

Massachusetts FCEV Working Group Update April 1, 2014

This presentation is incomplete without the accompanying oral discussion.

Massachusetts Hydrogen Coalition

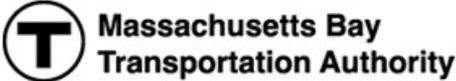
Fuel Cell Electric Vehicle Working Group

Industry

State & Federal

Fleets

Automakers

        	      	      	     
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Summary

Station Funding Program

1. Size the fleet to match the output of a hydrogen 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 – the process is workable. Nuvera Fuel Cells, Giner, Angstrom Advanced (Verde) and Nanoptek all agree.

Financial Institution Support - Bank of America has agreed to help create the HPA funding instruments.

During the fleet sales process, fleet fuel usage would need to be developed in order to determine the optimal number of FCEV for a 50 kg / day station.

Confirmed FCEV Fleet Interest

Light Duty Vehicle Fleets in the MA FCEV Working Group joined our working group with the understanding that we are creating an FCEV Fleet program that matches the fleet FCEV order to the size of a hydrogen fueling station.

The initial fleet orders will range between 18 and 50 vehicles.

Fleet industry profile of the Working Group.

- | | | |
|-----------------------|---|----------------------------|
| Federal Government | – | GSA |
| State Government | – | Massachusetts |
| Municipal Government | – | City of Boston |
| International Utility | – | National Grid |
| Car Rental | – | Zipcar (Avis Owned), Hertz |

Fleet Profiling Work Underway



	Mass State Fleet	Sedan	SUV
State Agencies (Boston, Chelsea, Cambridge, Framingham, Natick, Worcester)	PAR – Parole Board	102	1
	DPW - MassDOT	66	7
	EQE –Enviro Protection	49	4
	DPH –Public Health	38	1
	DCR- Conservation/Rec	37	13
	FEW – Fish and Wildlife	25	8
	AGO	24	0
	DPS	19	0
	DYS	18	0
	TRE	13	1
	AGR	10	0
	CDA	10	2
	DPU	10	0
	DMH	6	0
	Total	427	37



City of Boston	
Category	Vehicles
Light Duty	790
Heavy Duty	250
Total Vehicles	1040
PHEV	3
BEV	2
2013 Purchases	
Total	110
Light Duty Only	60

Vehicle count above is for only six counties in Greater Boston area.



- All vehicles return to the location they are rented from
- Rental rate includes fuel



- Over 10,000 vehicles (SUV & Sedans)
- Follows EPACT alternative vehicle fleet mix guidelines



Fleet Profiling Work Underway

Location	State	Sedans	Ambulance	Bus	LT Truck 4x2	LT Truck 4x4	Medium Duty	Heavy Duty	Total	
GSA Massachusetts Overall Fleet		1081	6	44	684	494	83	2	2394	
GSA Fleet In Select Cities										
Boston	MA	226	0	4	102	77	16	2	427	
Cambridge	MA	10	0	0	11	4	0	0	25	
Lynn	MA	8	0	0	1	0	0	0	9	
Plymouth	MA	5	0	0	1	1	0	0	7	
Massachusetts Subtotal		249	0	4	115	82	16	2	468	47%
Albany	NY	81	7	1	57	61	2	2	211	
Albany Metro (Schenectady, Troy)	NY	124	2	5	75	61	9	9	285	
Albany NY Subtotal		124	2	5	75	61	9	9	285	29%
Farmington	CT	4	0	0	0	0	0	0	4	
Hartford	CT	117	0	3	64	37	0	0	221	
Newtown	CT	0	0	0	0	0	0	0	0	
Storrs Mansfield	CT	1	0	0	6	0	0	0	7	
Connecticut Subtotal		122	0	3	70	37	0	0	232	23%
Manchester	NH	3	0	0	5	0	0	0	8	1%
Grand Total		498	2	12	265	180	25	11	993	

- GSA Fleet Vehicle Replacement Guidelines:
 - Passenger Vehicle: 3 yrs & 36,000 miles, 4 yrs & 24,000 miles, 5 yrs (end)
 - HEV's: 5 yrs & any mileage
 - 4x4: 7 yrs or 60,000 (gas), 8 yrs or 150,000 (diesel)
- Incremental additional replacement cost is spread across the individual fleet user account
- Alternative Fuel Vehicle offerings increased 71% in FY2013
- There are now 1500 AFV models in the mix now
- Renewables, AFV, solicitations occur four times a year

Actions To Increase the Demand for H2



- **Bus, Commuter.** One bus equals one 50 kg H2 station. Consortium - Logan International Airport (operated by Massport), the operator of Framingham Logan Express, and an FCEV integrator.

- **Ground Support Equipment (FC Powered).** To compliment demand for hydrogen negotiate with Logan and Airlines to convert baggage tugs to FCEV.



- **Medium Duty Delivery Fleet FC Range Extender Hybrid.** A major retailer has agreed to explore conditional order for 20 units subject to performance of one.

- **Bus, Mass Transit.** MTBA Nuvera FC bus not due until end of 2014. Use that experience to expand FC Mass Transit Bus population in state starting in 2015.



- **Bus, Regional Transit.** A Regional Transit Authority is moving to CNG over the next several months. They have expressed interest in FC Battery Electric Hybrids and are interested in creating a shared fueling station that supports a retail FCEV program.

Increase Demand For Hydrogen

Late 2014 start development of strategies expanding the use of hydrogen in Massachusetts

Energy Storage

- Explore at energy storage options for Cape Wind using hydrogen and fuel cell technologies
- Explore at energy storage options for wind and solar using hydrogen and fuel cell technologies

Marine

- Explore use of fuel cells for Boston Water Taxi
- Explore use of fuel cells for all Boston ferries

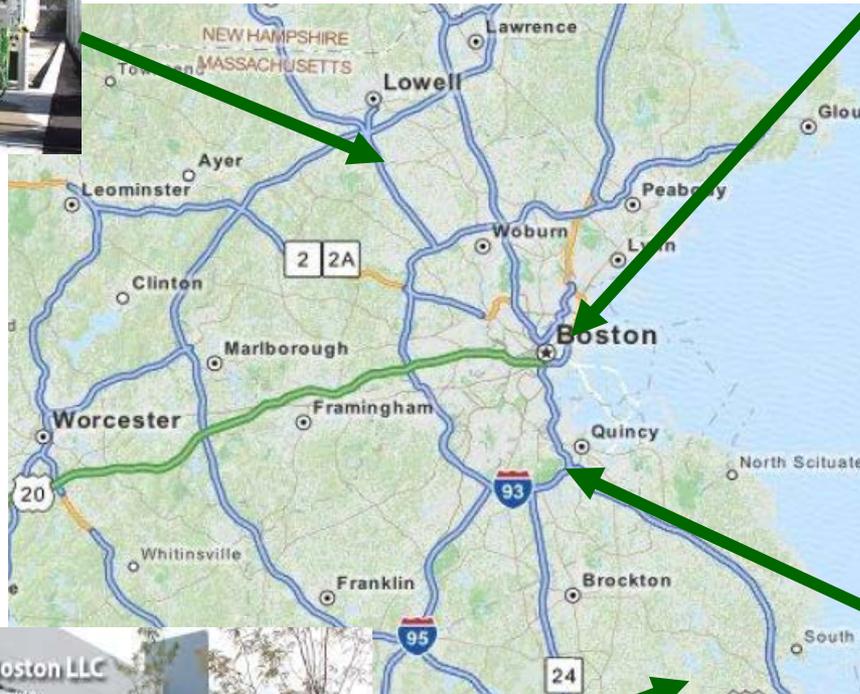
Other

- Explore use of fuel cell powered portable construction lighting by Mass DOT and MTBA
- Explore codes for cell tower back up power to add fuel cells
- Review Mass Green Communities program to see how it can encourage the use of fuel cells, hydrogen generation, hydrogen fueling stations and hydrogen use.

H2 Fueling Operational Now and On The Way



Nuvera, Billerica, MA
In Operation Now,
Fueling 2 Toyota
Highlanders,
Adding 700 bar
fueling end of Q1
2014



T Massachusetts Bay
Transportation Authority

MTBA Charlestown,
MA
1 FC Bus, Delivery
In Late 2014

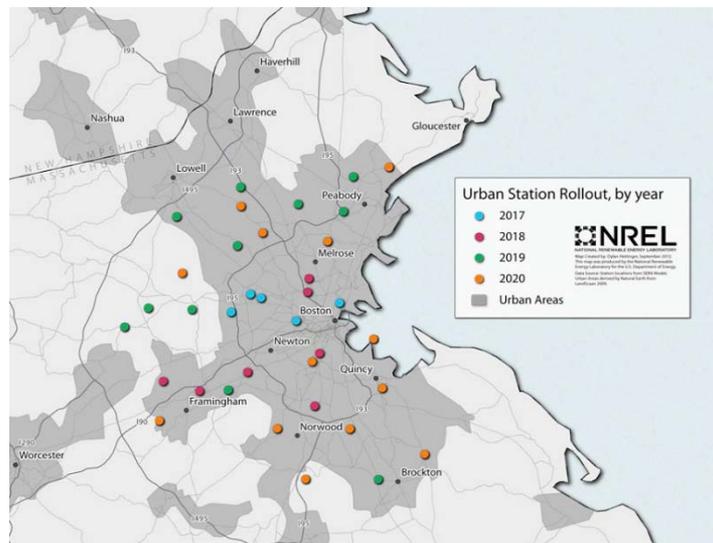
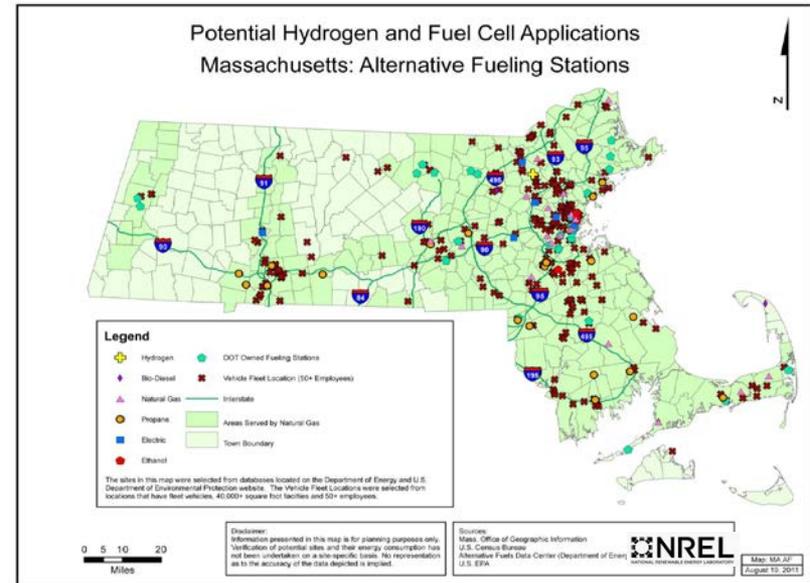
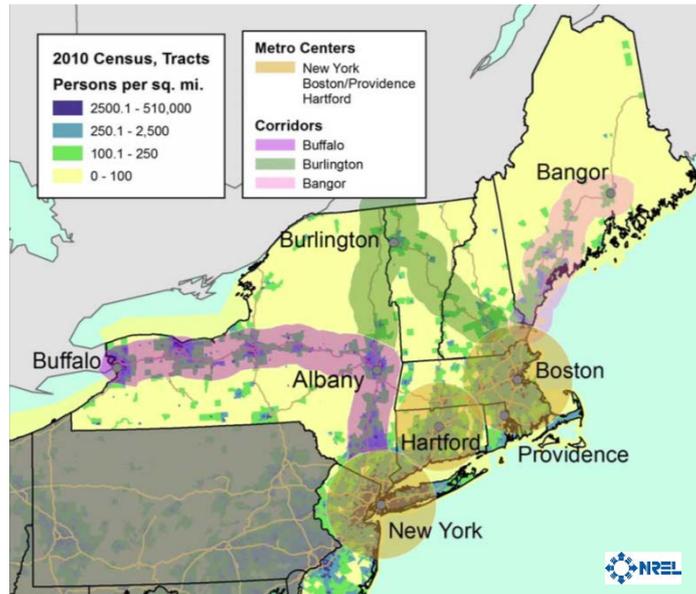
SYSCO, Plympton,
MA
Distribution Center
relies "only" on FC
powered fork lifts.
Over 230 are on
site.



Proton OnSite,
Braintree, MA
Q2 2014 Start Up



Concept Refueling Roadmaps



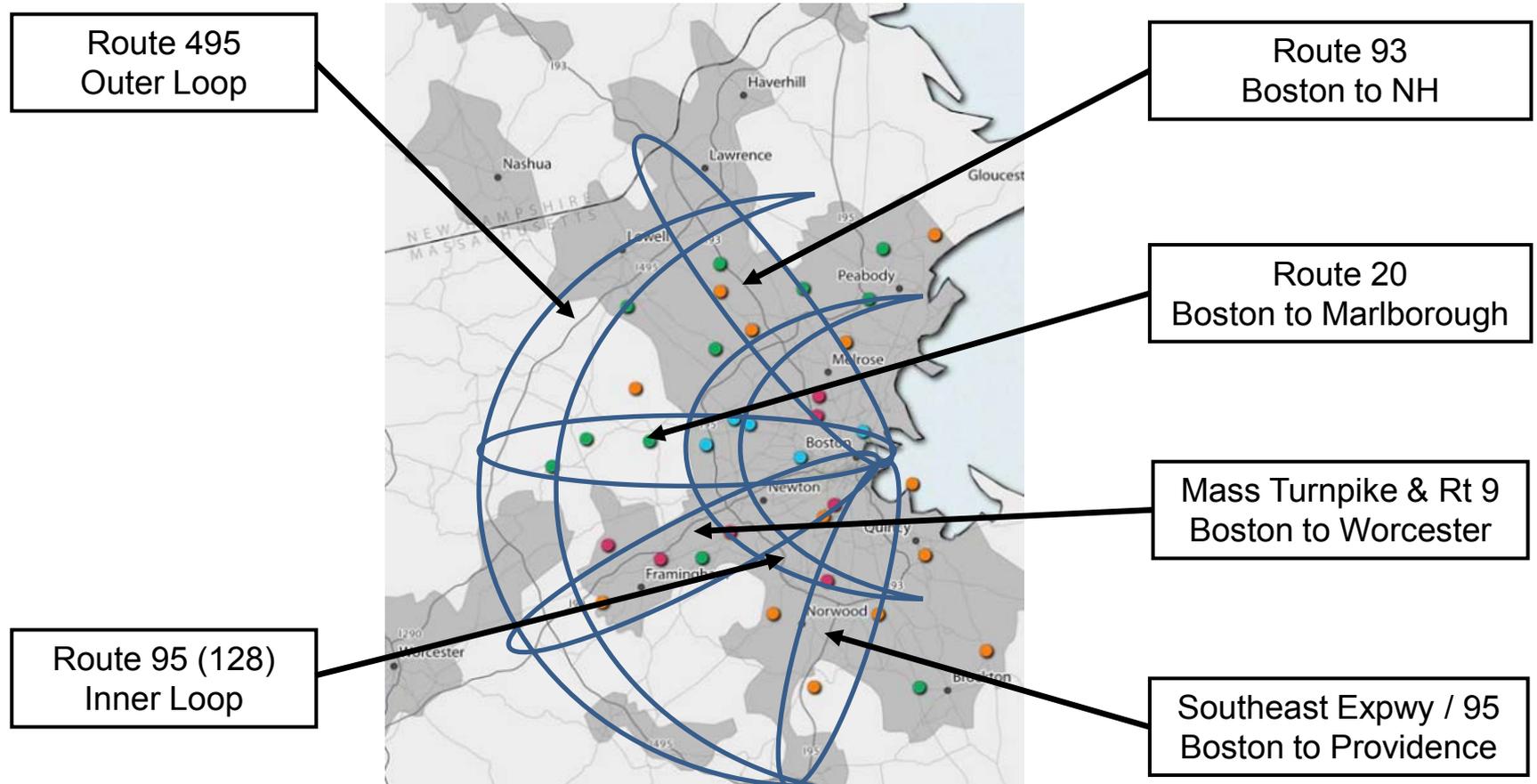
Top left map - basic northeast corridors in need of H2 infrastructure coverage.

Top right map – an early rendition of station locations to meet a 2020 vehicle population.

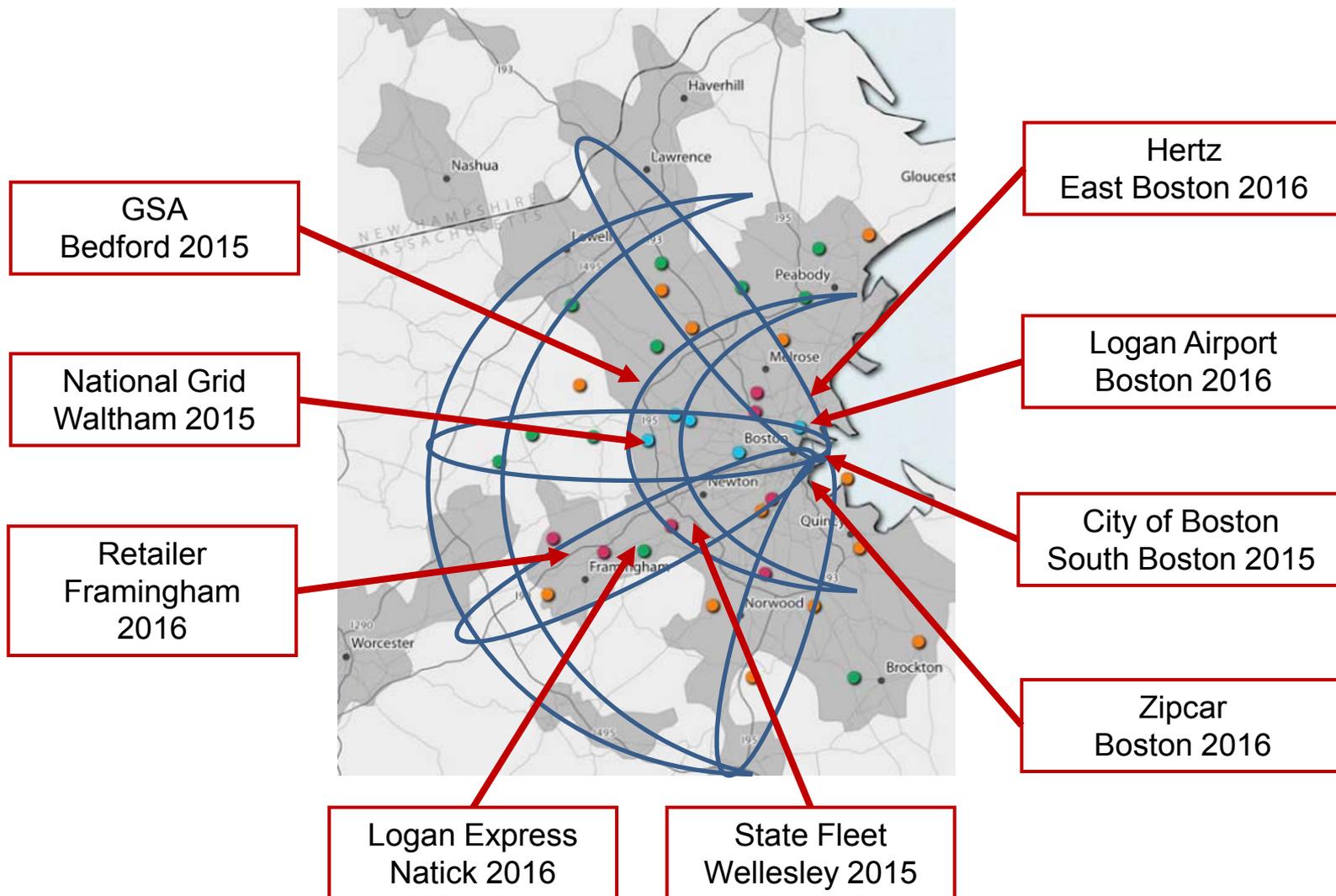
Lower left map - an example of what a phased station location plan might be for the initial launch years of the greater Boston FCEV market. Years will be restated and start at 2015.

Greater Boston H2 Concept (NREL Data)

Greater Boston Concept 4 Spokes – 2 Loops



Based on Current FCEV Interest This One Possible H2 Station Locations Map



Transition From Fleet to Retail Model

Starting in 2015 and running parallel to the fleet sales program, the launch of the consumer FCEV sales program.

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

Expand fleet base - Worcester, Holyoke, Springfield, Westfield.

Add connector stations to other regions using Sturbridge and Lee.

ZEV MOU to H2 Station Forecast

Vehicle Type	ZEV Credit	Vehicles	Total Zev Credits
BEV	1.25	300,000	375,000
Scenario - ZEV Total is target with 200K BEV limit.			
BEV	1.25	77,000	96,250
FCEV	4	70,000	280,000
			376,250

Massachusetts allocation is 300,000 EV's.

Match allocable ZEV credits using mix of both BEV and FCEV.

Station growth assumes FCEV market growth 40% of CARB forecast.

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
FCEV Unit Sales	200	211	634	1227	2622	4483	6514	9136	11758	14888	18441	70115
Retail %			0.7	0.65	0.6	0.5	0.4	0.3	0.25	0.22	0.18	
Retail Unit			190	429	1049	2242	3908	6395	8819	11613	15122	
Fleet Unit			444	797	1573	2242	2605	2741	2940	3275	3319	
# of Fleets	5	5	11	20	39	56	65	69	73	82	83	
# on road	200	411	1046	2273	4895	9178	15280	23370	32856	42850	52112	
Phase 1 / 50 kg	4	8	8	8	10	10	12	14	14	14	14	14
Phase 2 / 250 kg			2	6	6	8	12	18	22	22	22	22
Phase 3 / 1000 kg					3	6	12	18	25	35	45	45
Kg/Day	200	400	900	1900	5000	8500	15600	23200	31200	41200	51200	
Total # Stations	4	8	10	14	19	24	36	50	61	71	81	81

Moving Forward Details

Facilitation of final fleet sizing and negotiations with car company, station operator and fueling equipment supplier.

Massachusetts Electric Vehicle Initiative Task Force (MEVI) is working to finalize EV rebates and other incentives.

Creating ability to pool a group of smaller fleets into one using a central station.

Modification of HPA station use to allow multiple users.

Fire & Safety code approvals for H2 FCEV in tunnels, parking garages and vehicle repair facilities.

Establishing the MA fuel measurement and purity validation program.

Development of the low volume connector fueling stations (Sturbridge, Lee).

MA Hydrogen Coalition Cluster Benefits

	Today	2025
FC/H2 Firms	>300	>1,200
Jobs	>1,000	>10,000
Sales/Investment in Massachusetts	~ \$200 Million	~ \$10 Billion
# of H2 Stations	1	200
FCEV's On Road	2	100,000
FCEV Dealers	0	200

Light Duty Vehicles Only - Trucks and Buses Not Included

Energy Security

- Saves 223 million gallons of gasoline through 2025.

Environmental Benefits

- Reduces CO₂ emissions by 2,824 billion pounds

Massachusetts Coordination

March 28, 2014 at Worcester
Regional Transit Authority



Left to right – Charles Myers (Massachusetts Hydrogen Coalition), Secretary Richard Sullivan, Governor Deval Patrick, Gus Block (Nuvera Fuel Cells)

- ❖ Secretary of Energy and the Environment
 - Under Secretary of Energy
 - ❖ Commissioner
 - ❖ Director, Green Business Development
 - ❖ MA Clean Cities
- Under Secretary of Environment (*8 State MOU*)
 - Commissioner
 - Deputy Director Massachusetts Dept of Environment
 - Director, Low Emissions Vehicle (LEV) Prog
 - NESCAUM (outside consultant)
- Secretary of Housing and Economic Development
- Secretary of Transportation
 - MassPort (Logan Airport)
 - MTBA
- State Senators (2)
- State Representatives (3)

Massachusetts Summary

MA FCEV Working Group established – members represent cross section of Fleet Operators, Automaker, H2 Station OEM's, State & Federal Agencies, Financial Institutions.

Station funding strategy – fleet size match to station output

Fleet profiling has started.

Conceptual station road map work has been done.

Applications to increase utilization of H2 stations are being pursued.

Remember the plan is to use Fleet only as the springboard to create critical mass.

The end game is Retail.

The Greater Boston FCEV Launch can serve as a model for other cities and regions.

Market Messaging

8 state ZEV MOU actions are directed by State Departments of Environmental Protection (DEP) or similar.

Perception – BEV is here now, FCEV is way off in the future, no state level actions are needed for FCEV today.

There will be ZEV vehicle incentives in most states.

Broader market contact with other state(s) groups is needed to prevent duplication of efforts and keep deployment schedule on track.

Updates are needed within the 8 State MOU groups on the FCEV market, H2USA, CA activities, CT activities, NE activities, MA fleet program activity.

Massachusetts EV Funding

Massachusetts Electric Vehicle Incentive Program (MassEVIP)(Source of funds RGGI)

2013 - \$ 555,000 (First Round) awarded to 20 municipalities for the acquisition of 47 electric vehicles and the installation of 17 dual-head electric charging stations.

2014 - \$ 2,000,000 (Second Round) incentives for municipalities to acquire electric vehicles and install charging stations.

Massachusetts Clean Cities Program (Source of Funds DOT CMAQ)

2014 – \$11,700,000

\$ 1,800,000 – purchase 8 battery electric school buses for a V2G trial with the Clinton Foundation.

\$ 6,000,000 - EV rebate program. Up to \$2500 for plug-in hybrid electric vehicles or electric vehicles with 10 KWh electrochemical energy storage (e.g., battery or hydrogen) and \$1500 for plug-in electric or electric vehicles with less than 10 KWh electrochemical energy storage. The program should be for three years with an evaluation after every six months to evaluate effectiveness.

\$ 4,100,000 – incentives to be developed for CNG and medium/heavy duty truck fleets.

Massachusetts Clean Energy Center – funded by the Renewable Energy Trust Fund through a systems benefit charge paid by electric ratepayers this group has not funded FCEV or H2 activities.

HTAC Action Request

- ✓ Continue support of the H2USA program to insure a national FCEV program.
- ✓ Technology – support development of H2 station compressors, metering and quality monitoring.
- ✓ Implementation – support use of DOE national resources; NREL (modeling and mapping), Sandia (code approvals), PNNL (safety training)
- ✓ Coordination of federal agencies
 - facilitate introductions to those who can use FCEV
 - to create H2 siting programs through the use of enhanced use lease and other mechanisms
 - to adopt other vehicle technologies that will increase the demand for hydrogen using FTA and FAA as examples.
- ✓ Support FCEV demonstrations that expand the application of FCEV into other transportation, motive power, applications
- ✓ Support FCEV deployment programs replicable to other locations.

Massachusetts Hydrogen Coalition



AVSG



Energy For A Clean Planet™

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