



California Energy Commission

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AUGUST 1 2013

Fuel cell electric vehicles and hydrogen fuel for California

California Energy Commission
IEPR workshop on Transportation Energy Scenarios
7/31/2013



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.**

**Fill hundreds
of vehicles per
station.**

**Full-size
SUVs & sedans.**

**5-7 minutes
to refill.**

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.



Hydrogen fuel cell electric
vehicles make sense

National Research Council March 2013

- Analyzed alternative vehicles and fuels scenarios with the goals of:
 - » Reducing oil consumption by 50% below 2005 levels by 2030
 - » Reducing oil consumption and greenhouse gases by 80% below 2005 levels by 2050

COMMITTEE ON TRANSITIONS TO ALTERNATIVE VEHICLES AND FUELS

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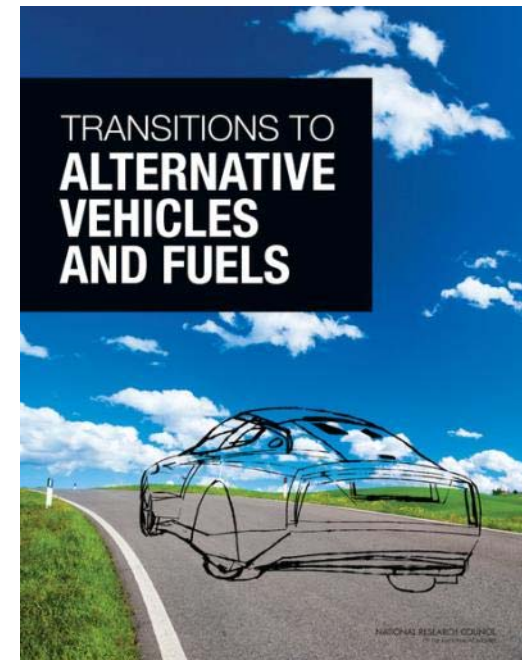
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FCEV costs from NRC report*



- Assumes 200,000 per year production volume
- FCEVs competitive with other electric drive vehicles
- Before 2050 the cost of FCEVs could be lower than the cost of an equivalent ICEV, and operating costs should also be lower.
- FCEVs are expected to be equivalent in range and refueling time to ICEVs.

* NAS Transitions to Alternative Vehicles and Fuels, March 2013
(http://www.nap.edu/catalog.php?record_id=18264)

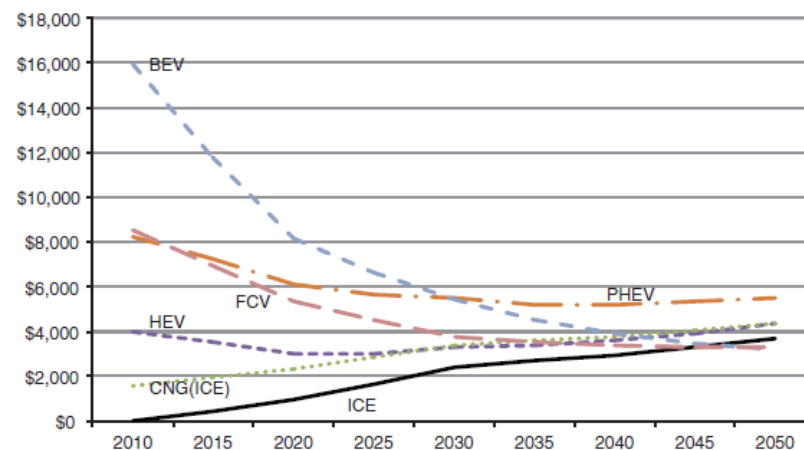


FIGURE 2.8 Car incremental cost versus 2010 baseline (\$26,341 retail price)—Midrange case.

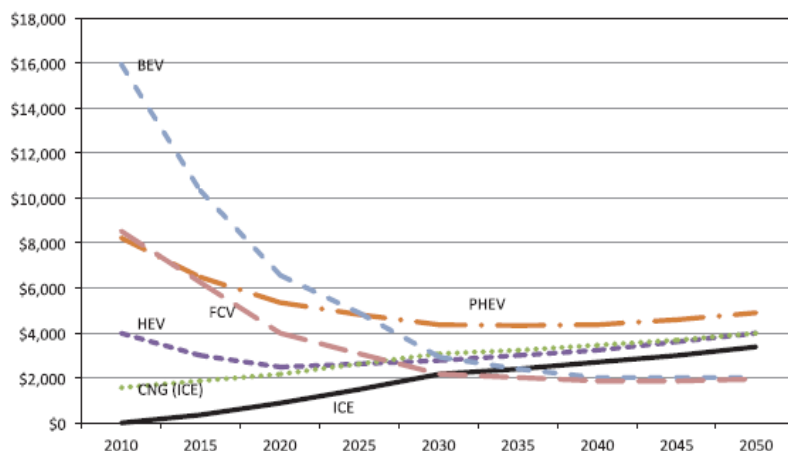
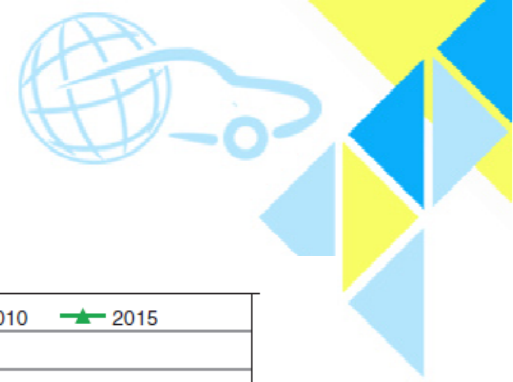


FIGURE 2.10 Car Incremental cost versus 2010 baseline (\$26,341 retail price)—Optimistic case.

Fuel cell and hydrogen costs*



- Fuel cell system costs projected at \$36-\$40/kW, assuming commercial introduction of FCEVs at annual production volumes over 200,000 units, with the primary economy of scale occurring at 50,000 units (emphasis added)
- Hydrogen costs can be competitive with gasoline**

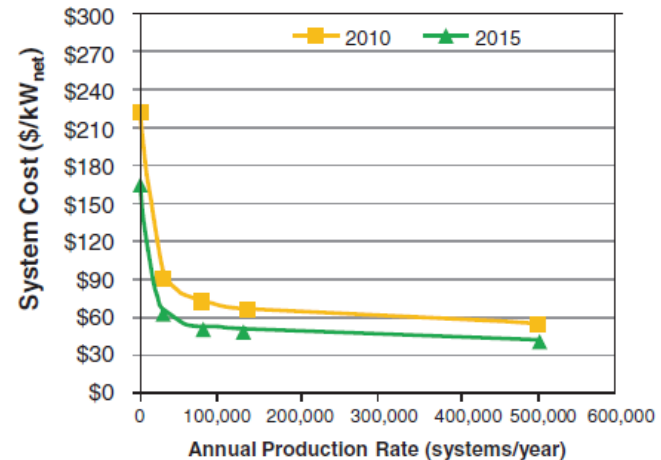


FIGURE 2.6 Progression of fuel cell system costs with production volume.
SOURCE: James et al. (2010).

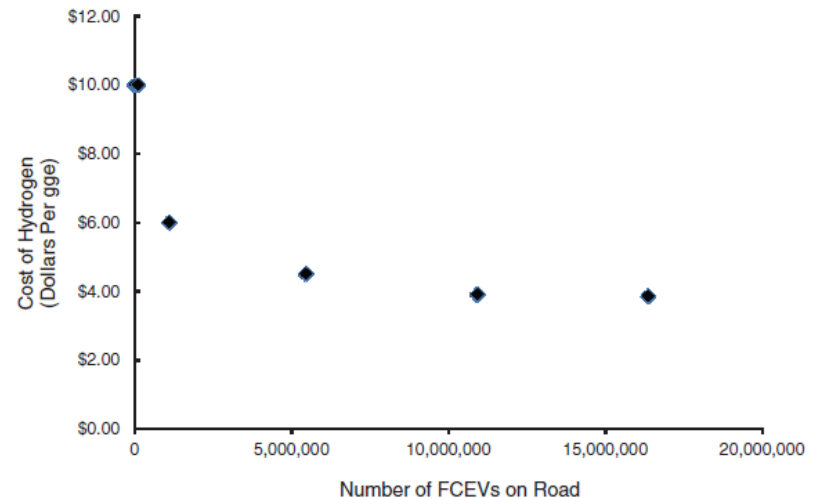


FIGURE 3.3 Hydrogen cost versus number of FCEVs.

* NAS Transitions to Alternative Vehicles and Fuels, March 2013 (http://www.nap.edu/catalog.php?record_id=18264)

** FCEVs travel 2-3 times as far as ICEVs on the same energy



California policies and
incentives are a smart
investment

FCEVs: Real and ready



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

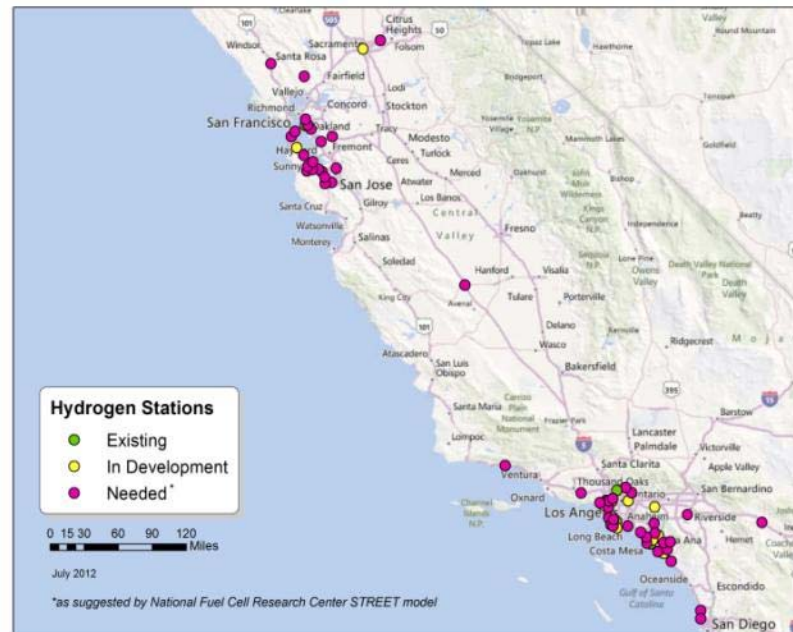
Toyota partnership with BMW [1/24/2013](#)
Toyota announces sedan-type FCEV
launch in 2015 [9/24/12](#)

Honda and GM announce joint development
and Honda confirms 2015 launch [7/2/13](#)



Stations must come first

- 68 stations provide coverage to enable market launch
 - » Supports customer convenient fueling in early markets
 - » Enables travel throughout early market regions and state



Hydrogen Stations in California



Open Today:

- Burbank
- Emeryville
- Fountain Valley
- Harbor City
- Irvine #1
- Newport Beach
- Thousand Palms
- Torrance
- West LA #1



In Development:

- Beverly Hills
- Diamond Bar (upgrade)
- Hawthorne
- Hermosa Beach
- Irvine #2
- Los Angeles
- San Juan Capistrano
- Santa Monica
- West LA #2
- West Sacramento
- Westwood

➤ *Plus 7 more stations recently awarded*



Five clusters to launch market



- Santa Monica and West Los Angeles
- Torrance and nearby coastal cities
- Southern coastal area of Orange County
- Berkeley
- South San Francisco Bay area

Locations based on:

- Demographic information
- Individual OEM market assessments
- California Energy Commission/Air Resources Board Vehicle Survey
- Hybrid and alt fuel vehicles registrations
- Geographic distribution of Clean Vehicle Rebate Program

Access to stations

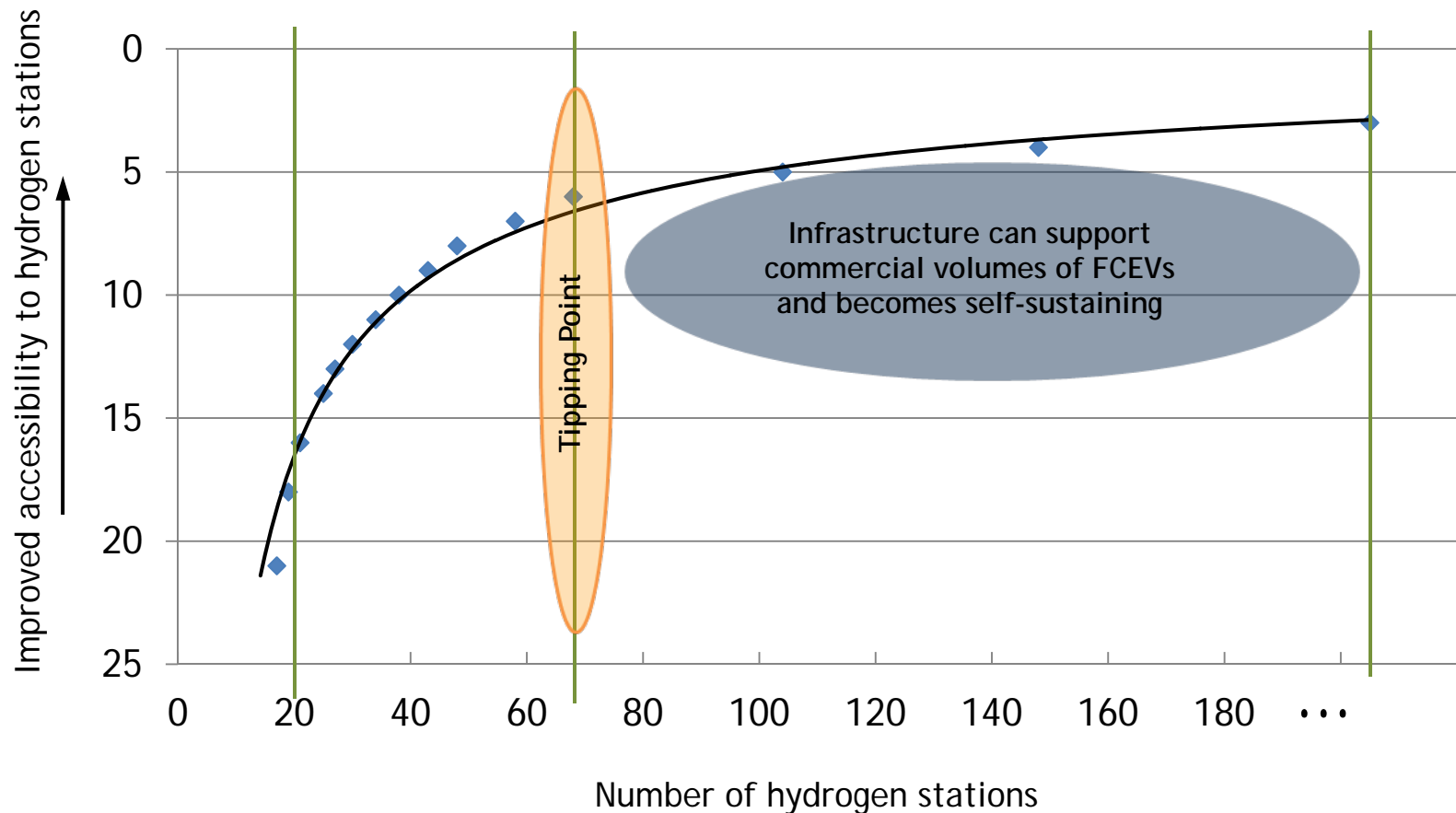
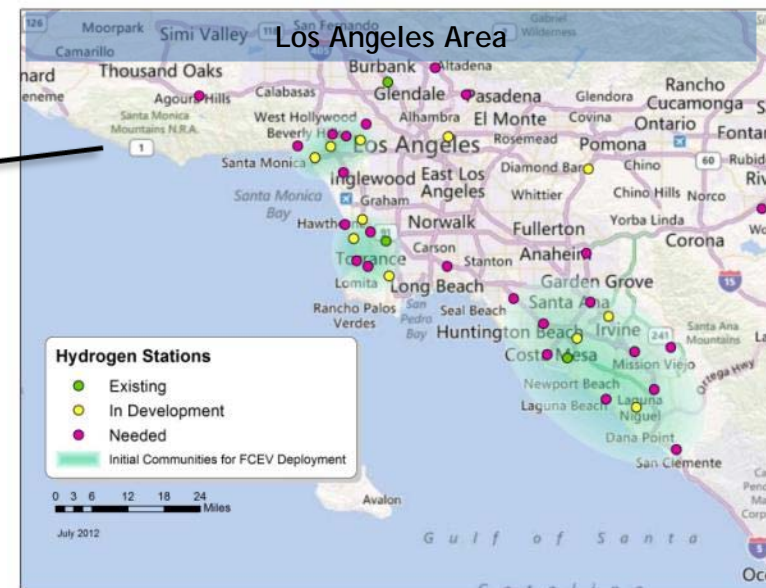
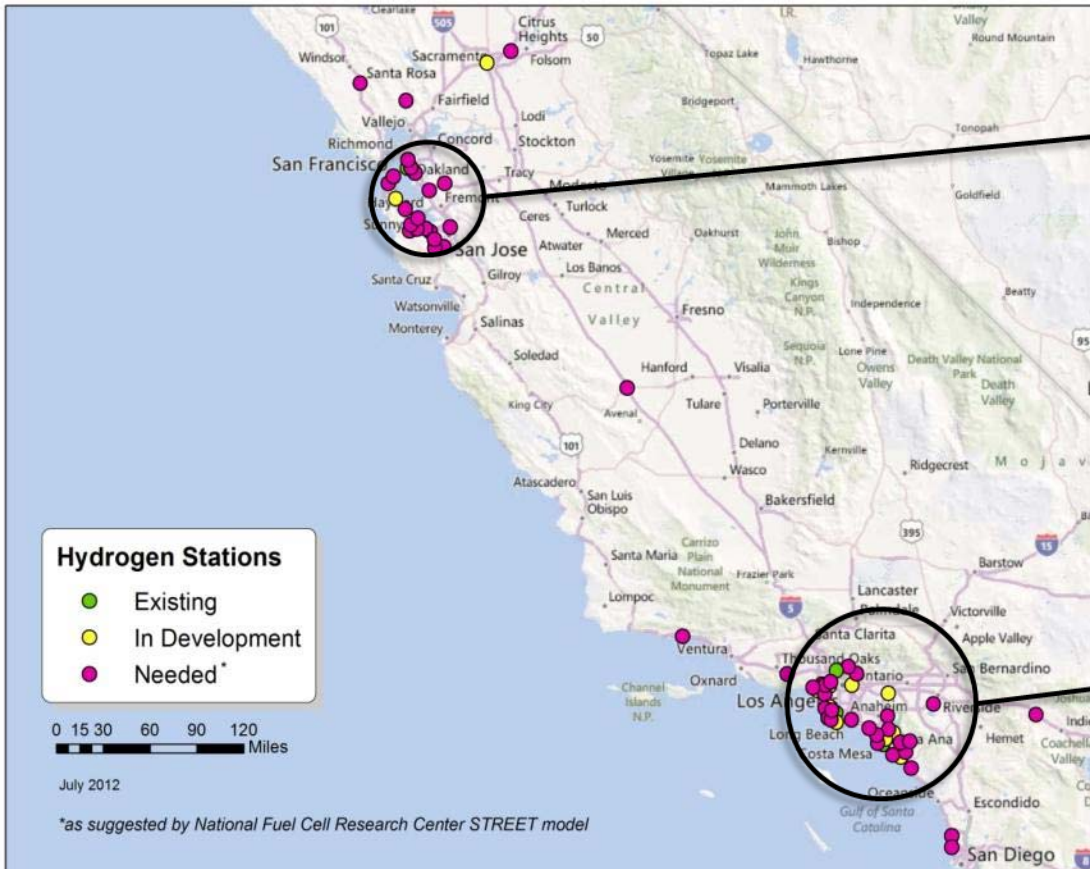


Chart courtesy of National Fuel Cell Research Center at UC Irvine

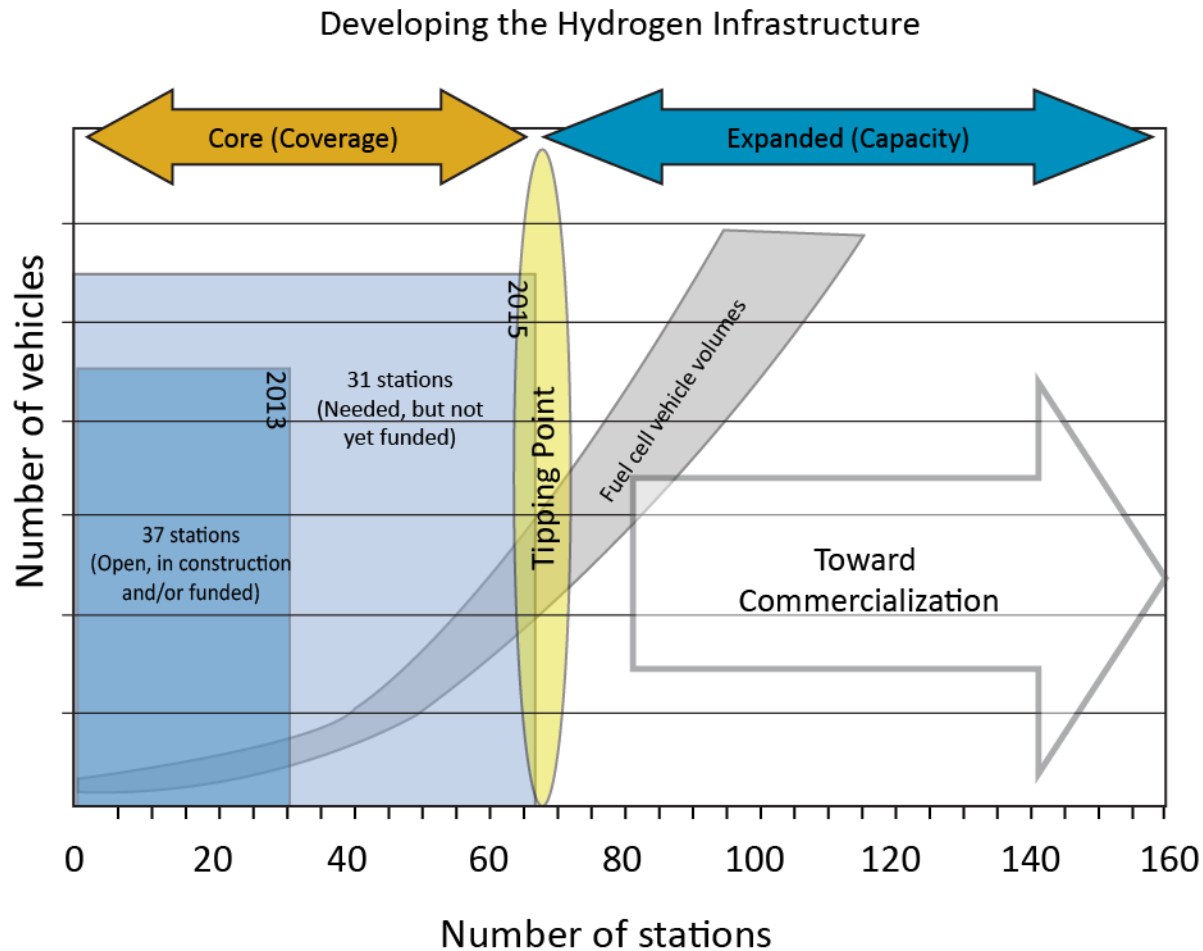
Building a statewide network



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

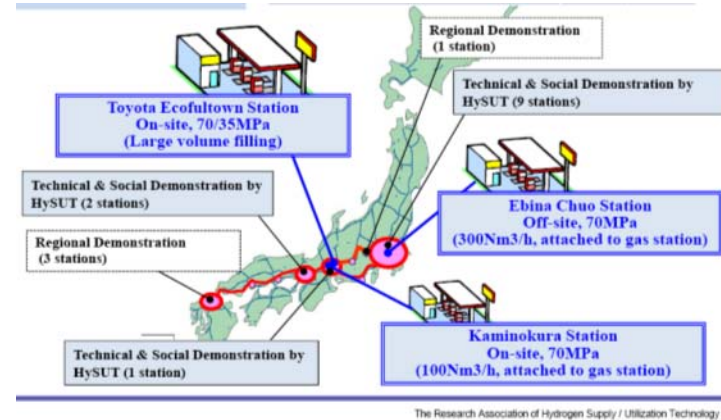
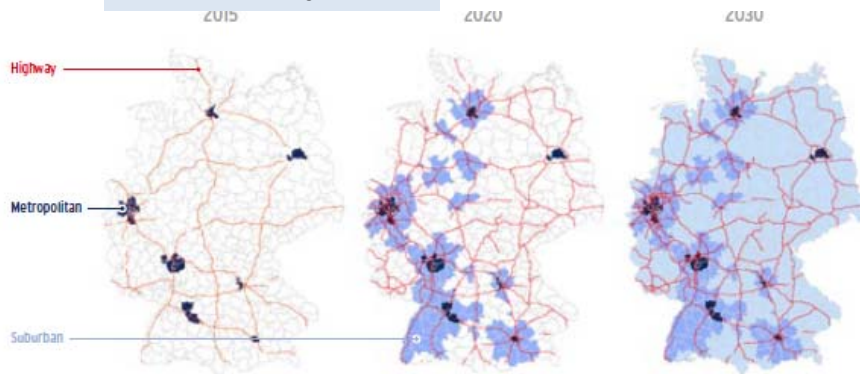


H₂ stations and vehicle growth



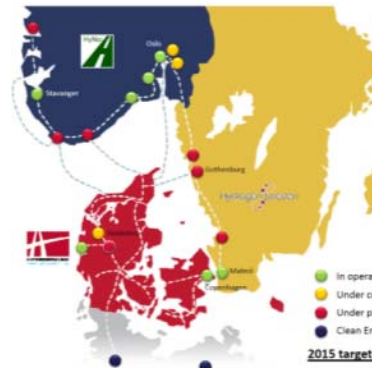
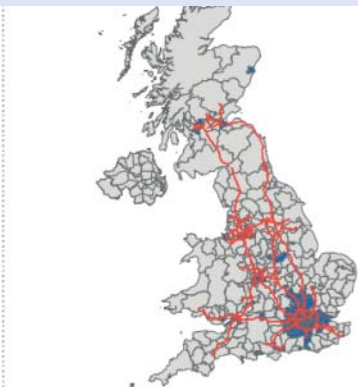
FCEVs will be launched worldwide

Germany:
50 stations by 2015



Japan:
100 stations by 2015

UK: 65 stations to launch



Scandinavia:
at least 15 stations by 2015

Phase 1 (~ 2012)
13 Stations



Phase 2 (~ 2015)
43 Stations



Phase 3 (~ 2030)
500 Stations



Korea:
43 stations by 2015



Customers must recognize
value in advanced
vehicles and fuels



go in minutes

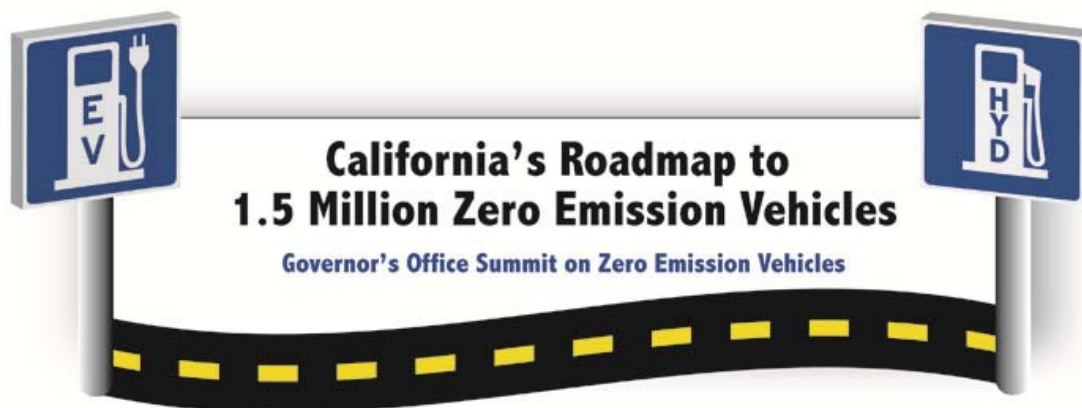
*In a hurry? Filling with hydrogen is fast and easy.
And with range comparable to gasoline vehicles, you're
fueling only when empty, thirsty or ready to wash the car.*

www.caafcp.org/go

California ZEV Action Plan



- By 2015: California major metropolitan areas “ZEV-ready” with infrastructure and streamlined permitting
- By 2020: California ZEV infrastructure can support up to 1 million vehicles
- By 2025: Over 1.5 million ZEVs in California





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(*AC Transit*)
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Questions or comments?

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