

# Hydrogen and Renewables in California

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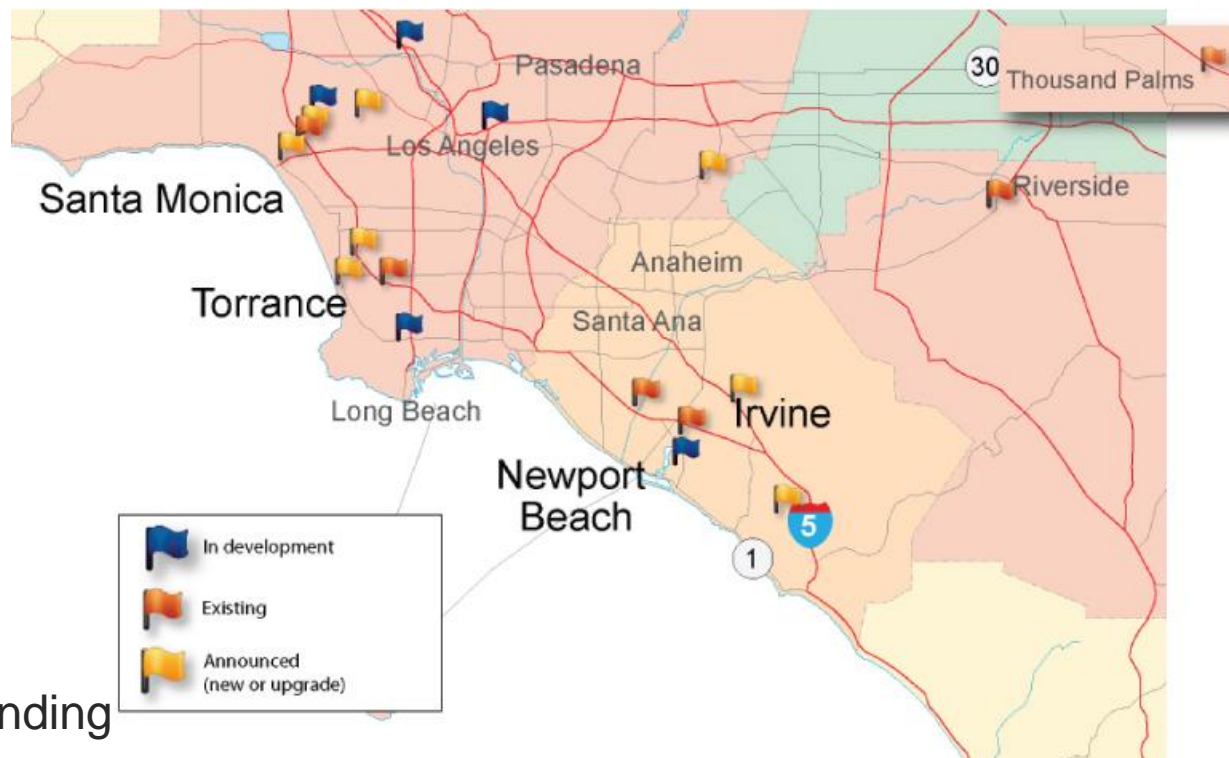
# FCVs in California



About 200 FCVs in CA today. Automaker surveys show plans to ramp up to 1,400 FCVS by 2014 and to more than 50,000 FCVs in California by 2017



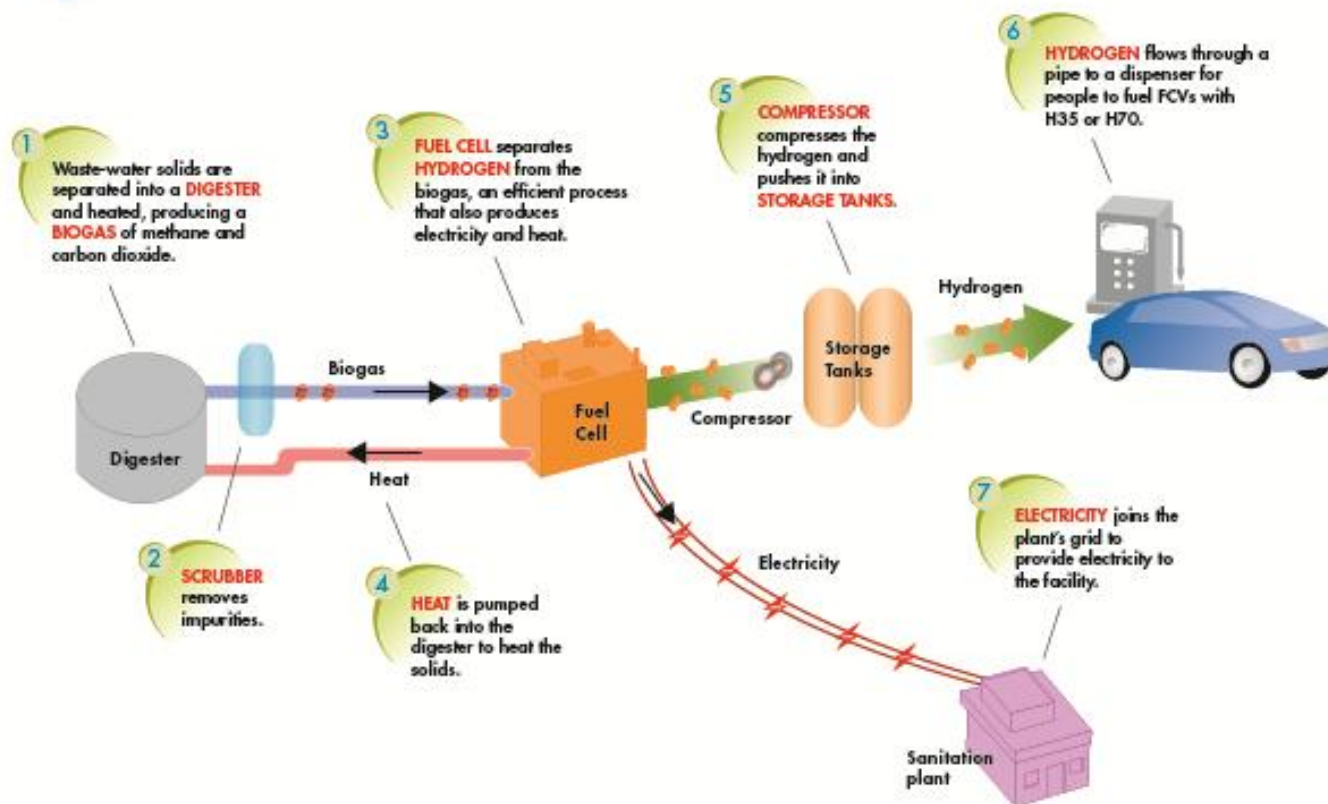
# Early hydrogen station network



20 H<sub>2</sub> stations by early 2013  
Funding for ~10-15 more pending

# Hydrogen from biogas

## BIOGAS MAKES HYDROGEN



## Orange County Sanitation District, Fountain Valley





# Hydrogen from solar power



AC Transit,  
Emeryville

# Renewable electricity in CA



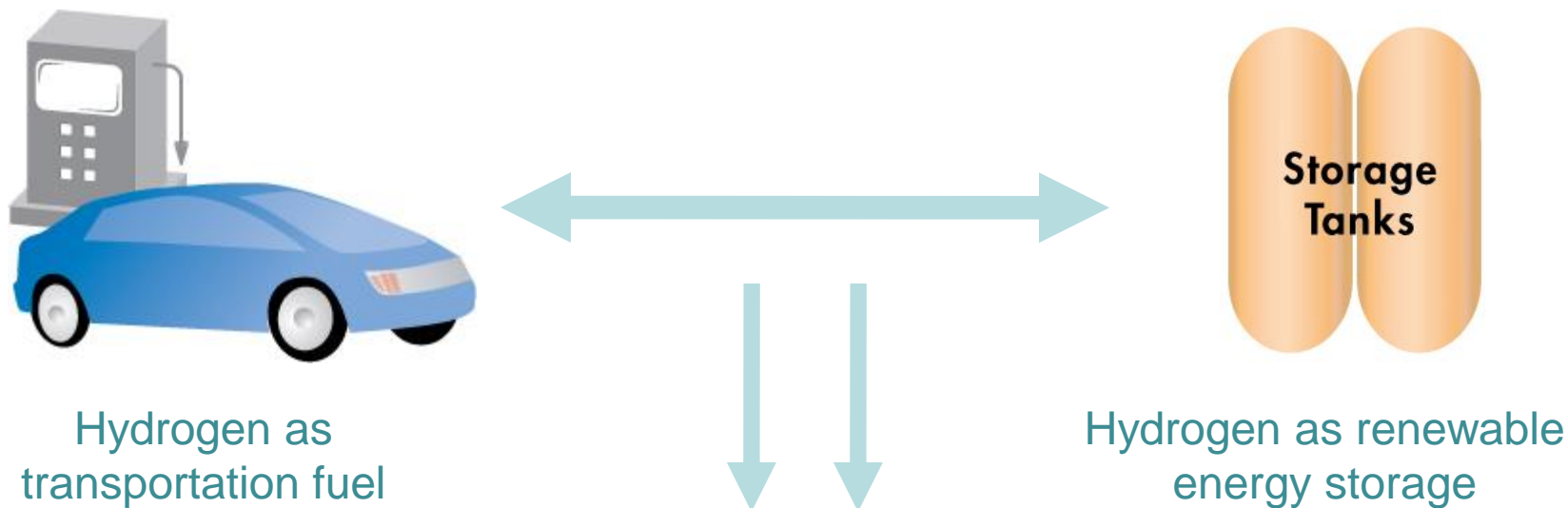
## ▶ Renewable portfolio standard

- 20% renewable electricity by 2010
  - Applied only to investor owned utilities (PG&E, SCE, SDG&E)
  - These IOUs collectively served 17% of their 2010 retail electricity sales with renewable power.
- As of April 2011, new law requires all utilities to meet RPS
  - 20% renewable electricity by 2013
  - 25% by 2016
  - 33% by 2020

## ▶ Energy storage for renewable integration

- Procurement targets to be set by CPUC (proceeding underway) to integrate 20,000MW of new renewables
  - <http://www.cpuc.ca.gov/PUC/energy/electric/storage.htm>
- Batteries, compressed air, flywheels are primary technologies
- Currently no significant attention on hydrogen as energy storage

# How do we link?



## New Value Stream

Find new value stream for customers and utilities

- ▶ Potential cost reduction for utility customers?
- ▶ Potential new revenue stream for utilities via sale of transportation fuel?





### **AUTOMOTIVE**

Chrysler  
Daimler  
General Motors  
Honda  
Hyundai  
Nissan  
Toyota  
Volkswagen

### **ENERGY**

Chevron

### **TECHNOLOGY**

AFCC

### **GOVERNMENT**

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

### **ASSOCIATE**

AC Transit  
Santa Clara VTA  
SunLine Transit  
Air Liquide  
Air Products  
Linde  
Praxair  
Ballard Power Systems  
Powertech  
ITS – UC Davis  
NFCRC – UC Irvine  
CA Dept. of Food & Ag

