

Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project

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Technology Validation Strategy

- Conduct learning demonstrations of hydrogen infrastructure in parallel with hydrogen fuel cell-powered vehicles ***to allow a commercialization decision by 2015.***
- Test, demonstrate, and validate complete system solutions
- Re-focus hydrogen R&D program as appropriate

Controlled Fleet Performance Targets

(From solicitation RFP, Appendix C)

- 2009 Performance Targets
 - FC Stack Durability: 2000 hours
 - Vehicle Range: 250+ miles
 - H2 cost at station: \$3.00/kg

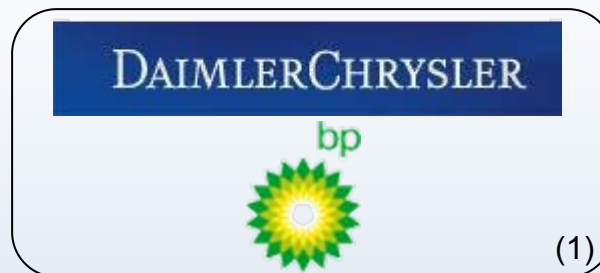
To verify progress toward 2015 targets
- 2015 Performance Targets
 - FC Stack Durability: 5000 hours
 - Vehicle Range: 300+ miles
 - H2 cost at station: \$1.50/kg

Subject of subsequent projects to validate 2015 targets

Proven for All Climates

Station/Vehicle Location	Climate				
	Cold	Moderate	Hot Arid	Hot Humid	
	SF/Sacramento CA		X	X	
	Southern CA		X	X	
	Detroit MI	X	X		
	Wash. DC/NYC	X	X		X
Orlando FL		X		X	

Successful Teams Announced



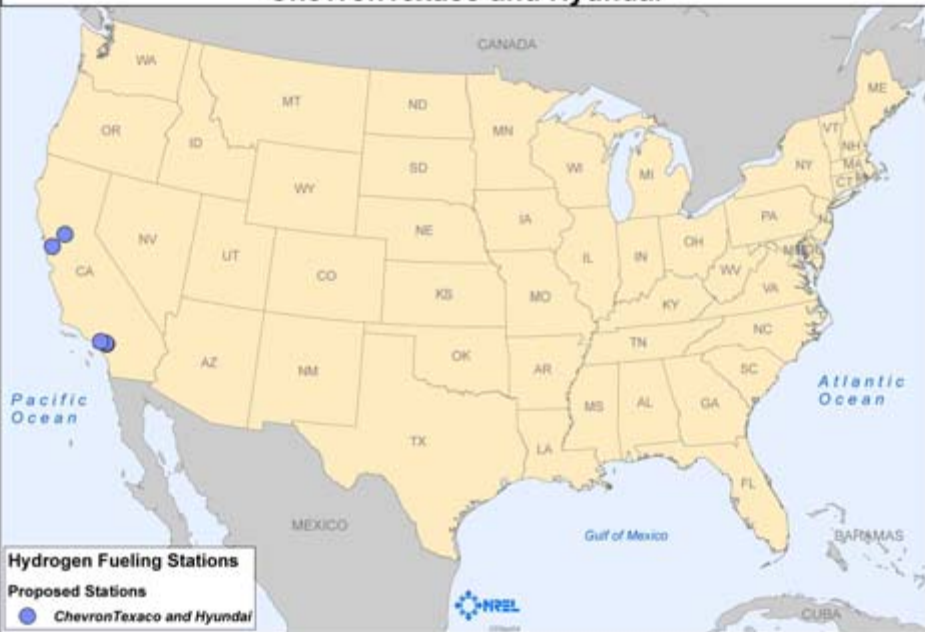
(1) Fuel cells supplied by Ballard

Team Summary – ChevronTexaco

ChevronTexaco

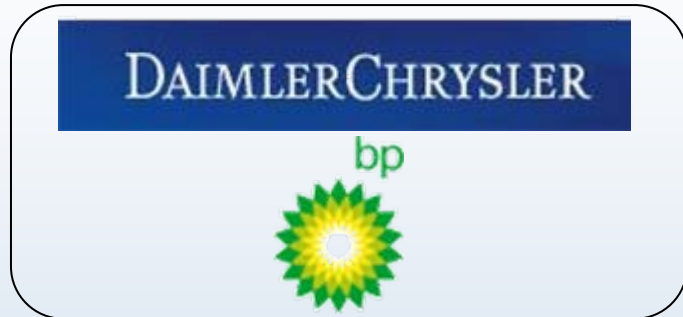


**Conterminous US - Proposed Hydrogen Fueling Stations
ChevronTexaco and Hyundai**

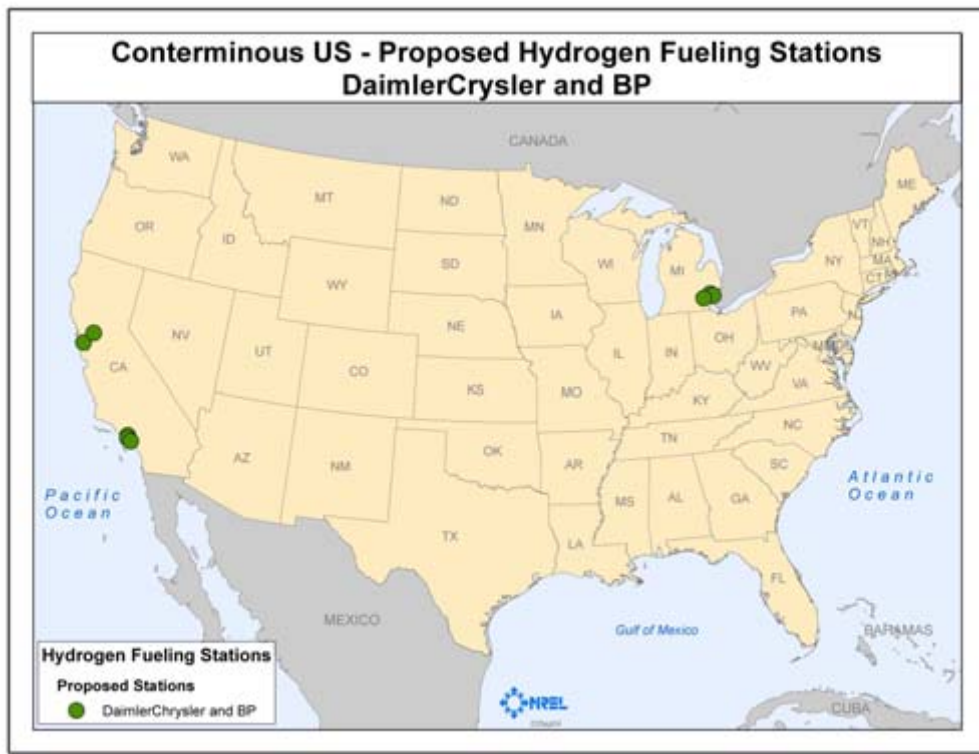


- 32 Fuel Cell Vehicles
 - SUVs
 - 2 Fuel Cell Generations
- 6 Fueling Stations

Team Summary – DaimlerChrysler



- 36 Fuel Cell Vehicles
 - F-Cell Vehicles & Sprinter Vans (Gen 1)
 - 2 Fuel Cell Generations
- 8 Fueling Stations



Team Summary – Ford



Conterminous US - Proposed & Existing Hydrogen Fueling Stations
Ford and BP



- 26 Fuel Cell Vehicles
 - Ford Focus Vehicles (Gen 1)
 - 2 Fuel Cell Generations
- 7 Fueling Stations

Team Summary – GM



- 40 Fuel Cell Vehicles
 - Opel Zafira Vehicles (Gen 1)
 - 2 Fuel Cell Generations
- 7 Fueling Stations

Conterminous US - Proposed & Existing Hydrogen Fueling Stations
General Motors and Shell



Project Begins to Create Network of H₂ Refueling Stations in 4 Regions of US

Northern California



Southeast Michigan



Southern California



Mid-Atlantic



Hydrogen Fueling Stations

Proposed Stations

- DaimlerChrysler and BP
- General Motors and Shell
- ChevronTexaco and Hyundai
- Ford and BP

Existing Stations

- ▲ Other Companies

Freeway System by Class

- Interstate
- US Highway
- State Highway

Composite Data Examples (25)

A. Critical Program Metrics:

1. Fuel Cell Durability, Actual vs. DOE Targets, All OEM's
2. Vehicle Ranges, Actual vs. DOE Targets, All OEM's
3. H2 Production Cost, Actuals/Projections vs. DOE Targets

B. Composite Performance Tracking:

Vehicles

4. Reliability (FC System & Powertrain, MTBF)
5. Start Times vs. DOE Target
6. Fuel Economy: Dyno, On-Road
7. Normalized Vehicle Fuel Economy
8. Fuel Cell System Efficiency
9. Safety Incidents - Vehicle Operation
10. Weight % Hydrogen
11. Mass of Hydrogen per Liter
12. Vehicle Hydrogen Tank Cycle Life

Hydrogen Infrastructure

13. H2 Production Efficiency vs. Process
14. Combined Heat and Power (CHP) Efficiencies
15. H2 Production Cost vs. Process
16. H2 Purity vs. Production Process
17. Hydrogen Impurities - Range for Production Process A
18. Histogram: Refueling Rate
19. Average Maintenance Hours - Scheduled and Unscheduled

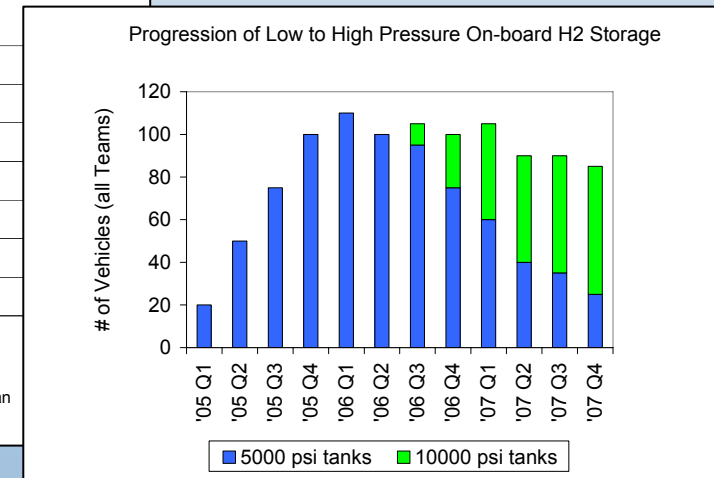
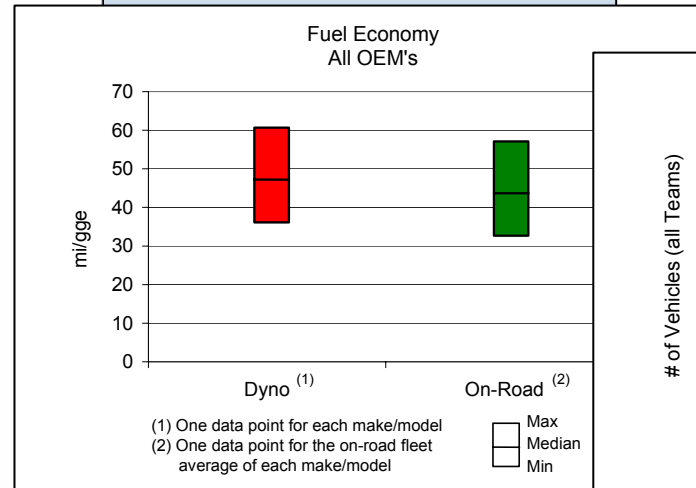
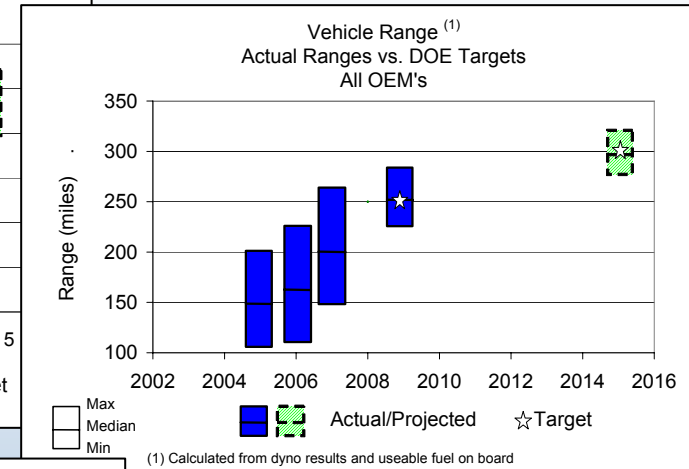
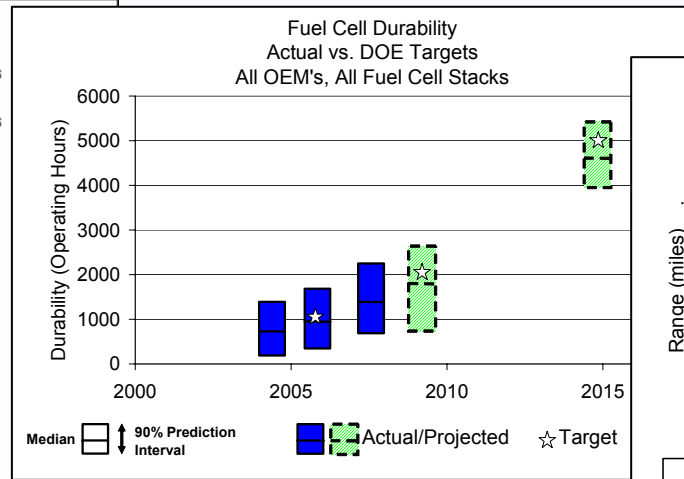
C. High Level Program Progress:

Vehicles

20. Range of Actual Ambient Temperatures During Vehicle Operation - All Vehicle Teams
21. Histogram: # Vehicles vs. Operating Hours to Date
22. Histogram: # Vehicles vs. Miles Traveled to Date
23. Cumulative Vehicle Miles Traveled - All Teams
24. Progression of Low to High Pressure On-board H2 Storage

Hydrogen Infrastructure

25. Cumulative Hydrogen Production - All Teams



Questions?