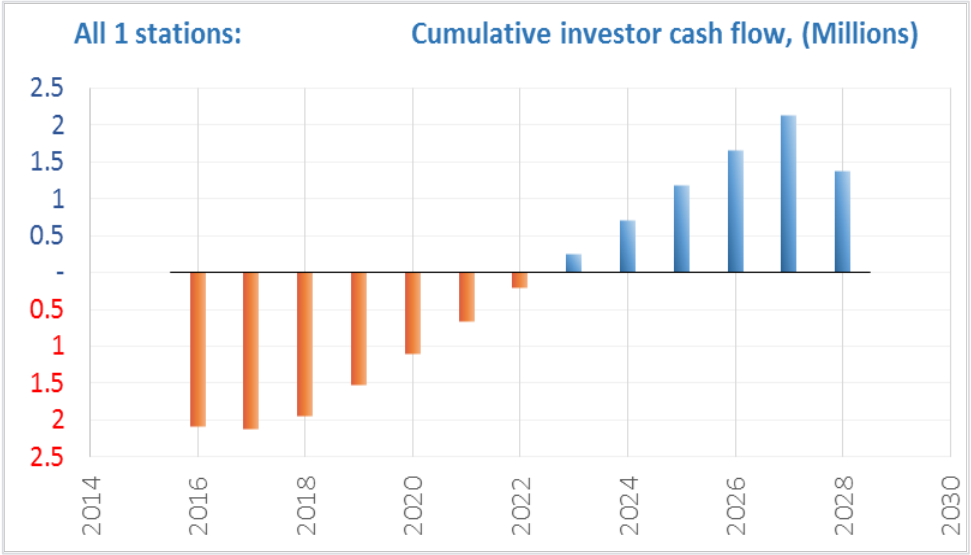
# New Strategies

- Strategies to reduce commercial risks to ensure high hydrogen and system utilization and reliability
- Business data from operating experience and development of replicable business cases

Example: Assess Car Sharing (CS) as Early Market for LD FCEVs

Strategic Factors Include:

- CS subscriptions nationwide nearing 1 million
- Popular with urban areas
- Continuous development of new apps e.g. fuel reserving
- Policies in ZEV mandate states & cities

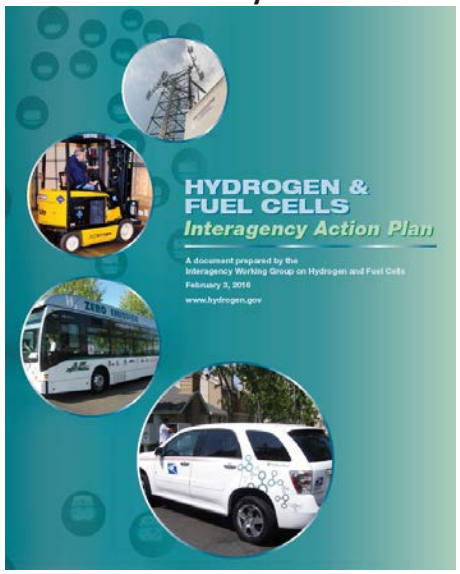


# Interagency Working Group on Hydrogen and Fuel Cells (IWG)



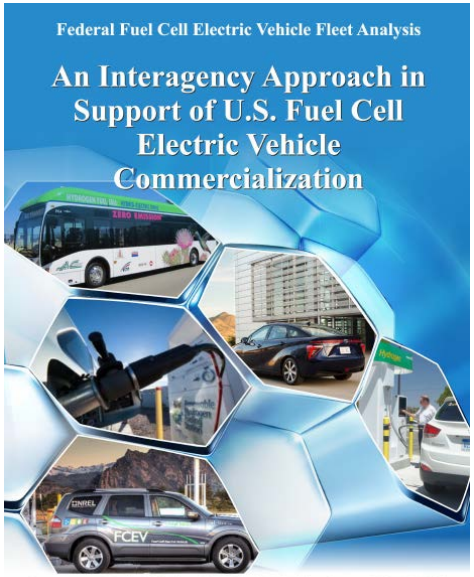
## Interagency Action Plan

- Published December 2011, updated in 2015
- Agencies came together to delineate responsibilities and explore leveraging opportunities
- New version coming online this year



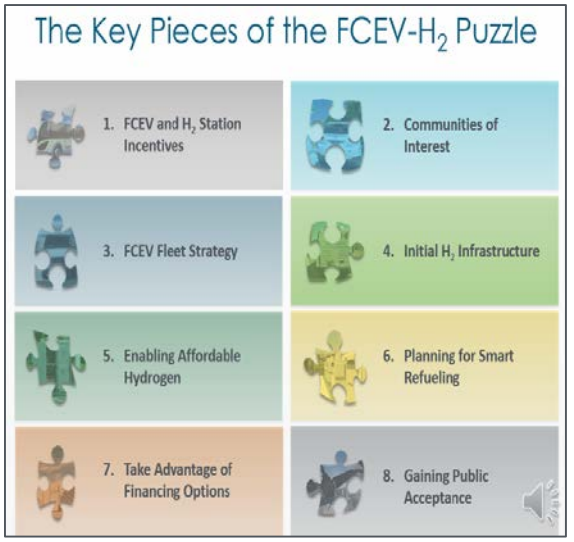

## Federal FCEV Fleet Analysis

- Developed IWG report that describes a Federal fleet program strategy
- Strategies show locations and quantities for near term deployment



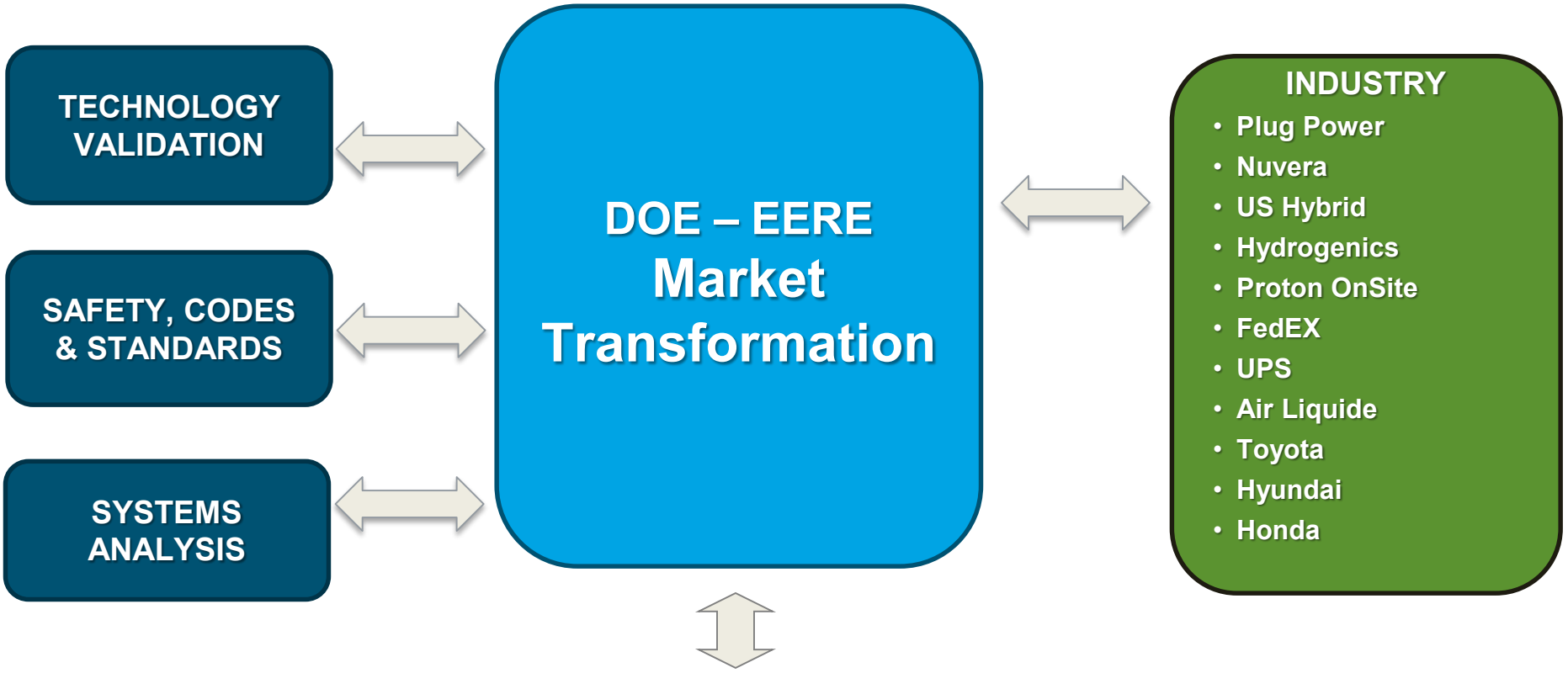

## Infrastructure Briefing

- Completed an animated briefing outlining basic steps necessary to bring fuel cell transportation into local communities.
- IWG and states helped create guide - existing tools and best practices



# Collaborations






*Applied R&D is coordinated among national and international organizations*

# Recent and Upcoming Activities



### Early Markets

- Up-take in fuel cell-based forklifts and back-up power systems continues strong annual growth.
- Commercial introduction in emerging applications such as cargo tractors and truck APUs in target regions is underway.

### Road Vehicles

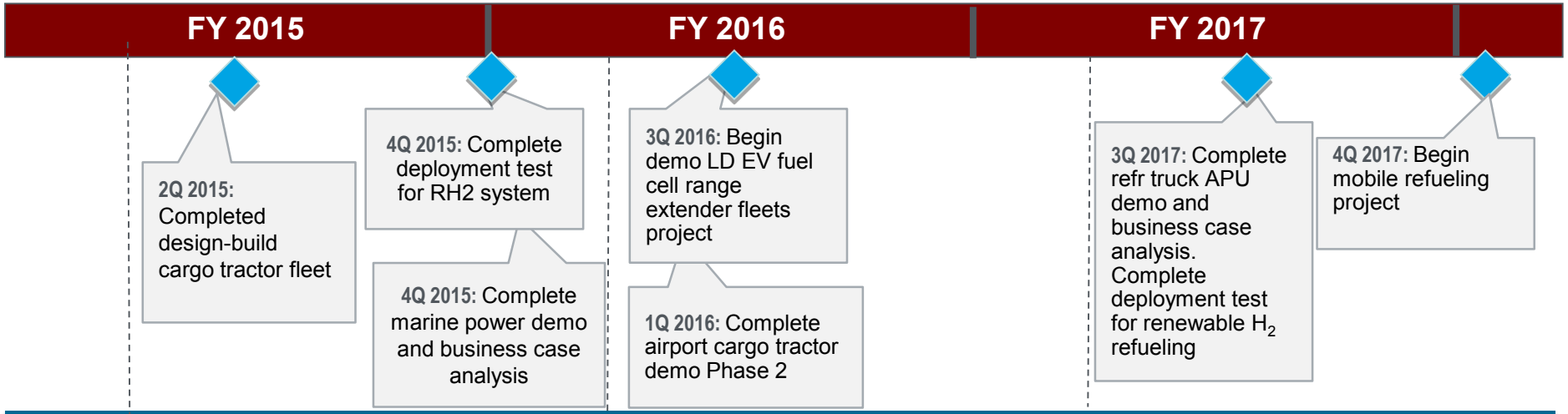
- Develop and demonstrate both medium and light duty EV range extender trucks in commercial operations such as parcel delivery, dispatchable services, and urban passenger services e.g. car sharing.

### Refueling Infrastructure

- Working with H2USA partners to plan and deploy infrastructure through site-specific business case analyses, vehicle demonstrations, and novel refueling technology demonstrations such as mobile refuelers.

***UPCOMING:***

- **Fuel Cell Electric Truck Targets RFI to be issued June 2016**
- **Lab Call with MT Topic to be issued this Summer**




***New investments in critical areas of early markets and infrastructure to support FCEV commercialization.***

# Contacts

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