GM Fuel Cell Program Overview

CARB ZEV Technology Symposium
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Sacramento, California

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GM Fuel Cell Activities

GM Has Set the Industry Vision with its Advanced Fuel Cell Technology Vehicles

AutoNOMY

GM Has Set the Industry Vision with its Advanced Fuel Cell Technology Vehicles

AutoNOMY

Hy-wire

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AutoNOMY

Hy-wire

Sequel

Hydrogen fuel cells are the fundamental enabler

GM's Fuel Cell Program

Warren, MI
- Basic Stack Research
- Hydrogen Storage R&D
- Vehicle Integration Eng

Honeoye Falls, NY
- Stack R&D
- FCS R&D

Mainz-Kastel, Germany
- Hydrogen Storage R&D
- FC propulsion system dev't

Torrance, CA
- Power Electronics
- Electric Traction

Hydrogen-Ready Proving Grounds

- **700 people working on FC technology**
- **> $1B invested to date**

GM's Partners for Hydrogen Collaboration

GM's Fuel Cell Program

Progress on key technology requirements

- **Power density**
- **Durability**
- **Freeze operation**
- **Range**
- **Simplification**

Technology development progress openly shared with CARB Expert Panel; on track to internal targets

GM's Next Generation Fuel Cell Vehicles

SEQUEL

EQUINOX FUEL CELL

GM's Next Generation Fuel Cell Vehicles

- **Fully functional 5-passenger crossover vehicle**
- **Low-profile, skateboard-like chassis**
- **Fuel cell propulsion**
- **By-wire steering and brakes**
- **Wheel hub motors**
- **300-mile range with today's hydrogen storage technology**

GM's Next Generation Fuel Cell Vehicles

- **Fully functional 4-passenger crossover vehicle**
- **Expected to meet FMVSS and ZEV requirements**
- **50,000-mile operating life**
- **Freeze durable**
- **200-mile range**
- **Uniquely styled; Chevrolet branded**

EQUINOX FUEL CELL

“Project Driveway”

- **Beginning in 2007, we’ll begin deploying 100 vehicles in 3 key U.S. regions with diverse climates and driving conditions**
  - **California, greater New York City metro, Washington D.C.**
  - **Europe and Asia programs to be announced later**
- **Participants from general population, business partners, policy makers and media**
- **Comprehensive feedback on all elements of customer experience**
  - **Learnings to guide future fuel cell vehicle development**

Collaboration with U.S. Army

- First Chevrolet Equinox Fuel Cell delivered to U.S. Army in Sept.
  - Engineering prototype
- Non-tactical transportation use
- Military bases in Virginia and California
- Early performance assessment of GM's latest generation of fuel cell technology
- Gain experience with operation, maintenance and logistics of fuel cell vehicles

GM's Fuel Cell Commitment to California

- **Advanced Technology Center in Torrance**
  - **>100 engineers**
  - **Advanced electric traction and power electronics development**

- **Project Driveway deployment of Equinox Fuel Cell vehicles in CA**
- **Award under CARB's hydrogen vehicle demonstration program**

Air Resources Board

- **Demonstration program with GM's HydroGen3 to be announced Sept. 27**
- **Equinox Fuel Cell vehicle deployment at a CA military base**
- **Constructive dialog with key California constituents**

GM

QUANTUM TECHNOLOGIES

California Hydrogen Highway

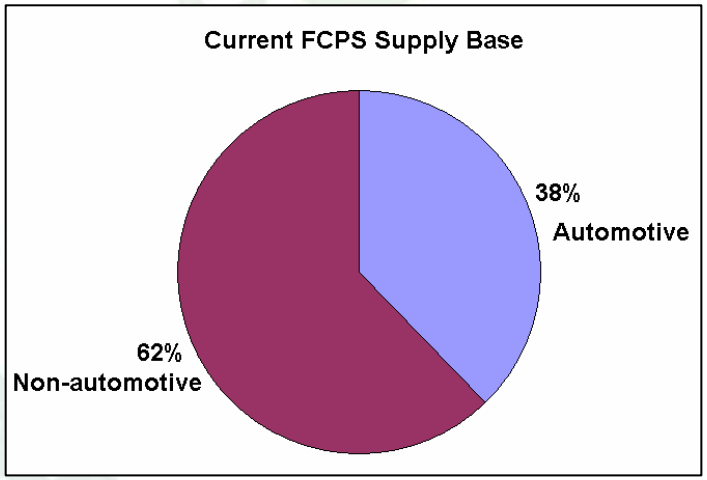
CALIFORNIA HYDROGEN HIGHWAY NETWORK

California FUEL CELL PARTNERSHIP DRIVING FOR THE FUTURE

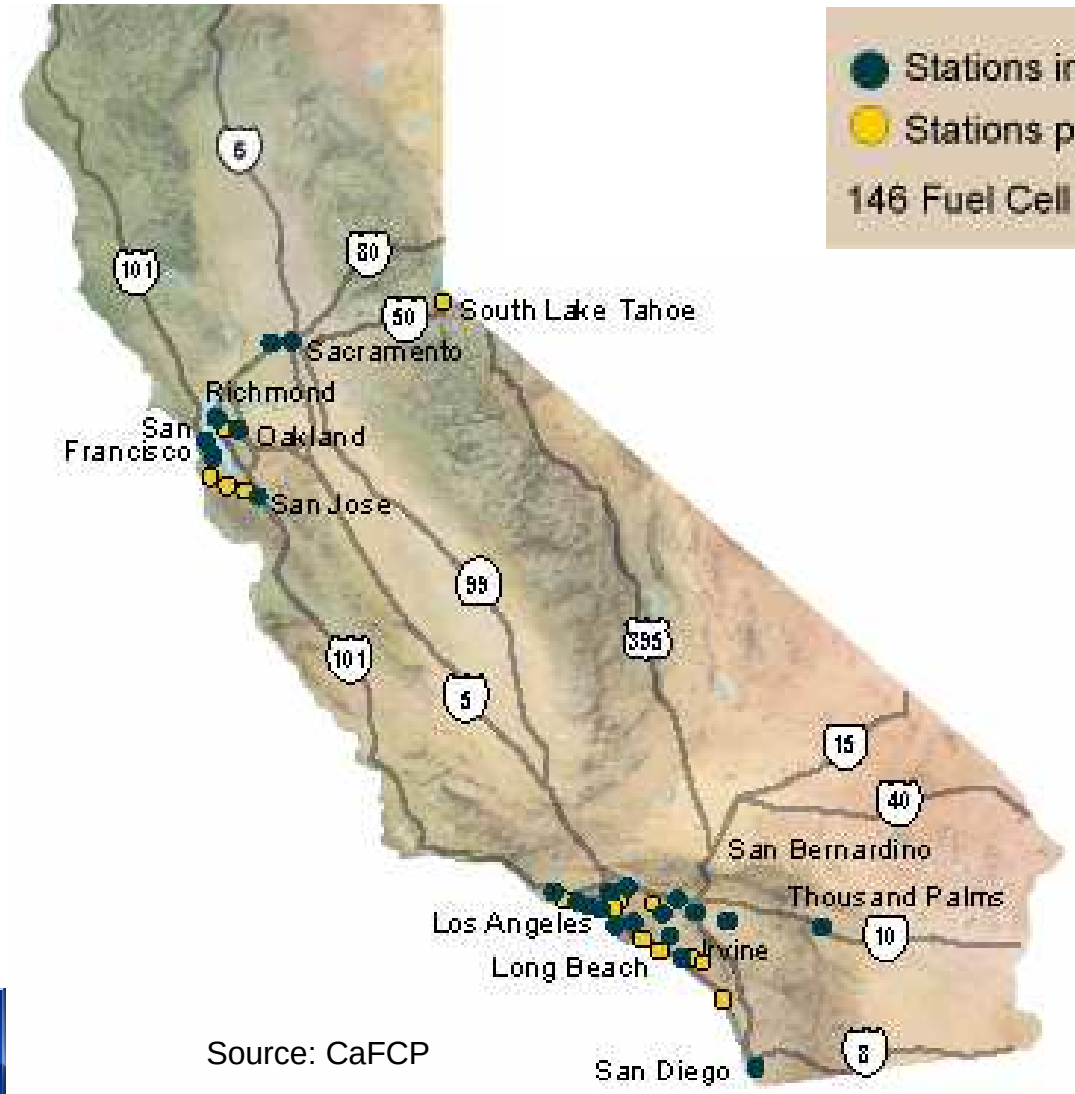
Beyond Project Driveway

Bringing fuel cell vehicles to market will require:

- **Further fuel cell propulsion system technology development**
  - **Hydrogen storage, fuel cell durability, cost**
- **Engineering discipline – product and process**
- **Supply base development**
  - **Majority of today's fuel cell suppliers lack automotive experience**
- **Customer acceptance**
  - **Education**
  - **Purchase incentives**
- **Safe, available and affordable hydrogen refueling infrastructure**



CaFCP Hydrogen Refueling Station Overview



Source: CaFCP

Behind-the-Fence Refueling

California

Public Refueling

Washington, D.C.

What Can California Do?

Infrastructure – near term

- Access to all existing stations
- Public refueling stations
- Local official and community support of all proposed stations
- Smooth and timely permitting process
- 700bar fast-fill capability
- Reliable station operation

Favorable tax policy on hydrogen as a fuel

Financial support for new supply base capitalization

Vehicle purchase incentives, including individuals, fleets and government customers