



Granite State Clean Cities

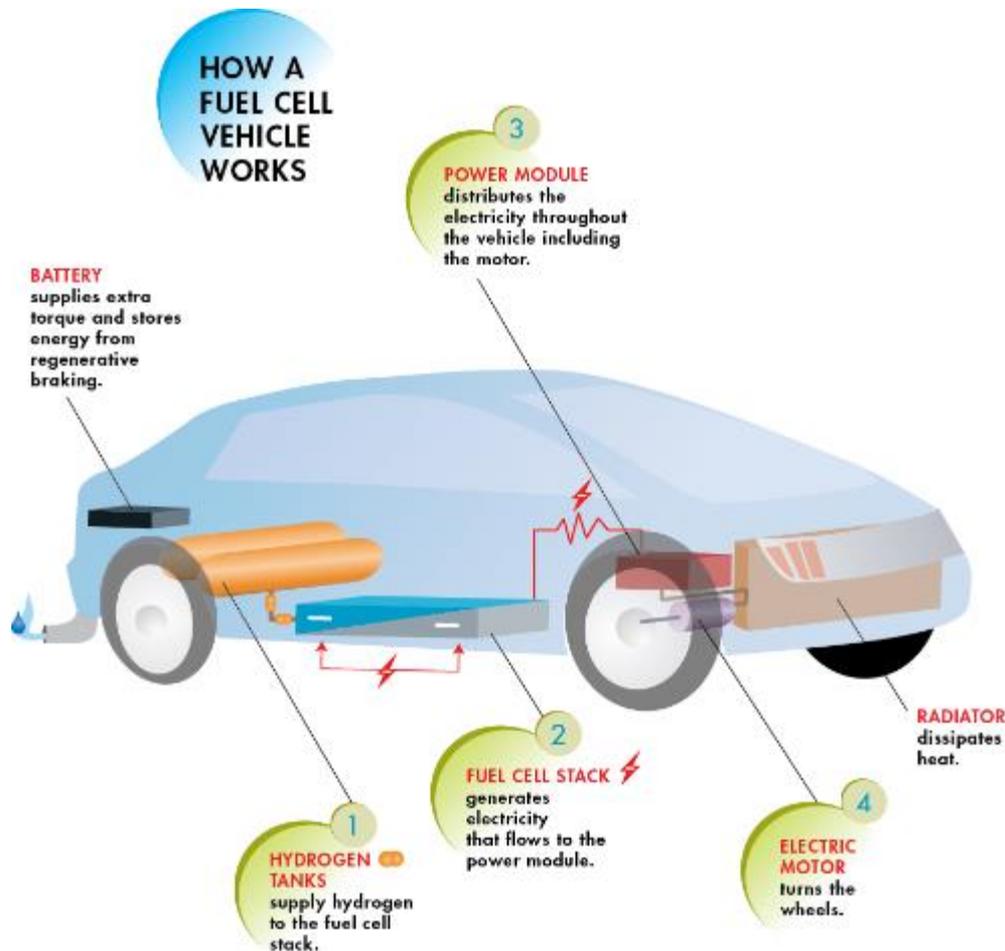
Northeast Fuel Cell Electric Vehicles and Hydrogen Infrastructure Update

June 2016

This presentation is incomplete without the accompanying oral discussion.

What Are Fuel Cell Electric Vehicles (FCEV)

An FCEV is like a regular hybrid with the fuel cell replacing the ICE. The fuel is Hydrogen (H₂) gas compressed in a tank similar to Compressed Natural Gas (CNG).



	Battery Electric Vehicle (BEV)	Fuel Cell Electric Vehicle (FCEV)
Zero Emission Vehicle	Yes	Yes
Primary Drive	Electric motor	Electric motor
On Board Energy	Batteries	Hydrogen & batteries
Source of Energy	NE Mix, Solar, Wind, Hydro	NE Mix, Solar, Wind, Hydro
Range	Variable to 265 miles (Tesla S)	Greater than 300 miles
Temperature Effect	Shortens range	No effect
Recharge Time	22 mile range/hour charging	Less than four minutes

Fuel Cell Electric Vehicles Are Coming

Hyundai started delivering FCEVs in California May 2014.

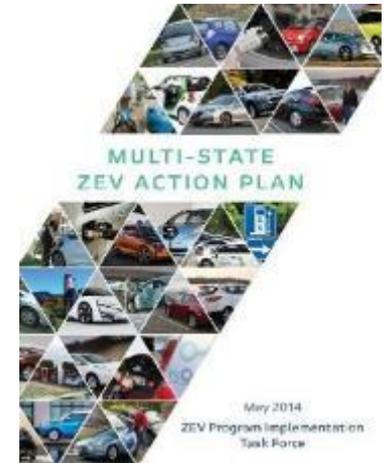


California Energy Commission
Alternative and Renewable Fuel and Vehicle Technology Program
Hydrogen Refueling Station Development Grants
Status: Projected Awards

Project Name	Location	Start Date	End Date	Amount	Notes
...



Both MA & RI created FCEV Working Groups to coordinate policy, legislation and programs supporting the ZEV Action Plan.



California statewide hydrogen stations becoming operational now with network by mid 2016 to compliment existing Southern California stations of today.

National program established to promote the commercial introduction and widespread adoption of FCEVs across America through creation of a public-private partnership to overcome the hurdle of establishing hydrogen infrastructure.

8 State ZEV Action Plan adopted May 2014 by CA, OR, MD, NY, VT, MA, CT, RI.

FCEV Automaker Launch Activity

Hyundai Motor America – Tucson Fuel Cell

- Available now in Southern California
- \$499 per month, including unlimited free hydrogen and concierge service.



Toyota Motor Corporation - Mirai

- Toyota Mirai are available now for sale or lease to California customers and may be in the Northeast in Q1 of 2017.
- MRSP \$57,500.
- Lease \$499 per month, including free hydrogen and concierge service.
- Hydrogen station interests include financial and investment relationships with fuel providers in California and the Northeast.



Honda Motor Company

- U.S. launch in late 2016.
- Financial and investment relationship with fuel provider in California.



Additional FCEV Will Increase Demand For Hydrogen



Full-size buses



Shuttle buses



Drayage Trucks



Garbage Trucks



Delivery Vehicles



Refrigerated Trucks



GSE Tow Tractors



Light Towers

All of these use the same hydrogen and will increase the demand for hydrogen as markets strive to reduce carbon emissions and noise.

Familiar Simple Refueling

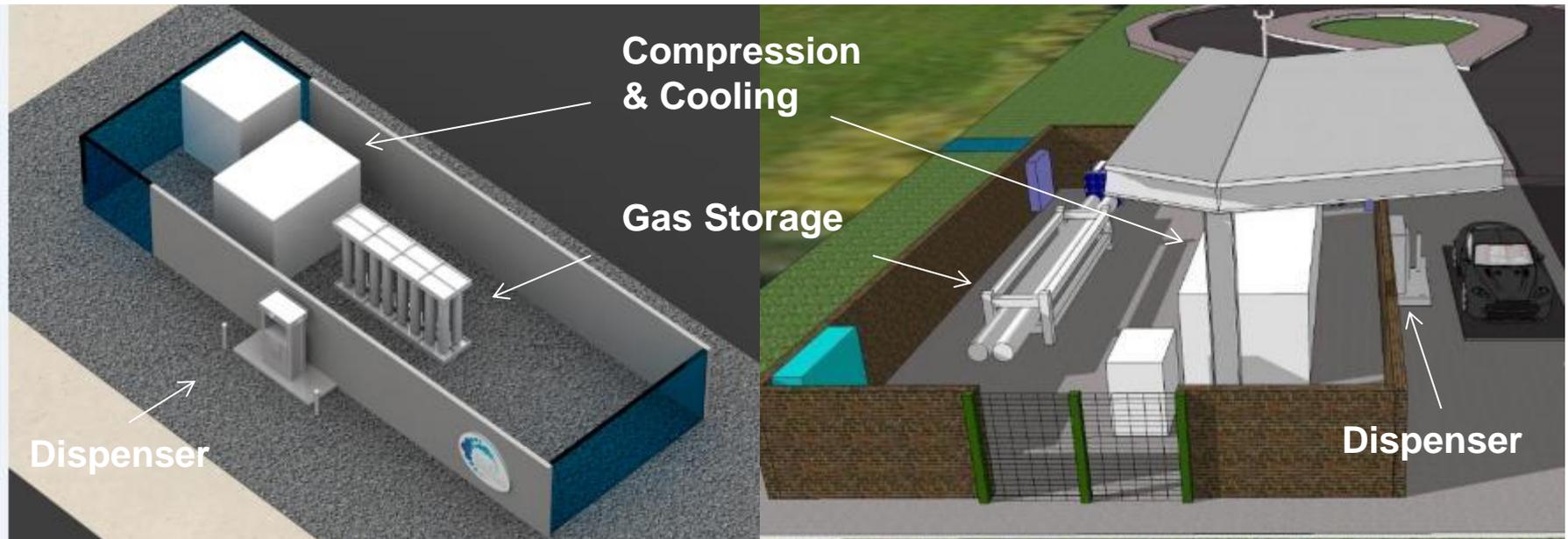


Shell, Torrance, CA Hydrogen Station



Typical Hydrogen Station Design

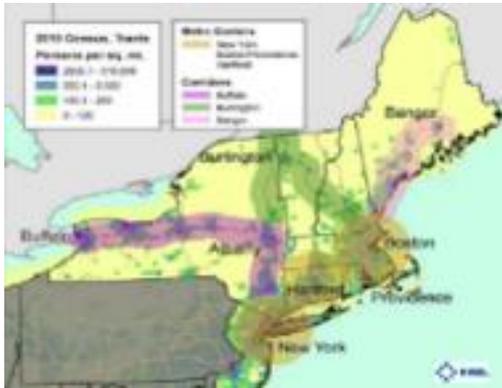
- Small foot print 1500-2000 ft²
- All equipment modular, above ground and expandable
- Fueling time 3-5 minutes
- NFPA 2 and CGA compliant



<http://www.nrel.gov/docs/fy15osti/64107.pdf>

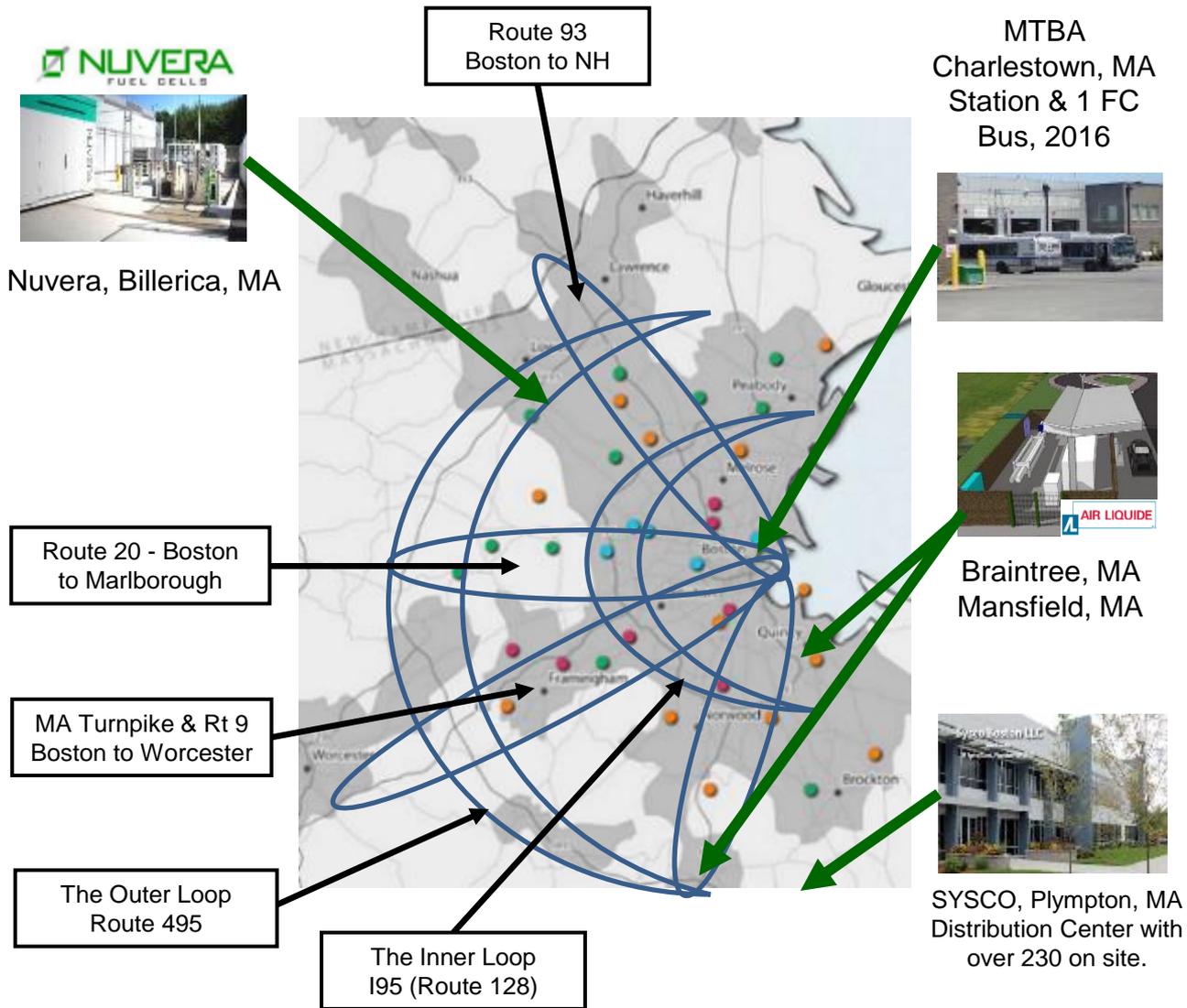
Northeast Hydrogen Station Update

Northeast Region



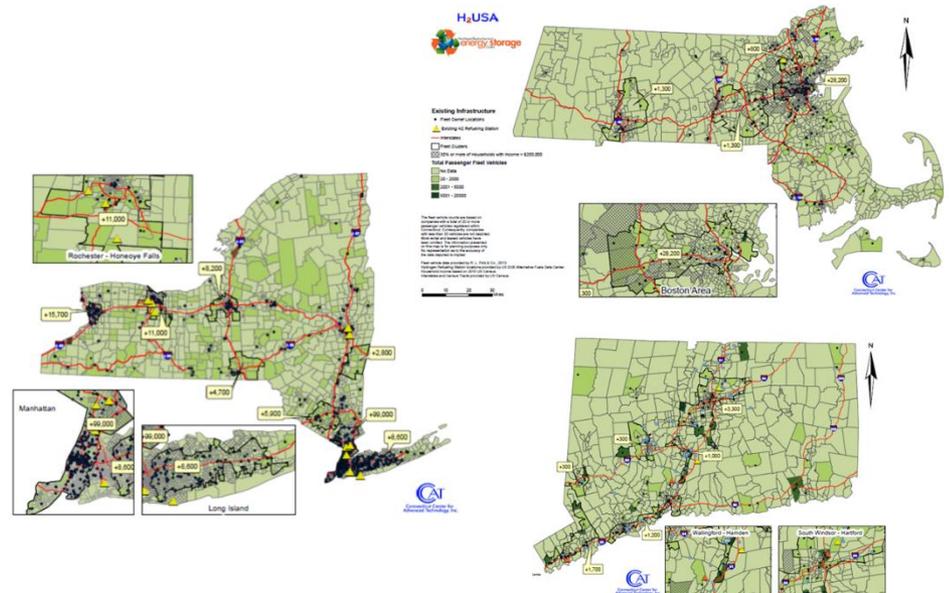
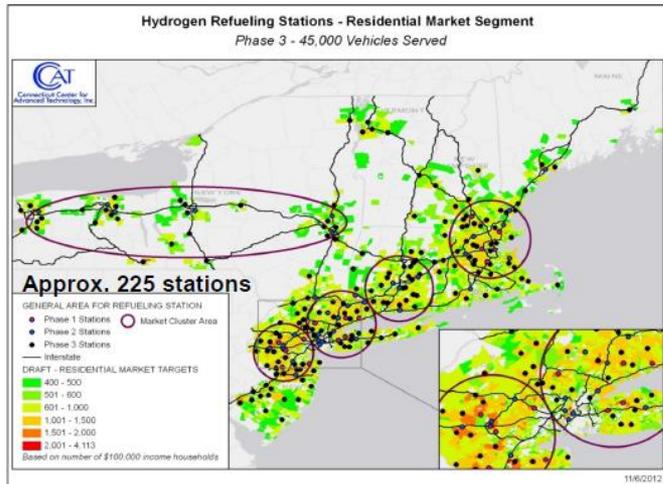
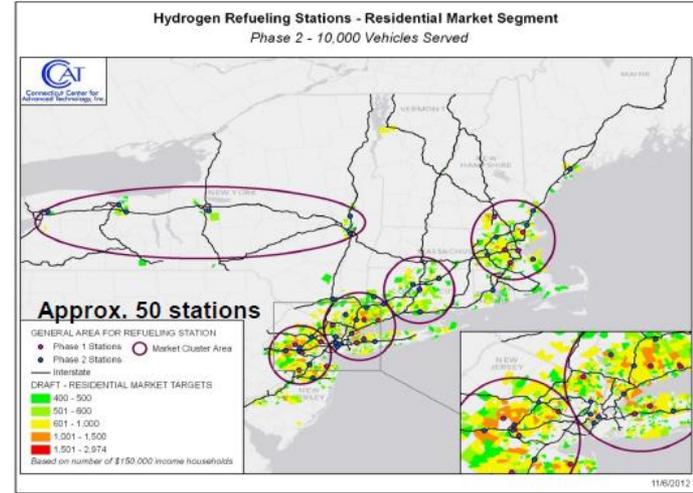
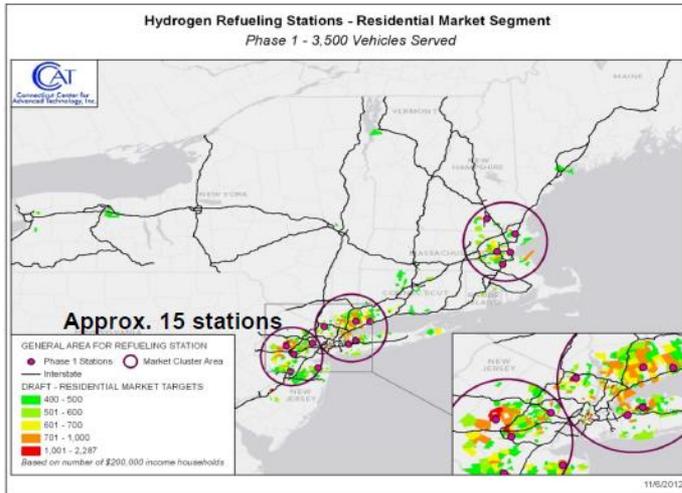
Air Liquide Northeast Program

- Air Liquide & Toyota partnering to build 12 retail hydrogen stations in the Northeast.
- Locations will connect Northern New Jersey, New York City, Connecticut, Rhode Island and Greater Boston.
- Stations are expected to be available starting early 2017.
- All of these stations will use renewable hydrogen.



Maps shown are draft and intended for discussion locating fleets and siting hydrogen locations.

Regional H2 Fueling Station Growth



Fuel Cell Vehicle Fleet Business Case

Feature	Benefit
High Efficiency	2 to 3 times more efficient than Internal Combustion Engines resulting in a 60 to 70+ miles per gallon equivalent.
Stable Fuel Costs	Fuel costs are not easily impacted by global geopolitical events.
Reliability	Fewer moving parts, no oil changes, remote monitoring capability
Nearly Silent	Expands hours of use to improve capital utilization.
Zero Emissions	Meets ZEV and EPA Act requirements.
Low Vibration	Improved passenger comfort.
Fuel Flexibility	Hydrogen can be generated onsite from renewables, biogas, natural gas, the grid.
Short Refueling Time	Less than 5 minutes.
Vehicle Performance	Not impacted by weather.
Energy Resilience	FCEV power plant can be used to power homes, commercial businesses and for remote power.
Vehicle-To-Grid Capability	FCEV power plant can be used in VTG applications.

MA FCEV Working Group & Deployment Plan

Industry	State & Federal	Fleets	Automakers	
				

Station Funding Program

1. Size the fleet to match the output of the H2 station.
2. Establish a Hydrogen Purchase Agreement (HPA) between the fleet owner and the station operator.
3. Station operator, using the HPA as collateral, uses 3rd party funding for his CAPEX in the same way the solar industry used PPA's.

H2 Site Generation Industry Response – station makers each confirmed the HPA process allows them to fund stations - Nuvera Fuel Cells, Giner, Verde, McPhy and Nanoptek.

Transition from fleet to retail in 2017 - Reduce % HPA reliance at H2 stations to free capacity for retail use in phases – 30% reduction then 50% reduction to 75% to zero.

Northeast Fuel Cell / Hydrogen Policy Summary

	ME	NH	VT	MA	RI	CT	NY	NJ
Energy Policy For Fuel Cells								
Mandatory Renewable Portfolio Standard	Green	Green	White	Green	Yellow	Green	Green	Yellow
Net Metering	Green	Green	Yellow	Green	Yellow	Green	Green	Yellow
Public Benefits Fund	Green	White	Yellow	Green	Yellow	Green	Green	Yellow
State Incentives For Fuel Cells								
Performance Based Power Purchase	Green	White	White	White	Yellow	Green	Green	White
State Grant Program	White	Yellow	Yellow	White	Green	Green	White	Green
State Loan Program	White	White	Yellow	White	Yellow	Green	White	White
Property Tax Incentive (Commercial)	White	White	Yellow	White	White	Green	White	Green
Sales Tax Incentive	White	White	Yellow	White	White	Green	Green	White
Property Assessed Clean Energy (PACE) Financing	White	White	White	White	White	Green	Green	Yellow
State Incentives For Hydrogen Fuel								
Zero Emission Vehicle Program (FCEV/H2 Infrastructure)	White	White	Green	Green	Green	Green	Green	White
	Green	Eligible		Yellow	Eligible If Renewable			

The Past 12 Months – It's Really Happening

The 8 U.S. ZEV MOU states (CA, MA, CT, NY, OR, MD, RI, VT) sign an accord with 5 countries to form an international alliance that commits to a ban on the sale of gasoline or diesel Light Duty Vehicles in 2050, delivering the accord to the Paris COP-21 meeting in December 2015.

The 8 U.S. ZEV MOU states rename their group the ZEV Alliance and draft individual state ZEV action plans to realize the goals spelled out in the MOU.

California issues a second round bid for nearly 20 stations in addition to the 28 stations they previously awarded as they work toward their goal of 100 stations.

Hyundai continues leasing the Tucson FCV to retail customers where stations are available in California. Toyota starts both the sale and leasing of the Mirai in California. Honda releases the Clarity FCEV in Japan and later in 2016 in the U.S.

Air Liquide and Toyota announce a relationship enabling the construction of 12 hydrogen stations in the Northeast.

FCEV rebates are created in MA, CA, and CT.



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