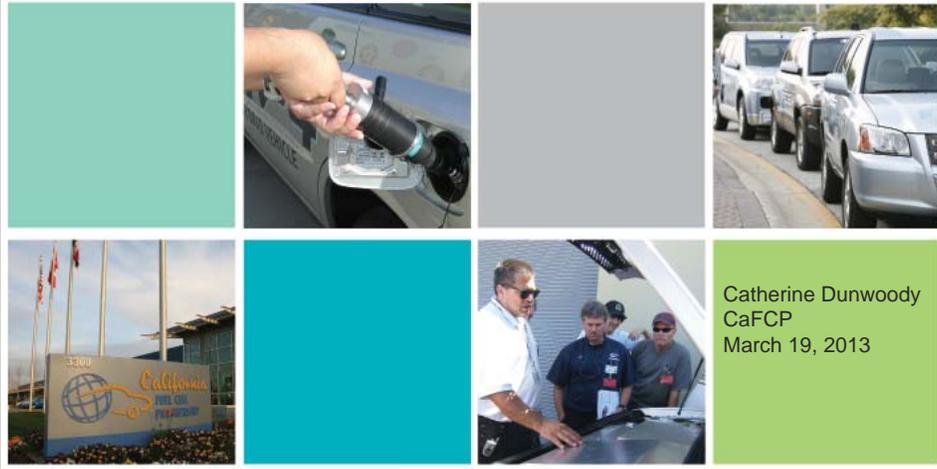
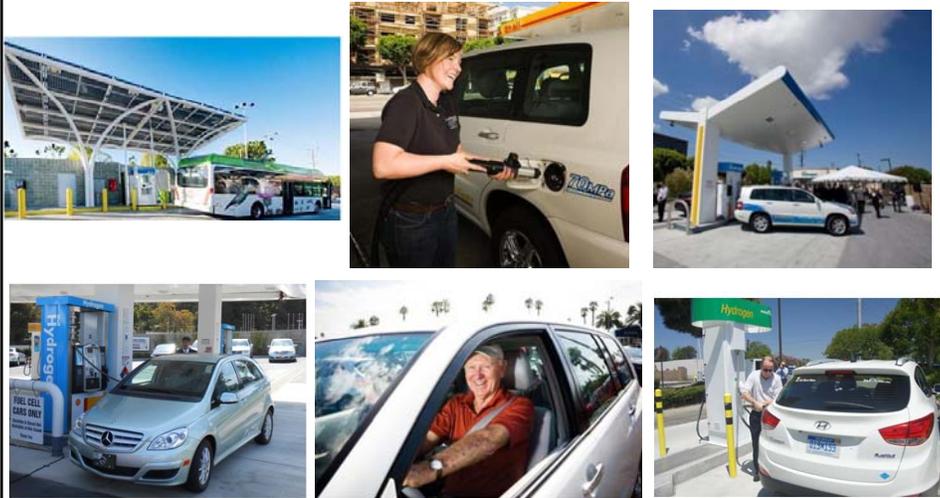


Bringing Hydrogen Fuel Cell Electric Vehicles to the Golden State

A California Roadmap



Real and ready for market launch



The cars are coming



Hyundai Tucson ix35 FCEV production launch [2/26/13](#)



Daimler/Nissan/Ford joint development announces 2017 launch of affordable FCEV [1/28/13](#)



Akio Toyoda | Norbert Reithofer
Toyota partnership with BMW [1/24/2013](#)
Toyota announces sedan-type FCEV launch in 2015 [9/24/12](#)



3

Technology Validation



Completed world's largest single FCEV & H₂ Demonstration to date (50-50 DOE-Industry cost share)

- >180 fuel cell vehicles and 25 hydrogen stations
- 3.6 million miles traveled; 500,000 trips
 - ~152,000 kg of hydrogen produced or dispensed; >33,000 refuelings



Partners		
Air Products	Daimler	Hyundai
BP	Ford	Kia
Chevron	GM	UTC Power

	Status	Project Target	
Durability	~2,500	2,000	
Range	196 – 254*	250*	
Efficiency	53 – 59%	60%	
Refueling Rate	0.77 kg/min	1 kg/min	
	Status (NG Reforming)	Status (Electrolysis)	Ultimate Target
H ₂ Cost at Station	\$7.70 - \$10.30/kg	\$10.00 - \$12.90/kg	\$2.00 - \$4.00/kg

National Fuel Cell Bus Program (DOT)

- Demonstrating fuel cell buses for passenger service (NREL data collection)
- Report published on 18 fuel cell buses at three transit agencies
 - In 1 year: > 250,000 miles
 - ~12,000 hours durability
 - 2x higher fuel economy than conventional buses

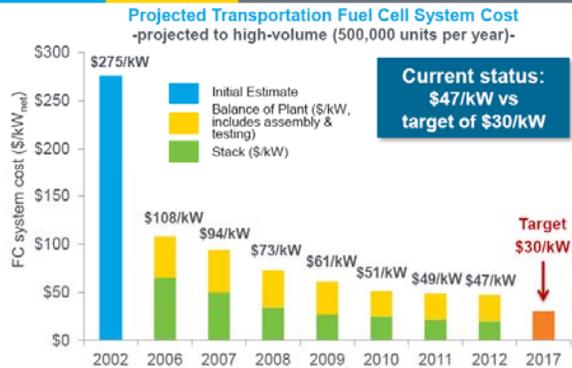
*Independently validated a vehicle that can achieve a 430 mile range.

Progress Example– Fuel Cells

Projected high-volume cost of fuel cells has been reduced to \$47/kW (2012)*

- More than 35% reduction since 2008
- More than 80% reduction since 2002
- More than 5-fold reduction in PGM
- Need continued R&D to reduce PGM and achieve durability targets (5,000 hrs)

*Based on projection to high-volume manufacturing (500,000 units/year). The projected cost status is based on an analysis of state-of-the-art components that have been developed and demonstrated through the DOE Program at the laboratory scale. Additional efforts would be needed for integration of components into a complete automotive system that meets durability requirements in real-world conditions.

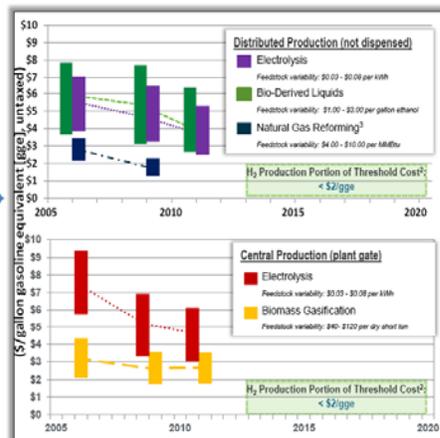
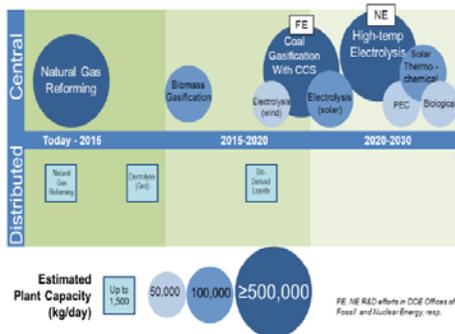


2 | Fuel Cell Technologies Program Source: US DOE 3/13/2013

eere.energy.gov

Hydrogen Production Strategies

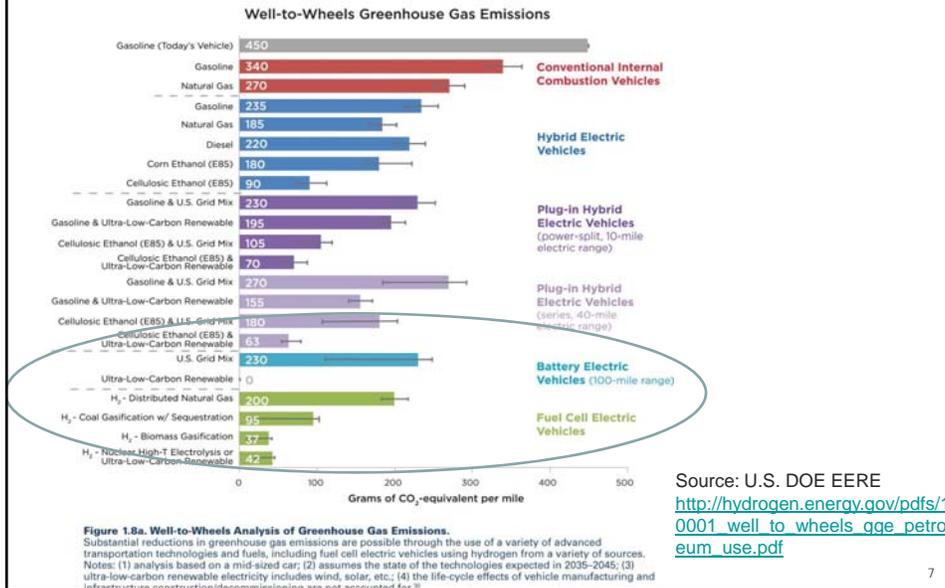
Goal: Develop technologies to produce hydrogen from clean, domestic resources at a delivered and dispensed cost of \$2-\$4/gge H₂



3 | Fuel Cell Technologies Program Source: US DOE 3/13/2013

eere.energy.gov

FCEVs significantly reduce GHGs



A California Road Map

- ▶ Develop station network
 - 68 stations to launch
 - 100 stations to self-sustaining
- ▶ Accelerate station implementation
 - Timeliness, performance, path to profitability
- ▶ Promote hydrogen readiness
 - Communities, businesses, consumers

www.cafcp.org/roadmap

A CALIFORNIA ROAD MAP
 Bringing Hydrogen Fuel Cell Electric Vehicles to the Golden State

COMMERCIAL LAUNCH OF FCEVs
 EXPECTED AROUND 2015

200-400 mile range
 Zero emissions
 Minutes to refuel
 Dynamically priced, on-demand hydrogen

THE NETWORK:
 CLUSTERS
 CONNECTORS
 DESTINATIONS

"Consumers need CONFIDENCE in a hydrogen fueling network"
 Initial station deployments will focus on geographic clusters in key markets with additional stations connecting these clusters into a regional network.

68 STATIONS
 NEEDED TO LAUNCH THE EARLY RGV MARKET

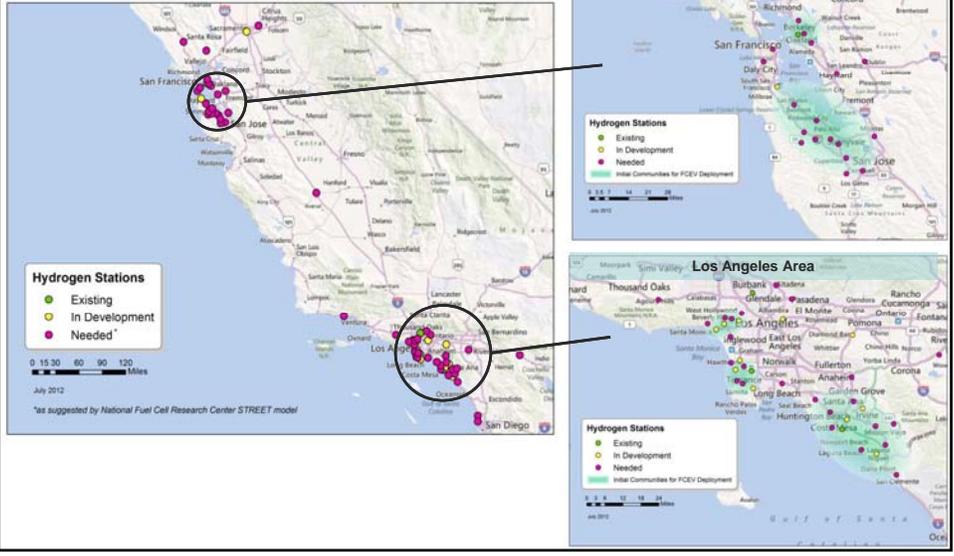
\$6.5 MILLION
 IN ADDITIONAL FUNDING NEEDED

Download A California Road Map at www.cafcp.org/roadmap

Building a statewide network



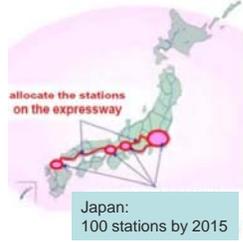
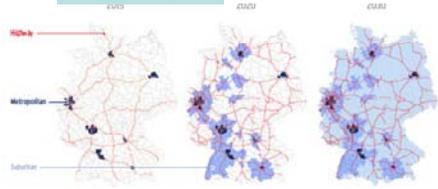
Map of 68 Hydrogen Fueling Stations: Existing, In Development and Needed



Worldwide commitment



Germany: 100 stations by 2015



Japan: 100 stations by 2015

UK: 65 stations to launch



Scandinavia: at least 15 stations by 2015



Korea: 43 stations by 2015

Figure 2. Initial H2S network coverage of trunk routes and major population centers by 2015.

Benefits of hydrogen and FCEVs

- Local, renewable fuel.
- 2-3 times more efficient.
- 200-400 miles on a tank.
- Zero tailpipe emissions.
- 60-90% GHG reduction.
- 5-7 minutes to refill.
- Full-size SUVs & sedans.
- Fill hundreds of vehicles per station.

Hundreds of zero-emission fuel cell electric vehicles are on the road today and tens of thousands are coming beginning in 2015. With about 100 stations statewide, customers will have sufficient access to hydrogen fuel to replace a conventional vehicle with an FCEV.

11

AUTOMOTIVE
 Chrysler
 Daimler
 General Motors
 Honda
 Hyundai
 Nissan
 Toyota
 Volkswagen

TECHNOLOGY
 AFCC

GOVERNMENT
 CA Energy Commission
 CA Air Resources Board
 South Coast AQMD
 US EPA
 US DOE
 US DOT

ASSOCIATE
 AC Transit
 Air Liquide
 Air Products
 Ballard Power Systems
 CalState LA
 CDFG
 CEERT
 EIN
 Hydrogenics
 ITS – UC Davis
 Linde
 NFCRC – UC Irvine
 NREL
 Powertech Labs
 Proton Onsite
 Sandia National Labs
 SoCal Gas
 SunLine Transit
 UTC Power

California Fuel Cell Partnership
www.cafcp.org
info@cafcp.org