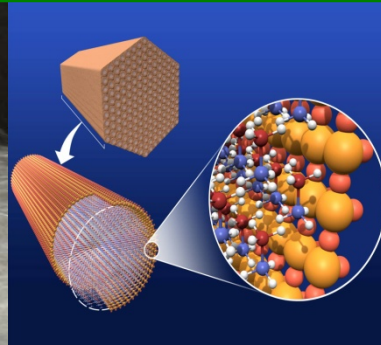




U.S. DEPARTMENT OF
ENERGY



Market Transformation - Plenary Presentation -

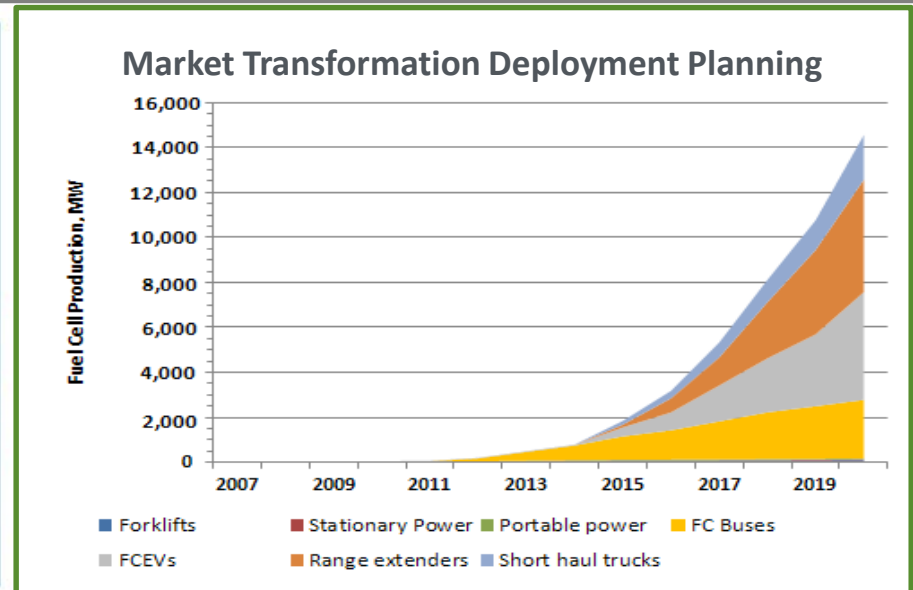
Pete Devlin

*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.

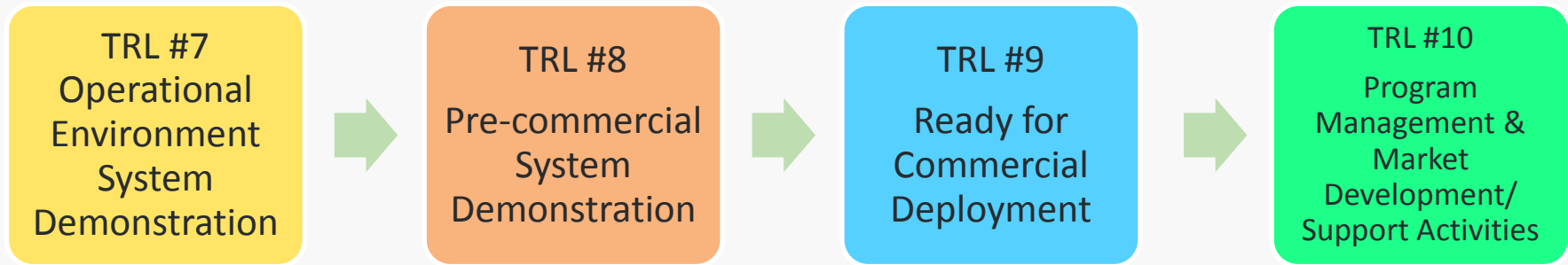


<http://www.navigantresearch.com/research/>

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



- 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

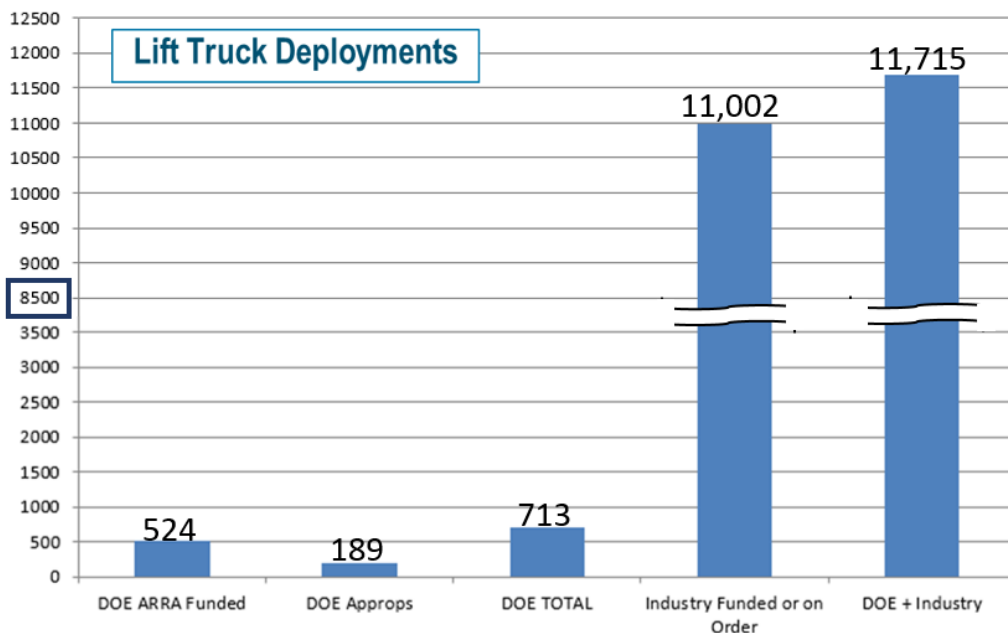
(Photo courtesy of ReliOn/Plug Power)



Material Handling Equipment at work in U.S. airports

(Photo courtesy of Hydrogenics)

Market Transformation Deployments

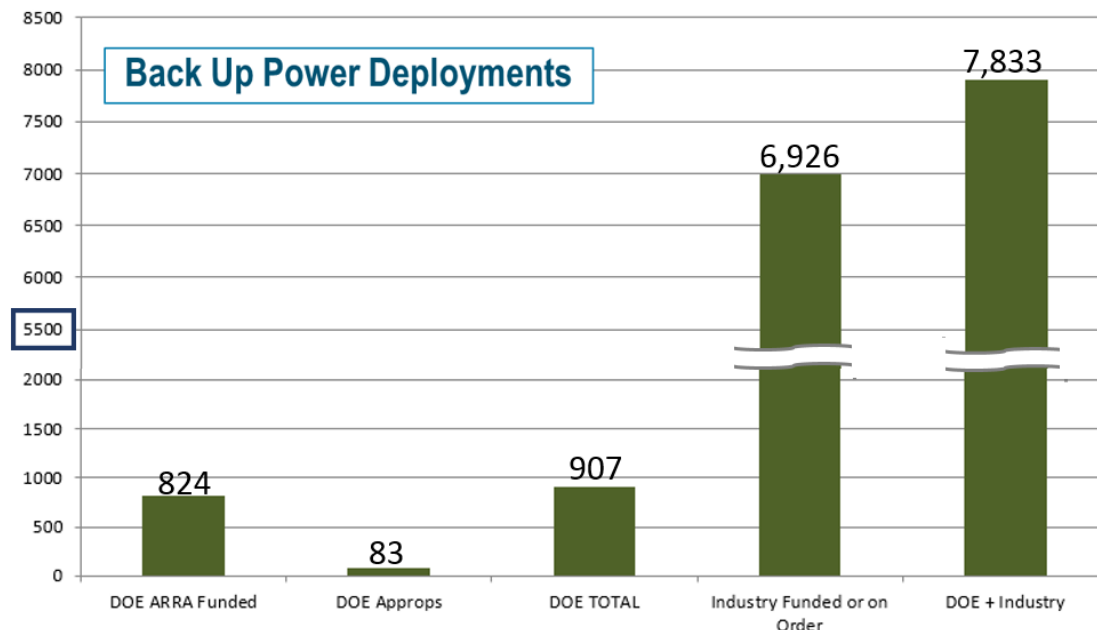


The successful deployment of 713 DOE fuel cell material handling units has led to over 11,000 industry purchased and on order units with no DOE funding.

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)*

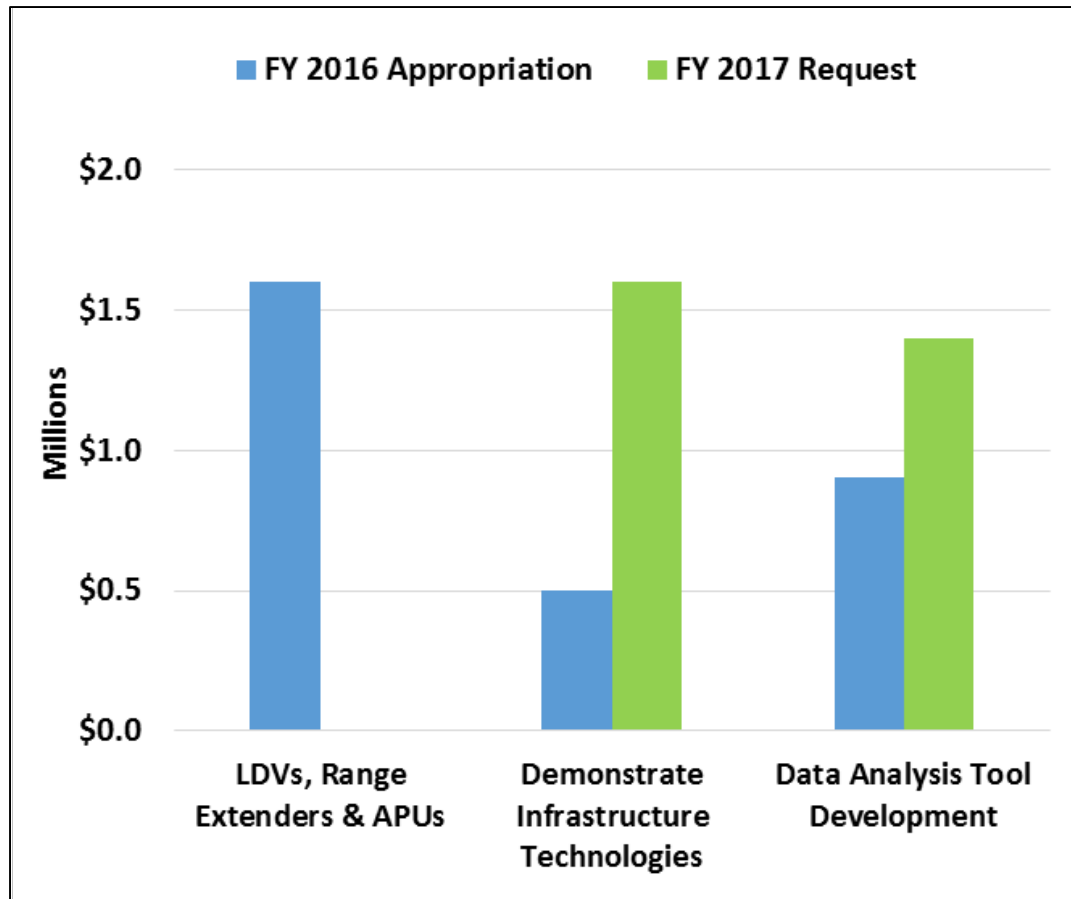


* Pending data records updates

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

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

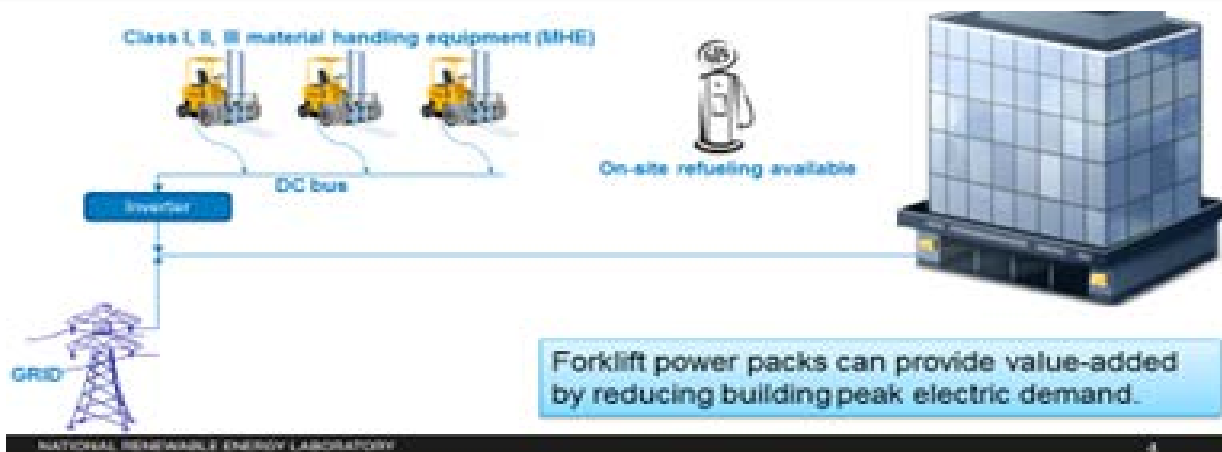
BEV-FC MDV parcel delivery truck for added range being developed and demonstrated



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



- **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

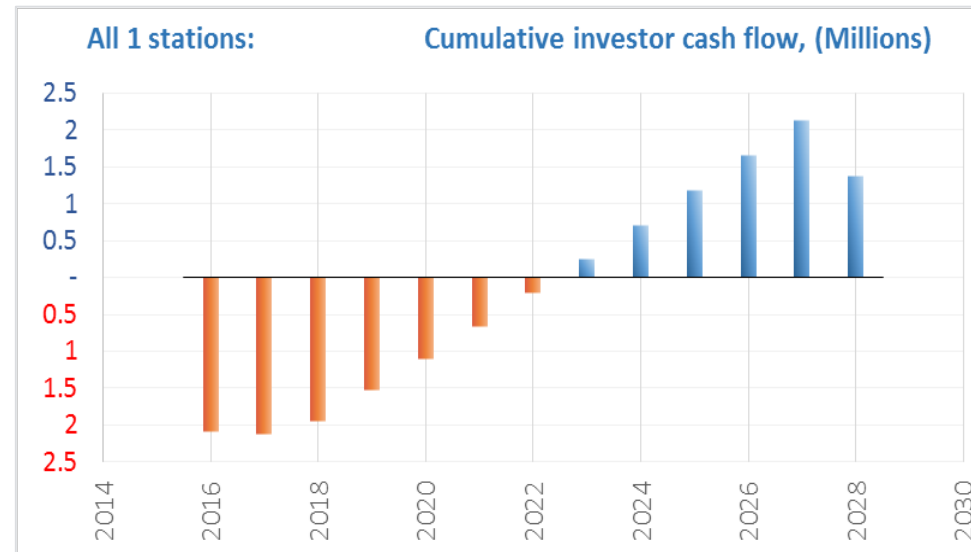


- Strategies to reduce commercial risks to ensure high hydrogen and system utilization and reliability
- Business data from operating experience and development of replicable business cases

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

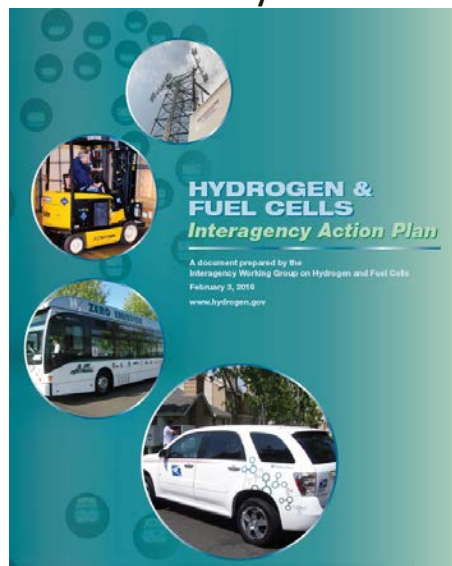
Strategic Factors Include:

- 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



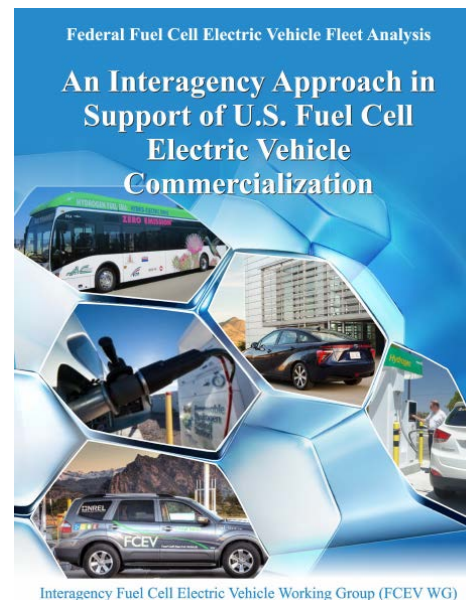
Interagency Action Plan

- 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

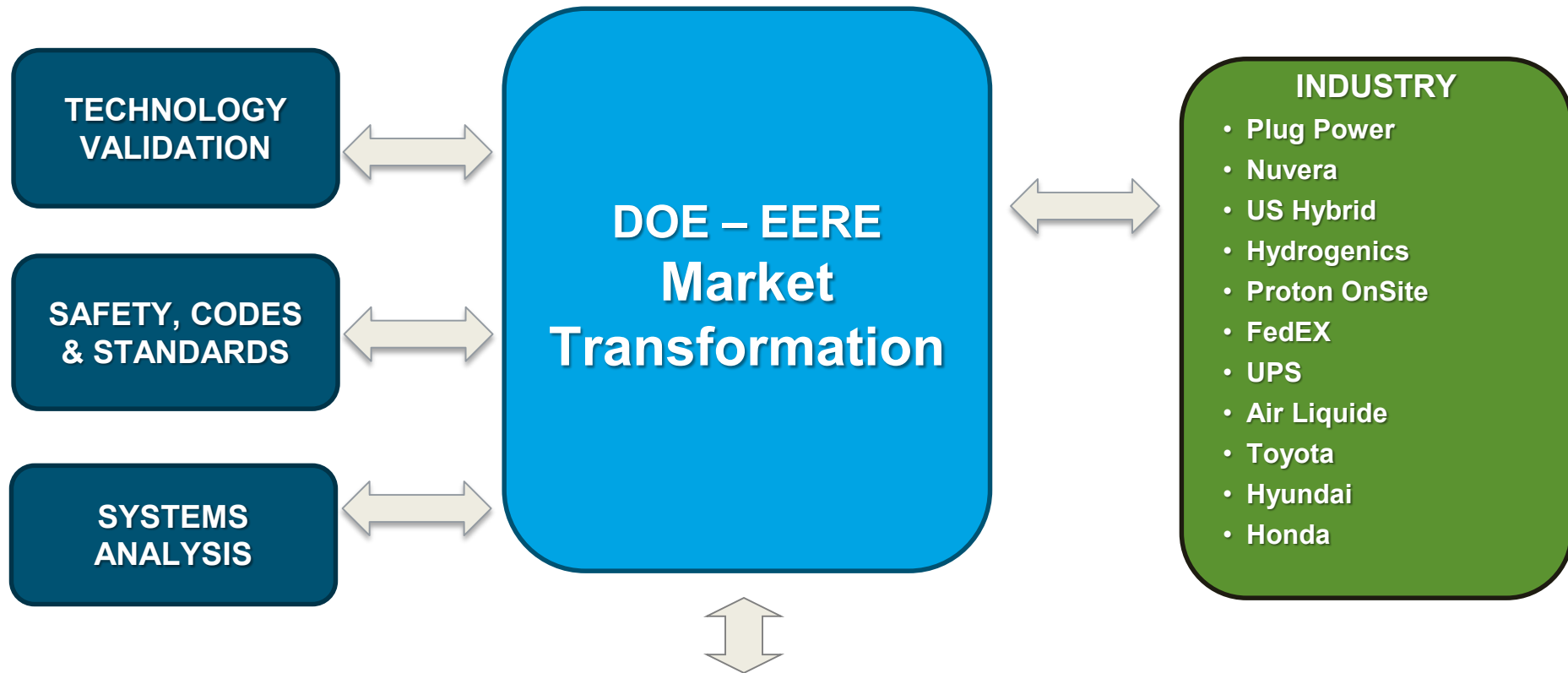


Infrastructure Briefing

- 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

The Key Pieces of the FCEV-H₂ Puzzle





National Collaborations (inter- and intra-agency efforts)

EPA, SCRA

DOT – MARAD
and FTA

DOD – ARMY,
NAVY, USMC,
USAF

HCATT,
CCAT

NPS, GSA

H2USA,
IWG

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

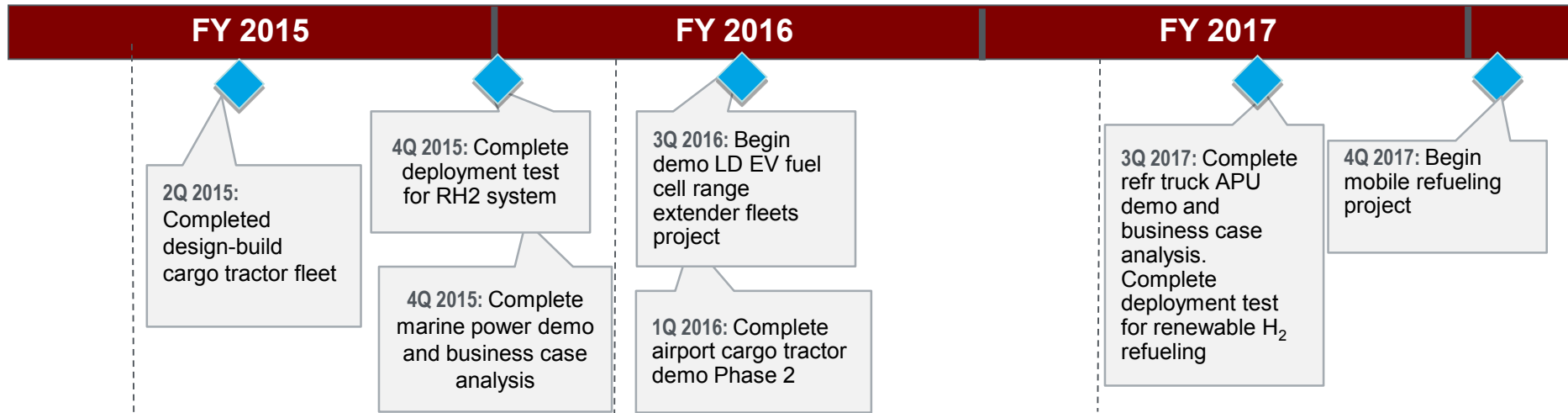
- Develop and demonstrate both medium and light duty EV range extender trucks in commercial operations such as parcel delivery, dispatchable services, and urban passenger services e.g. car sharing.

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.

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