# Program Overview

## US Dept. of Energy Fuel Cell Vehicle and Infrastructure Cooperative Program

### Timeline
- **Project Start Date:** 01/07/04
- **Project End Date:** 09/30/10*
- **Percent Complete:** 90%

### Partners
- Daimler
- MBUSA
- DTE Energy
- NextEnergy

### Budget
- **Total Project Funding:** $88.8M
  - **Federal Share:** $44.4M
  - **Industry Share:** $44.4M
- **FY05 Funding:** $5.1M
- **FY06 Funding:** $6.3M
- **FY07 Funding:** $7.6M
- **FY08 Funding:** $5.2M
- **FY09 Funding:** $3.0M

### Barriers
- A. Vehicles
- B. Storage
- C. Hydrogen Refueling Infrastructure
- D. Maintenance and Training Facilities
- E. Codes and Standards

* Project extended by 1 year in 09/2009
Relevance

- Address barriers to move toward technology readiness
- Align the Mercedes goals with DOE’s Hydrogen Program objective

<table>
<thead>
<tr>
<th>DOE Barriers</th>
<th>Mercedes Teams’ Project Goal</th>
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<tbody>
<tr>
<td>A. FCV Performance and Durability Data</td>
<td>• Record, collect and report data from fuel cell vehicles and hydrogen fueling stations to validate DOE performance targets</td>
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<tr>
<td>B. Hydrogen Storage</td>
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<tr>
<td>C. H₂ Refueling Infrastructure Available Data</td>
<td></td>
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<tr>
<td>D. Maintenance and Training Facilities</td>
<td>• Demonstrate the safe installation and operation of service facilities</td>
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<td></td>
<td>• Continuously update safety manuals and provide training</td>
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<tr>
<td>E. Codes and Standards</td>
<td>• Participate in various working groups to ensure continuous progress</td>
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<table>
<thead>
<tr>
<th>Performance Measure</th>
<th>2009</th>
<th>2015</th>
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<tbody>
<tr>
<td>Fuel Cell Stack Durability</td>
<td>2000 hours</td>
<td>5000 hours</td>
</tr>
<tr>
<td>Vehicle Range</td>
<td>250⁺ miles</td>
<td>300⁺ miles</td>
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<tr>
<td>Hydrogen Cost at Station</td>
<td>$3/gge</td>
<td>$2-3/gge</td>
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Objectives

Program Objectives

- Collect data to evaluate the technology status of FCV and H₂ infrastructure

2009/10 Objectives

- Maintain smooth operation of Gen I and 70MPa upgraded FCVs
- Continue internal operations of Gen II vehicles while preparing for Gen II customer operations
- Continue the high quality of technical vehicle and infrastructure data reporting
- Raise public knowledge of hydrogen technology and demonstration projects
- Operate DTE hydrogen fueling station
- Maintain project safety
Approach: Technical

- Operate Gen-I and Gen II vehicles under real world condition to monitor DOE performance targets
- Install and maintain data acquisition system that collects vehicle and hydrogen fueling data
- Set up initial fueling network to support FCV fleet
- Establish maintenance and service facilities to support FCV operations
- Support codes and standards activities
## Approach: Milestones

### Alignment Between the Workplan/Milestones of DOE and Team

- **Technology Validation R&D Milestone Chart**

### 2009-2011 DOE Targets
- Validate 2,000 hours FCV durability
- Validate cold start

<table>
<thead>
<tr>
<th>Team’s Task</th>
<th>DOE Target</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>% Complete</th>
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<tbody>
<tr>
<td>- Gen I</td>
<td></td>
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<tr>
<td>- Gen I Operation</td>
<td><img src="image" alt="10% Complete" /></td>
<td><img src="image" alt="10% Complete" /></td>
<td>100%*</td>
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<tr>
<td>- 70MPa Vehicles Upgrade and Operation</td>
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<tr>
<td>- Gen II</td>
<td></td>
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<tr>
<td>- Fuel Cell Stack System Durability Test &amp; Analysis</td>
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<td><img src="image" alt="10% Complete" /></td>
<td>100%</td>
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<tr>
<td>- Gen II FDA Infrastructure Upgrade</td>
<td><img src="image" alt="10% Complete" /> <img src="image" alt="12% Complete" /></td>
<td><img src="image" alt="10% Complete" /></td>
<td>85%</td>
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<tr>
<td>- Internally Operate Vehicles</td>
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<td>0%</td>
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<tr>
<td>- Externally Operate Vehicles</td>
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**Official End Date**
Accomplishments and Progress
Gen-I Operations

Designed for a 2-year operation
Continuing to accumulate mileage for the 6th consecutive year
Submitted over 100 DVDs of raw data to NREL
Accomplishments and Progress
Transition to Gen II Technology

A Class F-Cell
Generation 1

2004 – 2009
Controlled fleet demonstration

B Class F-Cell
Generation 2

from 2010
Large fleet demonstration

B Class F-Cell:
- Higher stack lifetime (more than 2000h)
- Increased power
  - (65kW, 87hp ➔ 100kW, 134hp)
- Higher reliability
- Longer range
  - (160km, 100 miles ➔ 400km, 250 miles)
- Freeze start ability to -25°C, -13°F
- Li-Ion battery
Accomplishments and Progress
Gen II Technology

Completed internal operation and testing of Gen II pre-production vehicles

Hot Weather Testing

- Internal Operation/Testing
  - Cold start capability
  - Safety
  - Durability
  - Hot weather conditions
  - NVH

Durability

- Raw data to NREL
  - Internal operations
  - Acceleration
  - Durability
  - Gradeability
  - Efficiency
  - Cold Start

Cold Weather Testing

- Fleet Data Acquisition
Accomplishments and Progress
Gen II Deployment

Preparing for Gen II Pre-Commercialization

- Production assembly (similar to conventional ICE vehicles)
- Dealership involvement
- Maintenance
- Customer selection

Dealerships

Production
Accomplishments and Progress
Gen II Deployment

MBRDNA is Preparing for Fueling Infrastructure

- **Supported ARB/CEC** by recommending station specifications, site locations, supplier qualification guidelines and providing OEM commitment letters
- **Worked with CaFCP** to develop action plan detailing strategy for deploying H₂ fueling stations and FCVs
- **Collaborated with other OEMs** to coordinate locations of future fueling stations

<table>
<thead>
<tr>
<th>Station</th>
<th>Opening Date</th>
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<tbody>
<tr>
<td>Emergyville</td>
<td>Q3 2010</td>
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<tr>
<td>SFO</td>
<td>Q1 2011</td>
</tr>
</tbody>
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**Los Angeles**

- UC Irvine  Open
- Culver City Open
- Torrance   Q1 2010
- Bakersfield Q2 2010
- Fountain Valley Q3 2010
- Newport Beach Q4 2010
- CSULA      Q1 2011
- Harbor City Q1 2011
- UCLA      Q2 2011

**Northern California**

- [Map showing stations in Los Angeles and Northern California]
Accomplishments and Progress
Infrastructure

DTE Energy Continuing Operations

• Technical Data:
  – Hydrogen produced by electrolysis
  – Storage capacity of 140 kg
  – Capable of dispensing 35 kg/day

• Accomplishments:
  – Operational since 2004
  – Cold weather areas
  – Community outreach
  – New electrolyzer & dispenser installed winter of 2008-2009
  – Improved equipment reliability with new equipment
Accomplishments and Progress
Codes and Standards

MBRDNA Participated in various working groups to establish Codes and Standards essential to clear the way for FCV commercialization

- **First worldwide fueling guideline published in March**
  - J2601: Fueling Protocols for Gaseous Hydrogen Surface Vehicles
    - First worldwide guideline from an SDO establishing a baseline for fueling of hydrogen FCVs
    - New ARB/CEC hydrogen stations most likely to follow J2601

- **Continued participation in SAE working groups**
  - J2600: Compressed Hydrogen Surface Vehicle Fueling Connection Devices
  - J2578: Recommended Practice for General Fuel Cell Vehicle Safety
  - Vehicle Battery Standards Committee

- **Initial involvement in ISO TC197 WG 5**
  - ISO DIS 17268: Gaseous hydrogen land vehicle refuelling connection devices
Accomplishments and Progress
Codes and Standards – Next Energy

Continual progress in the development of appropriate Codes and Standards, updating hydrogen stakeholders of current and future directions from state, national and international perspectives.

- **Database (NextEnergy)**
  - Hydrogen Permitting Officials database posted to live NextEnergy Center website
  - Offered to DOE as a tool to identify H2 AHJs in Michigan
  - Hydrogen Station database posted to live NextEnergy Center website.
  - Offered to the H2 industry to voluntarily catalog installed infrastructure world-wide

- **Annual Conference (NextEnergy)**
  - Offered in 2007, 2008 and 2009
  - Slated for Fall/Winter 2010
  - Focus on current industry efforts toward C&S development

- **NFPA 2 - Hydrogen Technologies Code**
  - NextEnergy is a voting member of the Technical Committee
  - Instrumental in developing this extraction code for the industry
  - Intended to provide clarity to the infrastructure design process and to streamline permitting
Accomplishments and Progress

Safety

Safety practices insured
  • No safety incidents
  • Customer satisfaction

Operation & Maintenance
  • Updated Project Fleet Vehicle Incident Management Plan
  • Modified Safety Plan

Emergency Response
  • Supported multiple emergency responder trainings
  • Convinced station operators to remove PPE requirement

Station Commissioning
  • Commissioned and tested 70MPa station in Burbank, CA
Accomplishments and Progress
Public, Political & Industry Outreach

Participated in outreach activities to educate the public, encourage government support and raise awareness about the Team’s commitment to the technology.
Collaboration

**DAIMLER**
- **Subrecipient**
  - Gen I and II fuel cell vehicle development and testing
  - Program Management
  - Data Collection

**Prime Recipient**
- Partner to DOE
- Consortium leader

**Mercedes-Benz (USA)**
- **Subrecipient**
  - Deployment of hydrogen fuel cell vehicles

**DTE Energy**
- **Subrecipient**
  - Operations of hydrogen fueling station in the harsh weather condition of Michigan

**NEXTÉNERGY**
- **Subrecipient**
  - Permitting database
  - Establishment of annual conference
  - Participation in NFPA2
Future Work

• Prepare for Gen II demonstrations
• Maintain and finalize smooth operation of Gen I fuel cell vehicles with on-going service, maintenance and customer support
• Begin customer operations of production-level Gen II vehicles
• Maintain the high quality of technical vehicle and infrastructure data reporting to NREL/DOE
• Enlist support of corporate communications for a more expansive national outreach in addition to ongoing community and industry related events
Lessons Learned

• Vehicle
  – Extensive real world experience provided by DOE’s Demonstration and Validation Project has shown that vehicles are ready for the commercialization phase

• Infrastructure
  – Need public, customer-friendly fueling stations
  – Upgrade older, strategic stations
  – Coordination with OEMs to identify station locations

• Continued DOE funding and political support is essential
Summary

| • Improved equipment reliability and maintained operation of the DTE Station |
| • Continued mileage accumulation of Gen I vehicles |
| • Finalized internal operation and testing of Gen II pre-production vehicles |
| • Preparing for Gen II deployment with external customers and dealerships |
| • Participated in various working groups to ensure continuous progress with regards to Codes and Standards |
| • Continued data collection, analysis and reporting |