

Evaluation of U.S. DOE Energy Recovery Act Fuel Cell (Technologies Program) Initiative (ARRA-FCI)

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Arlington VA

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Project Objective

To conduct an evaluation to assess the early stage "market change" impacts of the Fuel Cell (Technologies Program) Initiative of the American Recovery and Reinvestment Act (ARRA-FCI) to accelerate fuel cell deployment and commercialization



Overview

Timeline

- Project start date: 1 Jan 2012
- Project end date: 31 Dec 2012
- Percent complete: 40%

Budget

- Total project funding
 - DOE share: \$250,000
 - Contractor share: \$0
- Funding received in FY11: \$0
- Funding for FY12: \$250,000

Barriers addressed

- Advancement of Technical Readiness
- Demonstration and Deployment of FC Products in Commercial End User Environment

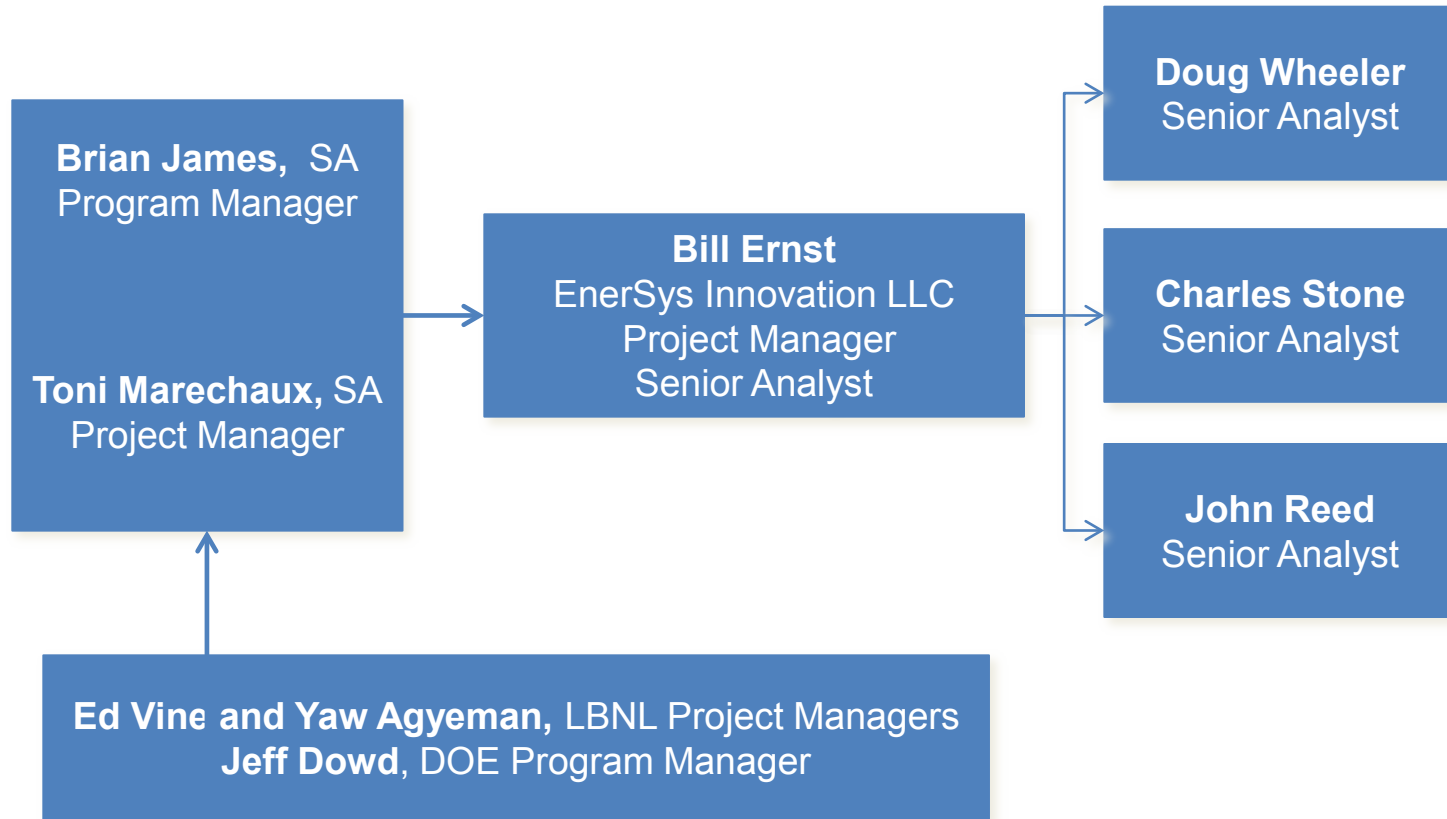
Partners

Senior Analysts

- Bill Ernst, EnerSys Innovation LLC
Project Manager
- Doug Wheeler, DJW Technology LLC
- Charles Stone, Eon Consultants Ltd.
- John Reed, Innovologie LLC



Team Structure



Project Objectives

Evaluate:

- Direct and indirect impacts of the ARRA-FCI on grantees in early fuel cell markets
 - Direct impacts: units fielded or sold
 - Indirect impacts: orders, unit cost, quality, performance, acceptance by end users, system integrators, codes and standards improvements, etc
 - Markets: Materials handling equipment (MHE), prime power (backup, and CHP), auxiliary power, and portable power
- Spillover impacts of the ARRA-FCI on others in the fuel cell industry
 - Replication: additional units purchased by end users for the site or other sites
 - Emulation: non-grantees sales and orders, etc
- Follow-on impacts of the ARRA-FCI along first-tier supply chain vendors
 - Follow-on impacts: component supplier (fuel and component) production volume, cost, quality, performance, etc



Project Objectives (cont'd)

Assess the net impact specifically attributable to the ARRA-FCI:

- Determine the early market baseline pre-ARRA-FCI
- Identify observable changes from the pre-ARRA-FCI baseline
 - Examples include: system deployments, number of users, purchase volume, availability, manufacturing rate, cost reduction, product reliability, etc
- Identify those changes that are a direct result of the ARRA-FCI investment
- Identify those market changes that cannot be attributed to the ARRA-FCI investment



Project Objectives (cont'd)

Search out defensible quantitative data, whenever and wherever possible, both pre- and post-ARRA-FCI, including:

- Type and availability of systems and associated OEMs for the four key product markets
- Identification of pricing, production volume, purchase volume and type of systems and their changes over time for the four key product markets
- Rate of increase in the availability of affordable fuel cell systems, and in the number of companies using fuel cell-powered systems
- Utilization/evaluation of DOE / NREL Composite Data Product (CDP) which reports public technical analysis results from DOE's Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project

Perform limited evaluation of jobs, based on self-reported information from participating companies, to provide a preliminary indication of gross job impacts



Evaluation Design

Evaluation Design Elements

The evaluation design is the strategy that permits defensible findings to be deduced from the evaluation data. It consists of:

- Development of market and logic models
- The metrics and measures from which structured questions will be developed to collect data from interviewees
- Collection and analysis of existing data from secondary sources
- Prioritization of participants to be interviewed:
 - Grantees according to funding level
 - Deployment projects > Demonstrations > R&D projects
 - OEMs, system integrators and end users have priority over supply chain vendors
 - Non-grantees at the end user, system integrator and OEM level to provide market baseline and support data for grantee interviews, as budget allows
- In-depth interviews to collect data from awardees, non-awardees, program and market stakeholders
- Analysis methods used to determine the net impact of the ARRA-FCI funding



Evaluation Design Considerations

The key to defensibility is clear identification of metrics, measures, events, timelines, grantees, non-grantees, secondary sources and use of highly structured questions during in-depth interviews

- Have both a retrospective and contemporary focus
- Identify key measures of program, market support, and change
- Produce defensible quantitative results and qualitative results
- Describe, quantify, and minimize internal factors that might explain the outcomes
- Describe and account for external factors that could provide an alternative explanation for the outcomes
- Attribute the outcomes to the program instead of to other influences
- Learn from non-grantee behaviors



8 Tasks and Status

T1: Initiate project	Complete
T2: Gather initial data	Complete
T3: Evaluation Plan with Logic Model	Complete
T4: Collect, analyze, and report data	In process
T5: Prepare draft and final reports	
T6: Brief DOE	
T7: Provide project management	
T8: Report project status	



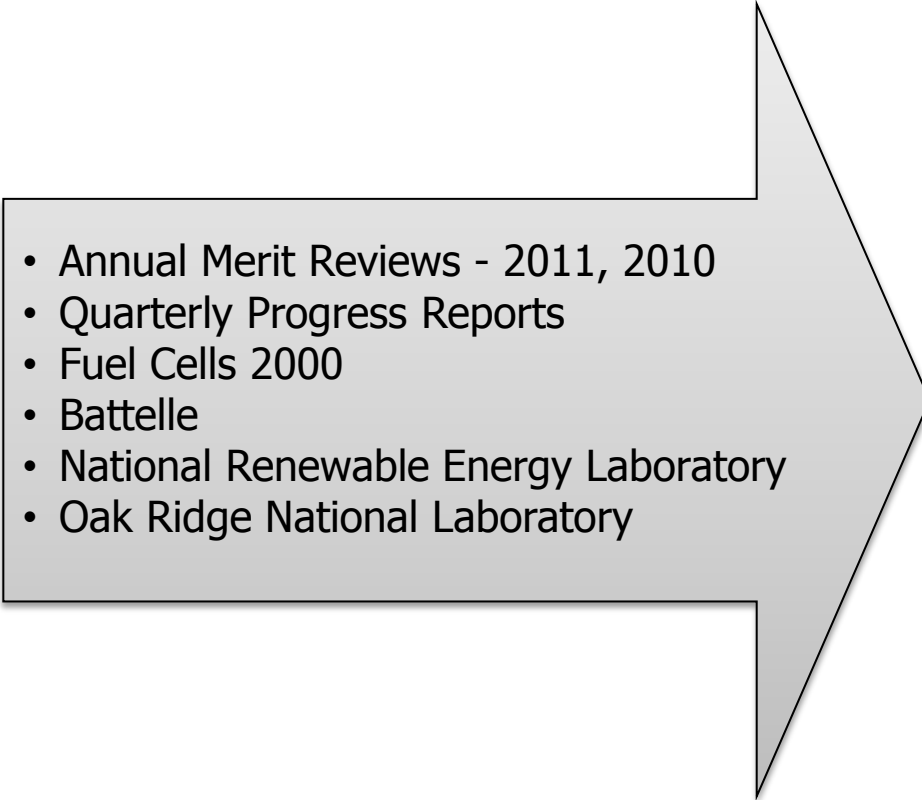
Task 1 & 2 Initiate Project and Gather Initial Data

- Objectives
 - Hold kickoff Meeting
 - Conduct initial and critical reviews of key documentation and other data
 - Prepare structured questions for Program Manager (PM) and Key Stakeholder interviews
 - Conduct interviews and meetings with DOE PM and Key Stakeholders to determine/refine perspective models, theories and evaluation plans for market assessment
 - Summarize and document results
 - Coordinate with stakeholders and other players throughout program
- Deliverable:
 - List of material reviewed, people interviewed, and findings

Complete



Task 2 Review of Secondary Data

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- Annual Merit Reviews - 2011, 2010
 - Quarterly Progress Reports
 - Fuel Cells 2000
 - Battelle
 - National Renewable Energy Laboratory
 - Oak Ridge National Laboratory

What we have learned so far:

- Fuel cell forklifts have moved well past demonstration stage to commercial sales
- ARRA-FCI helped deploy 465 fuel cell powered forklifts
- Many purchases made outside ARRA-FCI
 - > 2,000 fuel cell forklifts deployed or on order
- Major companies purchase forklift trucks
 - Coca-Cola (70+), Proctor & Gamble(200), BMW Manufacturing (85+), Sysco (600+), Whole Foods (60+)
 - Many purchase made post-ARRA-FCI funding
- Forklift manufacturers offering fuel cells as part of catalog items
 - Crown Equipment offers 29 qualified fuel cell – forklift combinations
- NREL reports total cost of ownership for fuel cell forklifts less than battery forklifts
- ARRA-FCI helped deploy 365 Backup power fuel cells for telecommunications
 - AT&T (259+), Sprint (250+)
 - Additional purchase outside of ARRA-FCI funding



Task 3 – Evaluation Plan with Logic Model

- Objectives
 - Using Task 2 results and the ARRA-FCI program and market theories, draft the logic model and the market model
 - Consider meritorious alternative theories and possible market changes for four impacted fuel cell industry entities (OEMs, system integrators, end users, and supply chain vendors)
 - Identify early market metrics for analysis collectable from project grantees and others, as needed
 - Revise and finalize the draft models and plans as needed
 - Determine question sets for study population
 - Complete Evaluation Plan after Peer Review coordinated by LBNL
- Deliverables:
 - Evaluation plan, including logic model and market model, program performance, and early stage market metrics and measures
 - Structured evaluation questions

Peer Review Complete



Approach - Logic Model



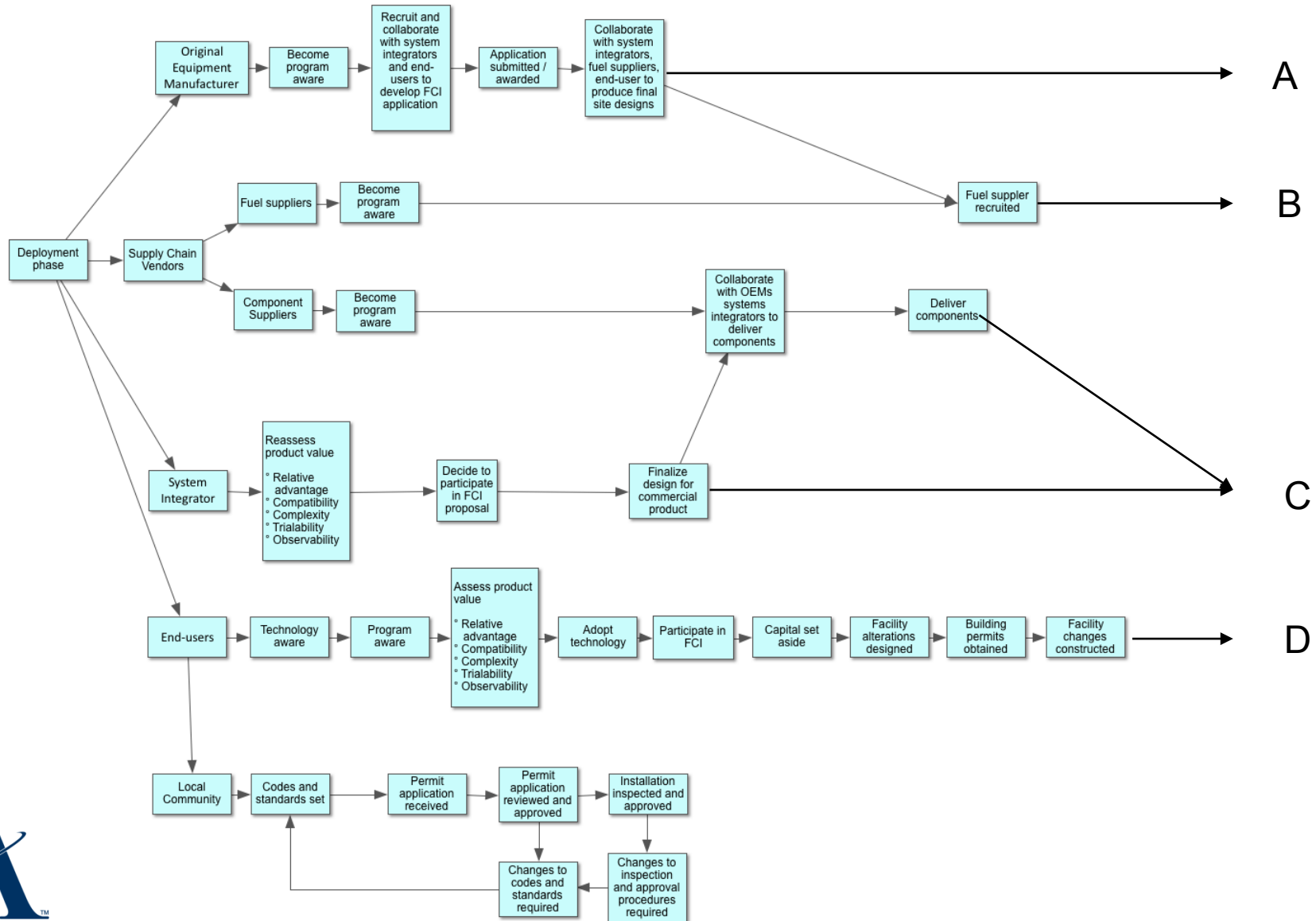
Timeline: These may occur on many time scales, some immediate and some stretching over multiple rounds of product and market advances



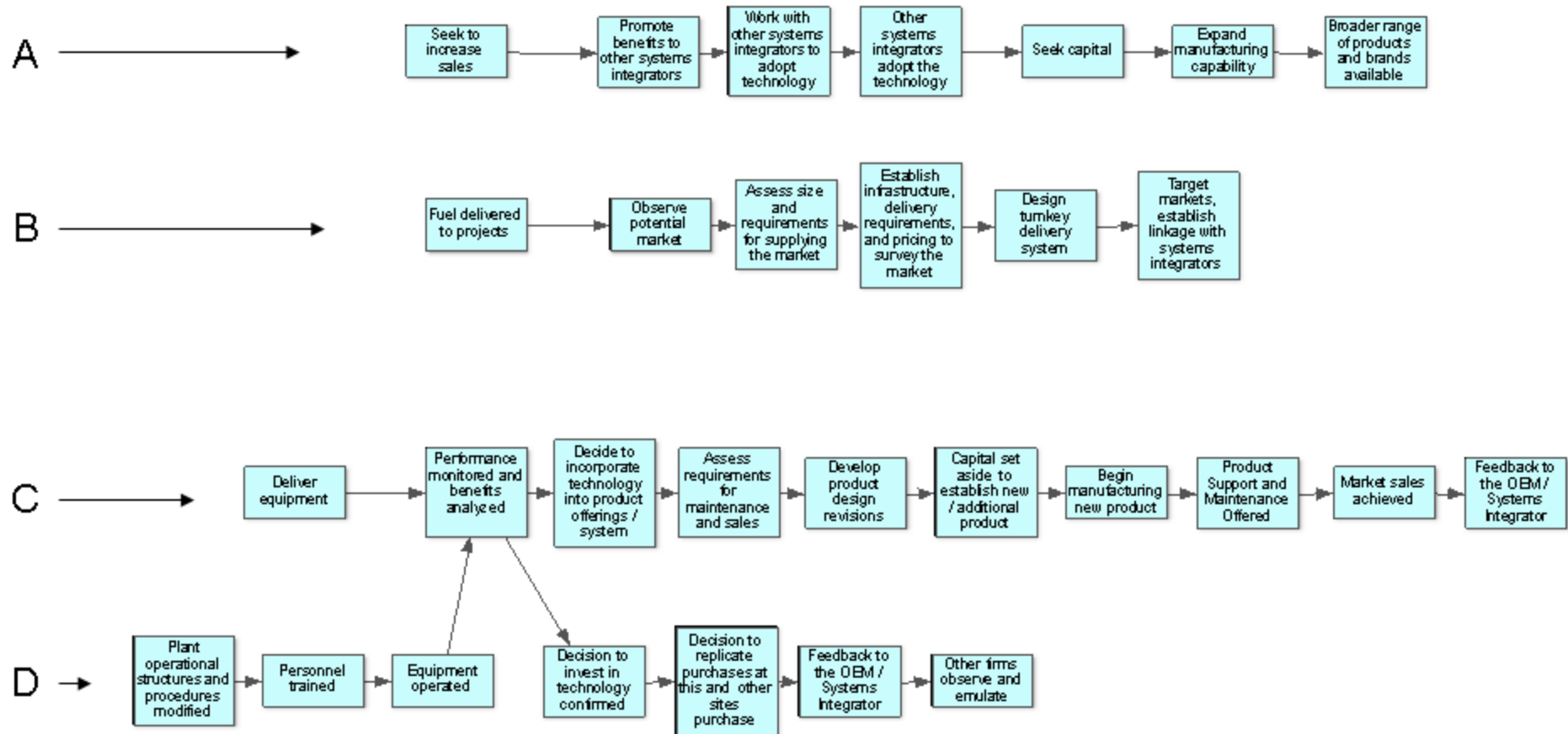
Approach – Market Model

- Applications
 - MHE, prime power, auxiliary power or portable
 - Prime power application includes: backup, backup-72 hrs, generator set and CHP
- Grantee commercialization phase
 - Depends on market status, technology maturity and manufacturing development
 - **Deployment phase** - Projects with a well-defined relationship between the resources, activity and output that are expected to achieve the effects and outcomes intended by the ARRA-FCI program (six projects, 61% of funding)
 - **Demonstration phase** - Pilots and field trials that are completed prior to deployment (three projects, 22% of funding)
 - **R&D phase** - Laboratory development (three projects, 17% of funding)
- Key market parameters
 - Product features, product portfolio, customer perception
 - Cost/volume, improvements in manufacturing processes
 - Fueling infrastructure, partnerships
 - Pricing, market introduction, market penetration
 - Barriers, incentives

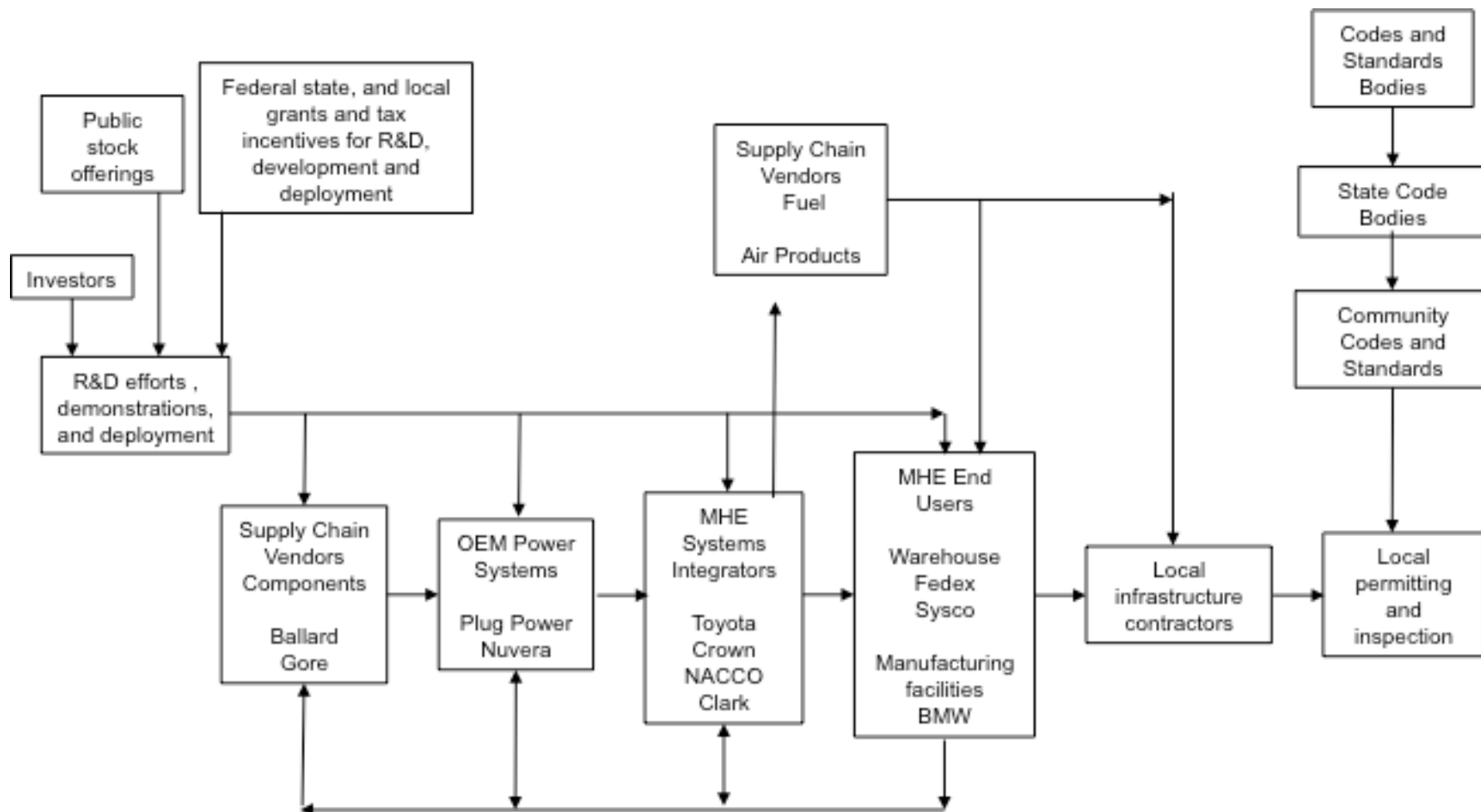
Logic Model Example - Deployment Phase



Logic Model Example - Deployment phase (continued)

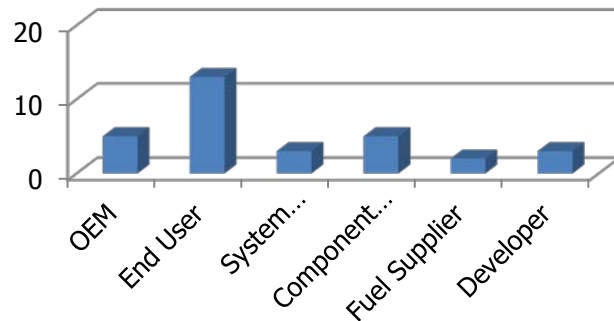


Market Model Example - MHE application

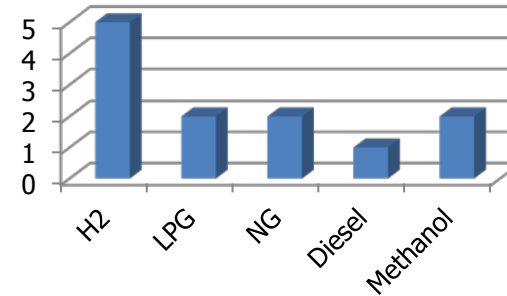


Approach – Grantee Evaluation Populations

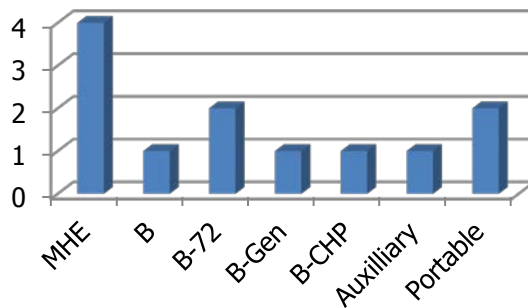
Potential Interviewees



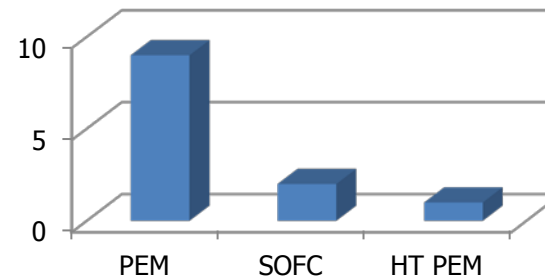
Fuel Types



Applications



Fuel Cell Types



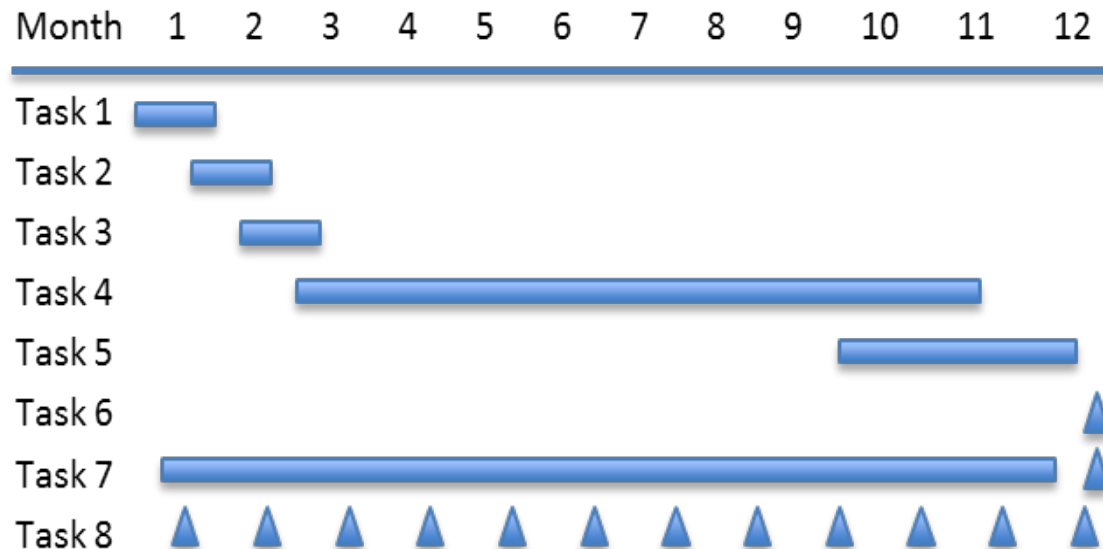
Approach - Structured Questions Development

- Priority given to MHE and backup (per their commercial maturity)
- Questions based on key metrics from logic model and market model:
 - Units of products sold
 - Product value
 - Incentives for product sales/services
 - OEM/supplier revenue/costs from products/services sold
 - System integrator acceptance
 - End user acceptance
 - Community acceptance



Summary

- The evaluation of U.S. DOE Energy Recovery Act Fuel Cell (Technologies Program) Initiative is well underway
- Secondary data review complete including analysis of NREL Composite Data Product (CDP) for ARRA-FCI
- Evaluation Plan Peer Review completed
- Primary data collection underway



Questions?
