Massachusetts Zero Emission Vehicle Action Plan:

A Roadmap to Reach 300,000 Zero Emission Vehicles on Massachusetts Roads by 2025

DRAFT

The Commonwealth of Massachusetts

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Introduction and Goals

The 2008 Global Warming Solutions Act (GWSA) required the Secretary of the Executive Office of Energy and Environmental Affairs to establish a statewide limit on greenhouse gas (GHG) emissions of between 10 and 25 percent below 1990 levels for 2020 and to 80 percent below 1990 levels by 2050. Massachusetts subsequently released the Clean Energy and Climate Plan (CECP, December 2010) which is a portfolio of policies that state agencies will or are implementing to ensure that the Commonwealth reduces GHG emissions to achieve the 2020 target. The Secretary established a statewide reduction target of 25 percent below the 1990 baseline level for 2020.

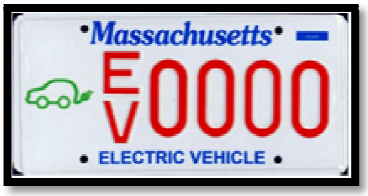
The GWSA offers a unique and historic opportunity for the Commonwealth to develop innovative solutions that will help prevent the devastating and costly effects of climate change while improving the quality of the environment and public health, saving households and businesses money through energy savings, creating jobs, and spurring economic development especially through the rapidly growing clean energy sector. In 2011, the transportation sector in Massachusetts accounted for 40 percent of GHG emissions associated with climate change. One of the key CECP strategies to reduce these emissions is to increase the deployment of zero emission vehicles (ZEVs), such as battery electric vehicles (BEVs), fuel cell electric vehicles (FCEVs) and plug-in hybrid electric vehicles (PHEVs).

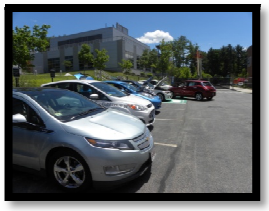
Zero emission vehicles can currently reduce GHG emissions by over 60 percent when compared to gasoline-powered vehicles and displace 4,000 gallons of gasoline over the 11 year lifetime of a typical car[1]. Continued private and federal investments into battery research will improve the efficiency and range of these vehicles and a progressively cleaner electricity grid will result in even more emission reductions from ZEVs sold today. Reducing GHG through advancing alternative fuels, specifically electricity as a transportation fuel, is the primary policy objective of the Massachusetts Electric Vehicle Initiative, or MEVI. Accelerated deployment of ZEVs will also help the Commonwealth to:

- Protect public health and air quality by reducing transportation-related air pollution that contributes to the formation of smog and related health effects such as asthma and heart attacks,
- enhance energy diversity and security,
- reduce up front and total ownership costs to save drivers money over the vehicle lifespan, and
- promote economic growth.

In May 2014, the governor's of eight states including Massachusetts released a Multi-State ZEV Action Plan to increase ZEVs on the road to a collective target of at least 3.3 million vehicles in the eight states by 2025 and to establish a fueling infrastructure that will adequately support these vehicles. The eight-state action plan identifies the joint cooperative actions that the signatory states must undertake in order to achieve the cumulative goal, but each state must take steps within its own jurisdiction to achieve its specific goal. Massachusetts' participation in this plan sets a bold goal of 300,000 ZEVs or 15 percent of projected registered vehicles in the state by 2025. This Massachusetts ZEV Action Plan identifies actions and strategies that are consistent with the eight-state plan and identifies additional state specific actions that align with the Commonwealth's own climate and renewable energy goals, policies and current ZEV market.

[1]Union of Concerned Scientists. *State of Charge*, June 2012; NASEO and VEIC. *Transportation Technical Reference Manual*, June, 2014; IHS/Polk. Average Age of Vehicles, 2014.





Massachusetts Electric Vehicle Initiative

MEVI grew from an Electric Vehicle Roundtable held on March 7, 2013. This roundtable was co-sponsored by the Executive Office of Energy and Environmental Affairs (EEA), the Department of Energy Resources' (DOER) Massachusetts Clean Cities Coalition and the Conservation Law Foundation. Over 90 participants provided recommendations to accelerate the deployment of plug-in hybrid, battery, and fuel cell electric vehicles here in Massachusetts. Senior managers in state government agreed with stakeholders that the Commonwealth must take numerous actions to demonstrate leadership on this important environmental, energy and transportation initiative. Participants advised that a high-level group, the MEVI Task Force, be created to set priorities and make specific recommendations on actions to consider implementing.

The Secretary of EEA set up a MEVI Task Force that is managed by a team of Undersecretaries, Commissioners and staff from EEA, DOER, the Department of Environmental Protection (MassDEP) and the Department of Public Utilities (DPU). Stakeholders from both private and public organizations were invited to participate in the Task Force to assist the Commonwealth in its dual goal to increase electric vehicle sales and reduce GHG emissions. The Massachusetts Department of Transportation and its GreenDOT team provide input, transforming their own fleet as well as taking action to support the state-wide goals. The Office of Consumer Affairs and Business Regulation became the lead agency on consumer protection issues related to electric vehicle service equipment (EVSE), test procedures and testing equipment. Three working groups were established to focus on infrastructure, incentives and outreach. The MEVI Task Force met for the first time on September 30, 2013 and held three subsequent meetings (on January 28, 2014, May 8, 2014 and September 29). Comments made during and after the final meeting resulted in a draft action plan.

In the FY2015 Massachusetts State Budget, Outside Section 205 created a formal Zero Emission Vehicle (ZEV) Commission with 27 named members. The Section includes the following directives:

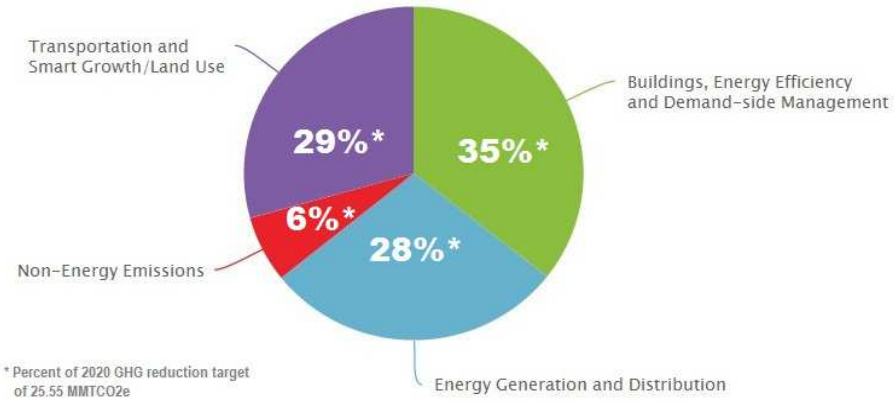
- File an action plan based on the work of the Massachusetts electric vehicle task force by September 30, 2014 and
- prepare a full report of the commission's findings and recommendations, including any draft legislation, to be filed with the clerks of the house of representatives and senate by April 15, 2015. The study shall include, but not be limited to, recommendations for policies to: (A) further expand access to electric and fuel cell vehicle infrastructure in the commonwealth; (B) encourage the purchase and lease of electric and fuel cell vehicles; (C) reduce the up-front costs associated with electric and fuel cell vehicle purchases; and (D) identify strategies for removing barriers to electric and fuel cell vehicle deployment.

One of the first items of business for the ZEV Commission will be to review this draft plan and they will be asked to approve it as a final MA Action Plan.

Energy Efficiency, Renewable Energy and Increasing Environmental Benefits of ZEVs

As required by the GWSA, the Secretary of the EEA established a state wide GHG emission limit for 2020. Concurrent with the release of the CECP in December 2010, the Secretary established a statewide GHG emission limit of 25 percent below statewide 1990 GHG emission levels by the year 2020. In an effort to achieve this goal, Massachusetts has emphasized energy efficiency, renewable energy and alternative transportation. Saving energy, reducing greenhouse gas emissions and developing a robust clean energy sector have helped establish the Commonwealth as a national clean energy leader. Over the last four years, for instance, the American Council for an Energy Efficient Economy (ACEEE) has ranked Massachusetts #1 in its annual state energy efficiency scorecard,[1] which incorporates transportation policies and practices as 20 percent of the score (ACEEE 2014).

Nationally, 97 percent of the transportation sector relies on petroleum[2], which is a nonrenewable and increasingly costly resource. In 2011, the transportation sector emitted more greenhouse gas (GHG) than other sectors in Massachusetts (40%).[3] The CECP estimates that implementation of transportation and smart growth/land use policies will contribute 29 percent or 7.5 MMTCO2e of the emission reductions needed to meet the Massachusetts target for 2020.[4]



The expected GHG reductions from the Clean Car Initiative (of which light duty ZEV replacement of petroleum fueled cars are a key component) is 385,535 tons by 2020.

With 4678 ZEVs registered in MA as of March 30, 2015, Massachusetts has avoided over 10,158 short tons of GHG emissions.[5] Governor Patrick's goal of replacing 300,000 gasoline powered cars with zero emission vehicles would greatly contribute to the reduction of greenhouse gas emissions. The replacement of 300,000 gasoline powered vehicles for 300,000 ZEVs will result in over 800,000 short

[1] http://database.aceee.org/state/massachusetts

[2] U.S. Energy Information Administration. *Annual Energy Review, Table 5.13c, 2011* http://www.eia.gov/totalenergy/data/annual/index.cfm#petroleum.

[3] MassDEP (2014). *MA Annual Greenhouse Gas Emissions Inventory: 1990-2011*

[4] http://www.mass.gov/eea/air-water-climate-change/climate-change/massachusetts-global-warming-solutions-act/progress-on-2020-plan/.

[5] U.S. DOE Clean Cities. Alternative Fuel Life-Cycle Environmental and Economic Transportation Tool at https://greet.es.anl.gov/afleet_tool.

tons of GHG emissions avoided each year[6]. The monetary savings to drivers related to reduced maintenance and fueling costs will also be significant. If ZEV registrations increase at a linear annual rate towards meeting the year 2025 goal, by 2020, 169,400 petroleum powered cars must be replaced, which would achieve 454,381 short ton GHG reductions every year.[7]

If 300,000 petroleum powered cars were substituted with 300,000 ZEVs, here are the savings:

	COSTS	**COSTS**	**SAVINGS**
	Gasoline	**EV**	
Annual Operating Cost			
Light Duty Vehicle (LDV) Fuel Cost	$496,000,000	$153,275,862	$342,724,138
LDV Maintenance Cost	$528,599,612	$465,769,995	$62,829,617
	EMISSIONS	**EMISSIONS**	**EMISSIONS**
	Gasoline	**EV**	**Avoided**
Annual Life-Cycle Petroleum Use (barrels)			
LDV Petroleum Use	2,905,704	34,611	2,871,093
Annual Life-Cycle Greenhouse Gas Emissions (short tons)			
LDV GHG Emissions	1,678,891	874,202	804,689
Vehicle Operation Air Pollutant Emissions (lb)			
CO	24,107,504	0	24,107,504
NOx	823,854	0	823,854
PM10	229,449	165,715	63,734
PM2.5	93,305	41,249	52,056
VOC	974,380	0	974,380

[6] Ibid.

[7] Ibid.

ZEV Regulatory Program Requirements

The ZEV regulatory program has been adopted by ten states (California, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island and Vermont) and requires increasing sales of ZEVs over the next decade. Massachusetts DEP regulations are found at 310 CMR 7.40: Low Emission Vehicles. [8] The annual sales requirements in state programs were modest at the outset, but increase over time, anticipating that consumer demand will expand as consumers become more familiar with a growing range of continually improving ZEV products. The ZEV program provides manufacturers substantial flexibility through mechanisms such as credit banking and trading, alternative compliance options, cross-state credit pooling, and by allowing manufacturers to develop their preferred compliance strategy using BEVs, PHEVs, FCEVs, or some combination.

The ZEV Market and Current Opportunity

There are currently 25 plug-in electric vehicle models from 14 manufacturers that are available for sale or lease in the U.S. with 12 models running on only electricity (BEVs), 13 that are plug-in hybrid electric vehicles (PHEVs) and 3 that are fuel cell electric vehicles (FCEVs). The manufacturers target diverse groups of drivers, whose interests and considerations differ, forming a collection of ZEVs that can tailor to the varying needs and lifestyles of the modern American car owner.

ZEV sales in the U.S. have risen almost fivefold since 2011 and as of June this year, more than 340,000 ZEVs have been sold nationwide[9]. This national increase reflects the efforts made by automobile manufacturers and individual states to deploy more BEVs and PHEVs, and this trend is forecasted to continue. As ZEVs enter the used car market and the price continues to drop with improved battery technology and increased production, the cars will become more affordable. Along with their considerably lower overall fuel and maintenance costs, the vehicles will become more attractive to additional income brackets.

As of March 30, 2015, Massachusetts had 4,678 registered EVs and PHEVs. The growing monthly sales are a result of the increasing awareness of ZEVs' environmental and financial benefits, the access to state and federal incentives, and the expanding availability of public and workplace charging stations. Consumer acceptance of ZEVs, which is growing faster than original hybrid deployment[10], along with the constant improvement of vehicle and battery technologies contributes to the forecast of a successful future for the ZEV market. Massachusetts is the second state to offer EV license plates, identifying a commercial or private vehicle as a BEV to other drivers and also for first responders.

State policies and funding have been crucial to bolstering the development of ZEVs in the Commonwealth. Grants help offset the higher initial costs of these advanced technologies. MassDEP's Electric Vehicle Incentive Program (MassEVIP) provides incentives to Massachusetts public and private entities, including municipalities, state fleet, universities and colleges, and driver's education schools, for the acquisition of electric vehicles and charging stations. As of July 31, 2015, MassDEP has provided more than $1.2 million in incentives for 115 electric vehicles and 43 Level 2 dual-head charging stations to fuel them. MassDEP is still accepting applications under MassEVIP until the $1.4 million available

[8] http://www.mass.gov/eea/agencies/massdep/air/programs/lev-registering-diesel-passenger-vehicles-and-light-duty.html

[9] http://insideevs.com/monthly-plug-in-sales-scorecard/

[10] US Department of Energy. *EV Everywhere Progress Report 2014.* http://energy.gov/sites/prod/files/2014/02/f8/eveverywhere_road_to_success.pdf.

funding is expended. The Green Communities Designation and Grant Program requires a fuel efficient vehicle policy for municipal fleets and provides grant funds for the purchase of ZEVs and charging infrastructure.

Based on recommendations from the MEVI Task Force, Massachusetts launched the first ZEV rebate program in New England in June of 2014. The Massachusetts Offers Rebates for Electric Vehicles (www.mor-ev.org) provides residents with rebates up to $2,500 for the purchase or lease of zero-emission and plug-in hybrid electric passenger cars. After the first $2 million were spent, an additional $2 million were allocated from the Regional Greenhouse Gas Initiative (RGGI) auction proceeds. As of July 21, $2,416,250 rebate dollars have been reserved or issued for 1024 ZEVs. The Massachusetts Clean Cities Coalition fleet grant programs also act as incentives for Massachusetts businesses to in; helping the Commonwealth reach its goal of putting 300,000 ZEVs on the road by 2025.

Along with grants that lower the point of purchase or lease price of zero-emission and plug-in hybrid electric vehicles, Massachusetts is using federal and state funding to help create an easily accessible network of charging stations across the Commonwealth. In 2010, there were no charging stations in the state. Several years ago, the DOER Clean Cities program spent slightly over $1 million of federal and state funds to install 140 publicly available Level 2 charging systems. In 2015, the DOER Clean Cities program solicited applications for a fast charger network. Twelve stations will be installed at MassDOT service areas and at least 10 additional private locations to create interstate travel corridors and ease travel in state. As of August 5, 2015, there are 874 public charging outlets throughout the state at 321 electric stations.

Through the MassDEP's MassEVIP workplace charging grant program, 331 charging stations have been funded (as of July 31, 2015) at 123 different workplaces for use by employees. MassEVIP workplace charging grant program provides 50 percent of the funding for charging station hardware costs. Co-workers of ZEV owners will have the opportunity to see ZEVs plugged in at work, and ask their peers about their experience. The U.S. Department of Energy Workplace Charging Challenge has documented

that employees of companies with workplace charging are 20 times more likely to drive a PEV than the average U.S. worker.[11]

[11] U.S. DOE EV Everywhere, Workplace Charging Challenge, Progress Updates 2014: Employers Take Charge, November 2014

To complement the workplace charging programs, the Commonwealth initiated a hands on ride and drive program at employer locations and at several public events. Test drive events are a proven, most effective mechanism for driving both consumer and fleet awareness and adoption. The Mass Drive Clean Campaign was launched in the spring of 2015 and is the first state-wide ride and drive program in the nation. The Executive Office is working with Plug In America with funding from the Merck Foundation and MassDEP to market and conduct eight ride and drive events. Best practices from working with a managing partner of the award-winning Bay Area Experience Electric Campaign (REACH Strategies) were adapted to the Massachusetts market. The initiative received an overwhelmingly positive response from corporate hosts during a pilot phase in spring, 2015. After test driving, 81% of drivers reported that their overall opinion of an EV is better than before and 63% report that they are more likely to purchase an EV. Information about the changes in consumer perception and engagement as well as upcoming events will be posted at a www.MassDriveClean.org website in the last quarter of 2015.

Federal Framework and Multiple State and Interstate Initiatives

Massachusetts drew on a number of federal resources to evaluate opportunities to increase ZEV deployment. The U.S. Department of Energy Clean Cities program, the National Renewable Energy Laboratory, and the National Research Council have each completed in-depth assessments of potential barriers to ZEV adoption and policy approaches to overcome these barriers.[12]

The Massachusetts Clean Cities Coalition, staffed by the Massachusetts Department of Energy Resources (DOER), is part of the nationwide program sponsored by the U.S. Department of Energy (DOE) that focuses on reducing petroleum use in the transportation sector through the adoption of alternative fuel vehicles, as well as supporting the development of infrastructure necessary to make these

[12] Frades, M. *A Guide to the Lessons Learned from the Clean Cities Community Electric Vehicle Readiness Projects*. Prepared for the U.S. DOE by the Center for Climate and Energy Solutions. January 2014. DOE/CHO-AC02-06CH11357-1301 at http://www.afdc.energy.gov/uploads/publication/guide_ev_projects.pdf;
Stephens, T., *Non-Cost Barriers to Consumer Adoption of New Light-Duty Vehicle Technologies*. Transportation Energy Futures Series. Prepared for the U.S. DOE by Argonne National Laboratory, Argonne, IL. March 2013. DOE/GO-102013-3709 at: http://www.nrel.gov/docs/fy13osti/55639.pdf;
National Research Council. *Overcoming Barriers to Electric-Vehicle Deployment: Interim Report*. Washington, D.C: The National Academies Press. 2013 at: http://www.nap.edu/catalog.php?record_id=18320;
National Research Council. *Transitions to Alternative Vehicles and Fuels* National Academies Press. 2013 at: http://www.nap.edu/catalog.php?record_id=18264.

vehicles a viable transportation option. Zero emission vehicles are a strategic priority for the next five years.

The Massachusetts Clean Cities Coalition provides:

- Grant funding opportunities,
- discussion forums for alternative fuels, vehicles, and related infrastructure,
- information pool and vendor base,
- technical assistance with alternative fuel projects,
- help with planning and implementing alternative fuel events,
- education and training for the safety and maintenance of vehicles and infrastructure and
- program support to increase alternative transportation for both state and local fleets across Massachusetts (mandated by the Green Communities Act).

DOER's Clean Vehicle Program is funded by the Congestion Mitigation and Air Quality (CMAQ) improvement program sponsored by the U.S Department of Transportation's Federal Highway Administration. This $11.7 million dollar project proposes to replace more than 200 public and private vehicles powered by gasoline and diesel with alternatively fueled vehicles such as natural gas (CNG), propane (auto gas), battery, hybrid, and solar electric, as well as hydraulic hybrid technology. Approximately half of the funding is slated for EV projects and half for CNG/propane projects. The Clean Vehicles Project funding will also provide for EV Fast charging infrastructure and natural gas infrastructure that includes provision for co-location of hydrogen fueling.

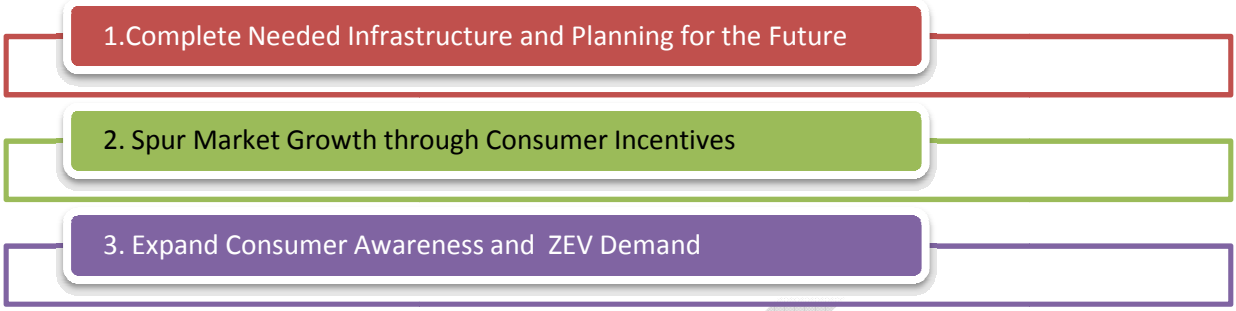
Announced by President Obama in March 2012, the EV Everywhere initiative of the U.S. DOE focuses on our country becoming the first nation in the world to produce plug-in electric vehicles that are as affordable for the average American family as today's gasoline-powered vehicles within the next 10 years. DOE has launched the Workplace Charging Challenge with a goal of achieving a tenfold increase in the number of U.S. employers offering workplace charging in the next five years. The Commonwealth is working as a workplace charging ambassador to facilitate the participation of employers in our state.

The Transportation Climate Initiative (TCI), formed in 2010, is a collaboration of the transportation, energy, and environment agencies from Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. EV infrastructure planning has been a marquee project for TCI since its inception. Through a collaborative project, supported by a U.S. Department of Energy grant, TCI produced a series of guidance documents and marketing materials for Level 2 EV charging station deployment that are currently in use across the region. Through TCI, state-level participation in this project by the relevant state agencies ensures a higher probability of success in policy implementation and the execution of planning elements. Information on TCI and its initiatives is available at: http://www.georgetownclimate.org/state-action/transportation-and-climate-initiative

Structure of the 2015 ZEV Action Plan

This action plan outlines significant actions grouped under three broad goals that state agencies are currently implementing or plan to take to help expand the ZEV market. It is also intended to show progress in the advancement of ZEVs in Massachusetts. Finally, it is a roadmap for the ongoing tasks that are currently in process, as well as the specific actions that are necessary for achieving the goal of having 300,000 zero-emission vehicles on Massachusetts roadways by 2025.

Three broad goals for the state government to advance ZEVs are included in this Action Plan:



Tracking of progress and results will be reported through the Clean Energy and Climate Performance Management System (CCPMS) and actions discussed with the ZEV Commission. The ZEV Action Plan may need to be modified based on analysis by the agencies and the ZEV Commission.

Another key element that has been discussed is the suggestion to establish an Environmental Justice committee to convene experts, understand opportunities to promote and incentivize ZEV purchases targeted to low income communities[13] and make recommendations to the full ZEV Commission for action.

The following abbreviations are used to denote the participating organizations and agencies:

CSE: Center for Sustainable Energy
DCAMM: Executive Office for Administration and Finance, Division of Capital Asset Management and Maintenance
DOER: Department of Energy Resources – Clean Cities and Building/Climate
DEP: Department of Environmental Protection
DFS: Department of Fire Services
DOS: Consumer Affairs & Business Regulation, Division of Standards
DPS: Department of Public Safety
DPU: Department of Public Utilities
EEA: Executive Office of Energy and Environmental Affairs
FCEV Working Group: led by MA Hydrogen Coalition with public and private entity participation
MassDOT: Massachusetts Department of Transportation
NESCAUM: Northeast States Coordinated Air Use Management
OVM: Office of Vehicle Management
ZEV Commission: Zero Emission Vehicle Commission established by FY2015 Budget, Outside Section 205

[13] In 2011, home energy and utility expenditures made up 6% of average household annual income and 23% of average low income household income. In contrast, transportation costs averaged 16% of overall household income and 33% of annual income in low income households. Table 2, NASEO and VEIC. *Transportation Technical Reference Manual*, June, 2014.

Goal 1: Complete Needed Infrastructure and Planning for the Future:

Additional charging infrastructure is necessary to further adoption of BEVs. Residential charging is currently the most utilized charging method for PHEV and BEV owners. Based on MOR-EV statistics, 67 percent of rebate applicants have or plan to install Level 2 home charging stations. This provides owners with easy charging that is reliable and efficient. However, the extra costs to purchase and install these systems (hiring an electrician to put in electrical wiring and conduits while ensuring enough power) are costs that conventional gasoline-fueled car owners do not incur. Home installation costs would be significantly reduced if new homes were designed and constructed with the capacity for PHEV and BEV charging rather than retrofitting them later.

The availability and accessibility to public charging stations provides a safety net and comfort for early adopters, helps owners without access to home charging and provides BEV drivers with "range confidence". Charging stations need to be placed in accessible and safe areas, aligning the location's designated use (e.g., shopping centers, grocery stores, highway rest areas or park and ride lots) with the adequate level charging station. Workplace charging is also a critical location for PHEV and BEV charging stations; it can create peer-to-peer discussions on the benefits and utility of ZEVs and creates new interest in ZEVs as well as extends the commuting range.

It is important that commercial and retail developments also plan for increasing numbers of PHEV and BEVs that will drive in Massachusetts. Commercial buildings and parking facilities may last for many decades and building in the capacity for PHEV and BEV chargers is the least expensive and easiest way to provide charging if done at the time of design and construction. Compared to installing EV-ready wiring and conduits, costs for adding electrical service and permitting later would be done at considerable expense.[14] If developers took the next step and installed charging stations in a percentage of these BEV-ready locations, building occupants, guests and parking clients would be able to recognize potential "fueling" opportunities.

There are also several manufacturers of electric vehicle service equipment, some of which are accessible to only certain PHEVs or BEVs, which create a challenge for drivers. Requiring open and accessible public charging stations and interoperability across charging station providers is crucial for the Commonwealth to encourage. Also critical to support BEV owners and vehicle manufacturers is the creation of an intra and interstate corridors of fast charging infrastructure. Having fast chargers installed in key locations will expand the ability to drive farther on electricity. EVSE vendors and auto manufacturers without public funding are providing additional access to fast charging and Level 2 systems in Massachusetts. Ensuring proper signage to direct traffic, along with pricing transparency posted at the charging station, will also provide BEV drivers with clear understanding and confidence in a growing fueling infrastructure.

As fuel cell electric vehicles (FCEVs) become available to our market, hydrogen fueling stations will be required. The fueling experience is similar to that of fueling CNG vehicles, although the options available for sourcing the fuel vary. Hydrogen can either be delivered to the station or site-generated. Hydrogen delivery by vehicles traveling through tunnels needs to be allowed. The MA Fuel Cell Electric Vehicle working group is also looking at station design standards and code adoption. The two most common site generation options are electrolyzing water using power from the grid and the reforming of natural gas. The capacity of the station can be matched to the number of FCEVs that require refueling. Selection of the hydrogen sourcing technology and the location of these stations to evolve the market is as

[14] Energy Solutions, *Preliminary Phase I Cost Analysis Summary*, December 2014. California Building Code, *Final Express Terms for Proposed Building Codes of the California Building Standards Commission Regarding Proposed Changes to the California Green Building Standards Code of Regulation, Title 24, Part 11*.June 26, 2014. *Initial Statement of Reasons for Proposed Building Standards.* April 24, 2014.

critical as the location of charging stations. Signage, pricing transparency and public access concerns match those of BEV owners.

The following actions related to infrastructure will support the Commonwealth's goal of having 300,000 ZEVs on the road by 2025.

Action	Lead Agency	Supporting Agency	Timeframe
Incentivize and Support ZEV Charging Infrastructure			
MA has spent slightly over $ 1 million of federal and state funds to install 140 publicly available level 2 EVSEs. Determine regulatory approach to EVSEs.	DOER, DEP DPU	EEA	Complete DPU Order 13-182-A issued 8/4/14
1. Using EPRI analysis and NESCAUM study, determine need and plan for additional EVSE installations and explore public private partnerships to expand Level 2 EVSE network without complete reliance on public funding	*EEA*	*DOER, MassDEP, MassDOT, ZEV Commission, private companies*	*In development*
2. Create Fleet and Workplace Charging Opportunities	*DEP MassEVIP grants*	*EEA, DOER*	*Ongoing*
3. MassDOT has evaluated all service plazas for fast charging station installation and has selected 12 service plazas for installation.	MassDOT	DOER, EEA	Complete
4. Adopt regulations to allow credits for EVSE in the Ride Share program	*DEP*		*2016*
5. Install a Northeast fast charging corridor including 12 locations at MassDOT facilities	*DOER, MassDOT*		*Installation by Jan. 1, 2016*
6. Coordinate with neighboring states to create interstate and Canadian corridors to facilitate long-range travel.	*DOER/Clean Cities*		*Ongoing*
Enable universal access to ZEV infrastructure for MA drivers			
7. Require that future state-funded ZEV charging stations are ChAdeMO certified or SAE-certified and accessible to all ZEV	*DOER, DEP*		*Ongoing*

Action	Lead Agency	Supporting Agency	Timeframe
drivers regardless of network membership			
8. Require that any state-funded hydrogen stations are open to the public, adhere to SAE standards, and are accessible to all FCEV drivers regardless of existing fueling agreements.	*DOER/Clean Cities*	*NESCAUM, Fire Marshall, FCEV working group, DOS*	*2016*
9. Include capacity for adding hydrogen as a review element in CNG station funding programs	DOER/Clean Cities		Complete
10. Require that state-funded and encourage all public EVSE and hydrogen installations be reported to the National Renewable Energy Laboratory Alternative Fuels Data Center database to provide a central clearinghouse for information that can be utilized to develop mapping applications	*DOER/Clean Cities*		*Ongoing*
11. Implement recommendations from Eversource study "Accommodating Garage Orphans".	*DOER, EEA*	*Eversource, Cities of Boston and Cambridge*	*2015*
12. MEPA project reviews include suggestions for charging station installations, typically as a percent of the available parking	*MEPA*		*Ongoing*
13. Install ZEV logos on highway supplemental signage which will provide driver way finding to ZEV fueling stations.	*MassDOT*	*DOER*	*2015*
Ensure pricing transparency, accuracy and best charging practices for ZEV fueling			
14. Adopt Method of Sale and signage related to sale of electricity as a motor fuel	DOS		Complete – NIST Handbook 44 Method of Sale
15. Develop standards for EV charging equipment and test procedures to ensure accuracy	*DOS*	*EEA*	*If adopted on schedule, January 2016*

Action	Lead Agency	Supporting Agency	Timeframe
16. Evaluate utility Grid Modernization plans that support innovation (e.g. electricity rate structures to encourage off-peak charging, demand charges and utility EV pilot programs).	*DPU*	*DOER, EEA*	*Grid Modernization plans submitted in August 2015*
17. Define DPU related issues (if any) to production and storage of Hydrogen for fueling.	*FCEV Working Group*	*DPU*	*2015*
Establish consistent statewide codes and standards for Infrastructure			
18. Support EV Ready standards in Building Code regulations.	*EEA*	*DOER Building and Climate Director*	*Draft regulations in late 2015*
19. Consider legislation similar to CA to prevent "prohibition of EVSE installations" at MDUs	*ZEV Commission*	*EEA*	*2015*
20. Conduct hydrogen infrastructure study that supports an interstate corridor, uniform national standards and signage to ensure consistency of requirements.	*NESCAUM*	*DOER, Fire Marshall, EEA, MOU states, FCEV Working Group*	*In development*
Implement elements of plan	*EEA*	*DOER, DEP, MassDOT*	
21. Help local officials with ordinances to penalize non-ZEVs in EVSE spaces and to adopt best practices	*EEA*	*DOER*	*2016*
22. Evaluate California and NIST standards related to Hydrogen delivery system testing for adoption in MA.	*DOS*	*EEA, FCEV Working Group*	*2015*

Goal 2: Spur Market Growth through Consumer Incentives:

In order to develop a sustainable market for ZEVs, it is important for Massachusetts to take actions to provide incentives at the consumer level and reduce the total cost of vehicle ownership since ZEVs are currently more expensive than gasoline engine models. Through monetary and non monetary rewards, the Commonwealth is providing incentives to drivers to purchase ZEVs and to see additional benefits in becoming a ZEV driver. Continuing to evaluate consumer incentives and finding long term, secure funding is critical. Providing cost-differential financial incentives to municipalities and state agencies for the acquisition of electric vehicles will increase the visibility of electric vehicles in Massachusetts for the short term. Additional non-monetary incentives can increase awareness of ZEVs particularly if they are visible and include a marketing component.

As fuel cell electric vehicles enter the market it will be important to review incentives and acquisition programs to include FCEVs. This ZEV action plan does not include other important incentive programs aimed at medium or heavy duty vehicles.

The following actions related to consumer incentives will support the Commonwealth's goal of having 300,000 ZEVs on the road by 2025.

Action	Lead Agency	Supporting Agency	Timeframe
Reduce the cost of ownership of ZEV's to encourage consumer purchasing and spur market growth			
23. Implement the MOR-EV program for rebates on the purchase of BEVs, FCEVs, PHEVs and ZEMs	*DOER*	*EEA – ensure funding available; ZEV Commission propose modifications*	*Ongoing*
24. Develop a pilot program for tiered MOR-EV rebates for all income levels. Evaluate pilot and recommend institutionalization	*EEA*	*DOER, ZEV Commission*	*Late 2015*
Provide additional incentives for ZEV owners			
25. Complete initial HOV lane analysis and make recommendations to allow access by ZEVs carrying the driver only	MassDOT		Complete
26. Provide technical analysis to MassDEP on air quality impacts	*MassDOT*	*DEP*	*Ongoing*
27. Draft and finalize regulations with EPA consultation on SIP (as needed to ensure air quality benefits)	*DEP*	*EEA*	*2016*
28. Specifications for FastPass include ability to use VIN decoder to allow reduced tolls on electric toll roads. *Conduct Cost/Benefit analysis to determine feasibility and impacts.*	MassDOT		Complete
29. Develop statewide policy that provides parking benefits for ZEVs in government-owned buildings, parking lots and other properties	*DOER*	*EEA, DEP, DCAMM*	*2016*
30. Evaluate Eversource pilot for utility managed residential EV charging that provides an incentive to help EV owners reduce their charging costs while helping to manage grid reliability.	*Eversource, DOER*	*EEA, DPU*	*2017*
31. Issue Order based on fall 2014 technical conferences.	*DPU*	*EEA, DOER, DEP*	*In development*

Goal 3: Expand Consumer Awareness and Increase ZEV Demand

Consumers are often hesitant to immediately adopt a new technology. Through outreach and education, consumers can better understand the comfort, convenience and fun of driving ZEVs. Events such as National Drive Electric Week and ZEV ride and drives invite consumers to celebrate and share the widespread appreciation and benefits of driving ZEVs. Finding ways to support dealers in selling more ZEVs will also be important to facilitate consumer education as the salesperson is the front line interface for consumers considering a purchase or lease. Through more outreach and education, ZEVs will become more widely accepted and adopted, leading to higher demand and lower costs.

The following outreach-related actions will support the Commonwealth's goal of having 300,000 ZEVs on the road by 2025.

Action	Lead Agency	Supporting Agency	Timeframe
Outreach			
Help consumers understand the comfort, convenience and fun of driving ZEVs			
32. Sponsor EEA events during National Drive Electric Week	EEA	DOER, DEP, Sierra Club	Sponsored in 2014
33. Identify opportunities to highlight ZEVs at high visibility events (e.g., sports or concert venues).	*EEA*	*DOER, DEP*	*2016*
34. Improve state ZEV website	*EEA*	*DOER, DEP*	*2015*
35. Emphasize education for legislators to become familiar with ZEVs so that they can help respond to constituent questions	*Sierra Club, EEA*	*DOER, DEP, ZEV Commission*	*Ongoing*
36. Create a Mass Drive Clean campaign that has 1000 ZEV drivers in the spring/fall 2015	EEA	DEP, MassDOT, DOER, Merck Foundation	8 events Spring and Fall 2015
*37. Work with utilities and energy efficiency experts to find additional ways to provide consumer education (*Mass Save®*, direct mailings)*	*EEA*	*DPU, DOER*	*2015*
38. Support, motivate and educate Dealers and Mechanics.	*DOER, CSE*	*EEA, DEP*	*Ongoing education and training*
39. Identify additional groups who could spread the word: religious, planning agencies, chambers of commerce, Mass Municipal Association annual meeting	*EEA*	*DOER, DEP*	*Ongoing*

Evaluate dealer incentives			
40. Determine how to motivate and increase enthusiasm for ZEV sales from dealers	*EEA*	*NESCAUM, DOER, DEP, Mass. Autodealer Association*	*2016*
41. Review monetary recognition programs(with funding)			
Lead by example by increasing ZEVs in state and municipal fleets			
42. Develop MA fuel efficiency standard and fuel economy requirements and purchase targets for ZEVs in state fleets to meet minimum of 25% of new LDV purchases for applicable uses by 2025. Qualified ZEVs to include FCEV as the models become available to the market.	*DOER*	*OVM, DEP*	*Ongoing*
43. Ensure state contract includes all ZEV makes and models to the extent possible	*OVM*	*DOER*	*Ongoing*
57. Develop best practice policies to maximize the "electric miles" driven by the state fleet	*DOER*	*OVM, MassDOT*	*2016*
58. Evaluate cooperative contracts to aggregate demand on ZEVs and EVSE		*OVM*	*2016*
Provide consumer education about battery life	*DOER*	*Raytheon*	*2016*
59. Evaluate technical reports on charging and cycling behavior of batteries			
60. Provide consumer education about how to maximize battery life			

LIST OF ACRONYMS IN THIS ZEV ACTION PLAN

BEV: Battery Electric Vehicle
CCPMS: Clean Energy and Climate Performance Management System
CECP: Clean Energy and Climate Plan
CSE: Center for Sustainable Energy (MOR-EV contractor)
FCEV: Fuel Cell Electric Vehicle
GHG: Greenhouse Gas
GWSA: Global Warming Solutions Act
LD or LDV: Light Duty Vehicles includes passenger cars, pick-up trucks, sport-utility vehicles or minivans of up to 8,500 lbs gross vehicle weight
MEVI: Massachusetts Electric Vehicle Initiative
PHEV: Plug-in Hybrid Electric Vehicle
ZEVs: Zero Emission Vehicles include battery electric vehicles, fuel cell electric vehicles and plug-in hybrid electric vehicles.