U.S. DEPARTMENT OF ENERGY

Manufacturing R&D

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2009 DOE Hydrogen Program & Vehicle Technologies Program Annual

Merit Review and Peer Evaluation Meeting

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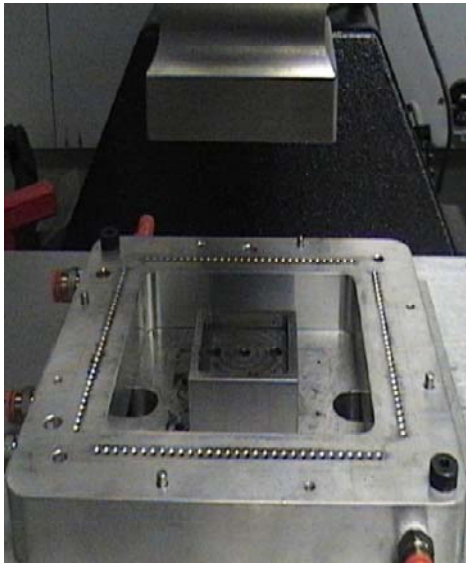
Challenges and Milestones

Develop and demonstrate technologies and processes that will:

- ***Reduce cost of components and systems for fuel cells, storage, and hydrogen production***
- ***Grow domestic supplier base***

Program Milestones

- ***2010***: Complete development of standards for metrology of PEM fuel cells.
- ***2012***: Develop continuous in-line measurement for MEA fabrication.
- ***2013***: Establish models to predict the effect of manufacturing variations on MEA performance.
- ***2013***: Demonstrate pilot scale processes for assembling stacks.



RPI's work on ultrasonic welding for MEA pressing.

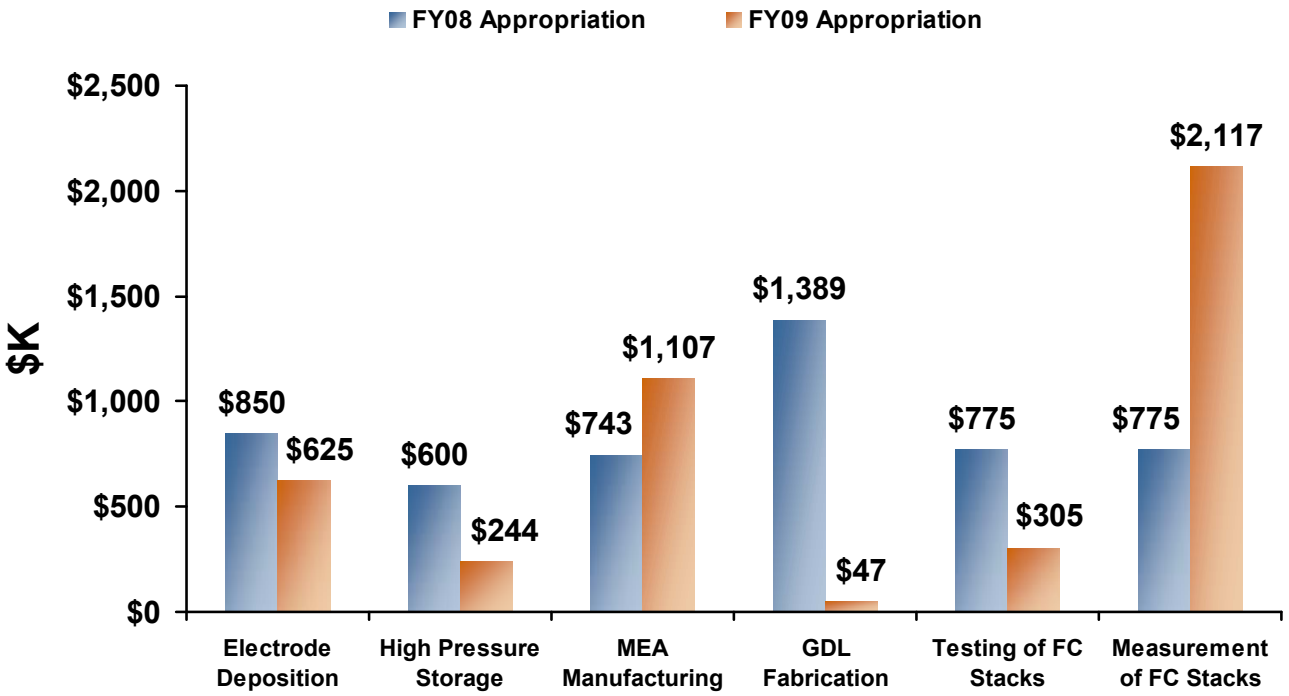
Near Term Goal for Early Markets

- Lower fuel cell stack manufacturing cost by $1,000/kW ($3,000 to $2,000/kW)

Budget

FY 2009 Appropriation = $4.9M

FY 2008 Appropriation = $4.9M*



EMPHASIS

1. Electrode Deposition
   - BASF, PNNL
2. High Pressure Storage
   - Quantum Technologies
3. MEA Manufacturing
   - Gore, LBNL, RPI
4. Gas Diffusion Layer (GDL) Fabrication
   - Ballard
5. Effective Testing of Fuel Cell Stacks
   - PNNL, UltraCell
6. Effective Measurement of Fuel Cell Stacks
   - NREL, NIST

Bi-polar plate manufacturing (SBIR)

*** $678K was funded by the Fuel Cell R&D Team in FY 2008.**

2009 Progress & Accomplishments

Critical projects are underway with initial results.

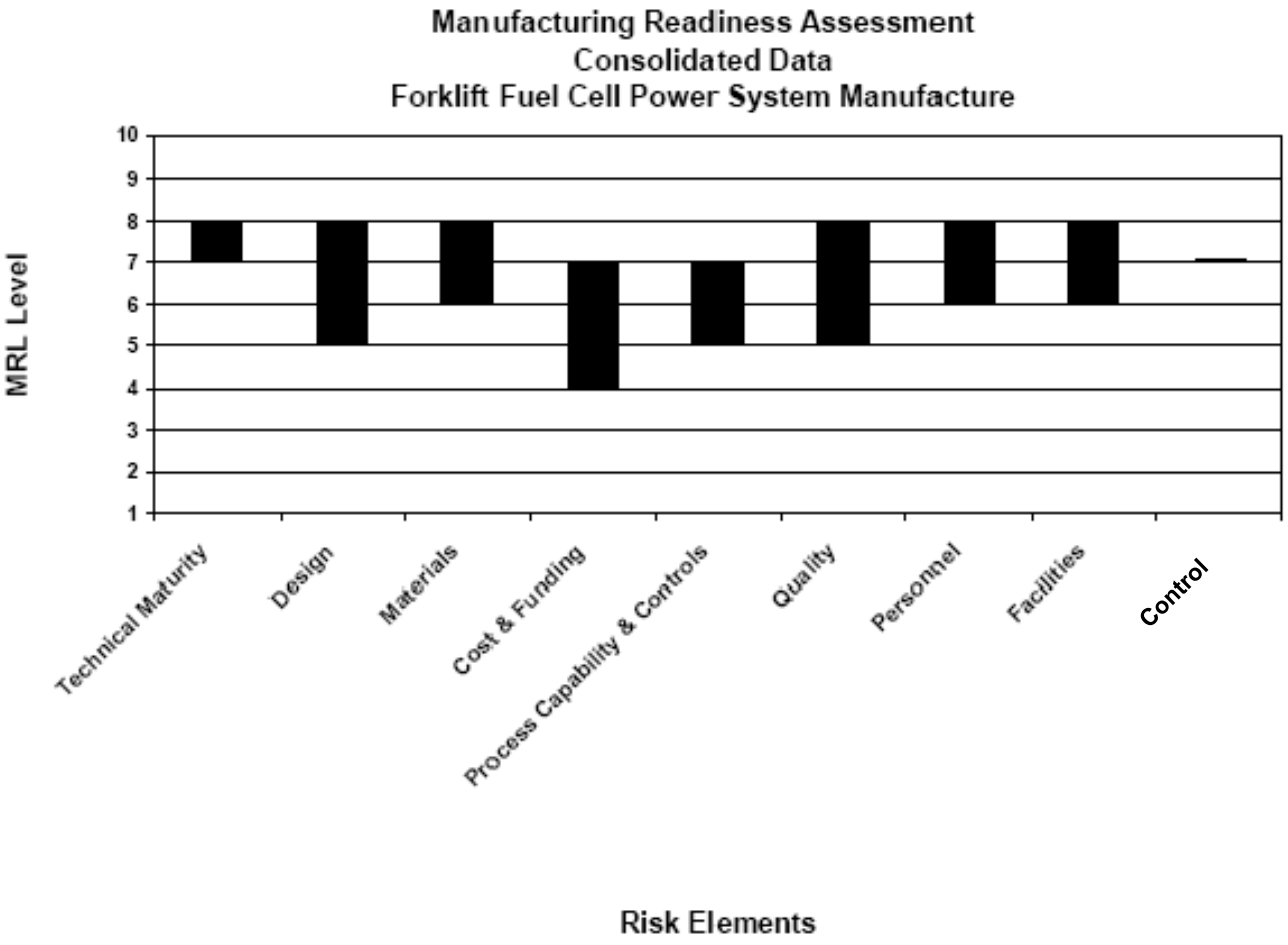
- Analyzed fuel cell stack manufacturing method procedure, throughput time, labor time, yield, failure modes (UltraCell)
  - Investigated leak-test methods and fuel cell stack components
  - Created specification for leak-testing
- Downselected on-line GDL coating weight measurement tool (Ballard)
- Validated 2D thickness measurement on different membranes, membranes with defects (NREL)
- Demonstrated ultrasonic welding (electrodes to sub-gaskets) cycle time of less than one second; current process (heated press) cycle time is one minute (RPI)
- Tested current commercial MEA (Gore)
  - Modeled generic decal lamination process
- Modeled Composite Tank Manufacturing Costs (Quantum /Boeing)
  - Alternate Processes – Filament winding (baseline), Automatic fiber placement, dry tape techniques
    - Manufacturing time and cost factors: labor, materials, equipment for specific processes

Manufacturing Readiness Assessments

Research project assessments needed for early market applications.

Manufacturing Readiness Levels (MRLs)

- MRL - 1 Manufacturing Feasibility Assessed
- MRL - 2 Manufacturing Concepts Defined
- MRL - 3 Manufacturing Concepts Developed
- MRL - 4 Laboratory Manufacturing Process Demonstration
- MRL - 5 Manufacturing Process Development
- MRL - 6 Critical Manufacturing Process Prototyped
- MRL - 7 Prototype Manufacturing System
- MRL - 8 Manufacturing Process Maturity Demonstration
- MRL - 9 Manufacturing Processes Proven
- MRL - 10 Full Rate Production demonstrated and lean production practices in place



Summary

Focus on progress toward near term cost goals for early market applications.

- Assess manufacturing readiness levels for Low Rate of Initial Production (LRIP) of 1000 units per year
- Establish Quality Assurance (QA) protocols
- Validate new processes against QA standards
- Achieve quantified near term cost targets

Ultracell modular fuel cells

For More Information

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