Connecticut Department of Energy and Environmental Protection

Connecticut Department of
ENERGY & ENVIRONMENTAL PROTECTION

GC3 Analysis, Data, and Metrics Working Group Meeting

December 3, 2015

2:30—4:30 p.m.

Connecticut Department of Energy and Environmental Protection

Agenda

2:30 Welcome

2:40 Review and discussion of California emissions reduction strategy – *Presented by NESCSAUM*

3:25 Role of electric utilities in deploying electric vehicles
Guest speaker, Watson Collins, Eversource

3:40 New items for discussion

4:00 Public Comments

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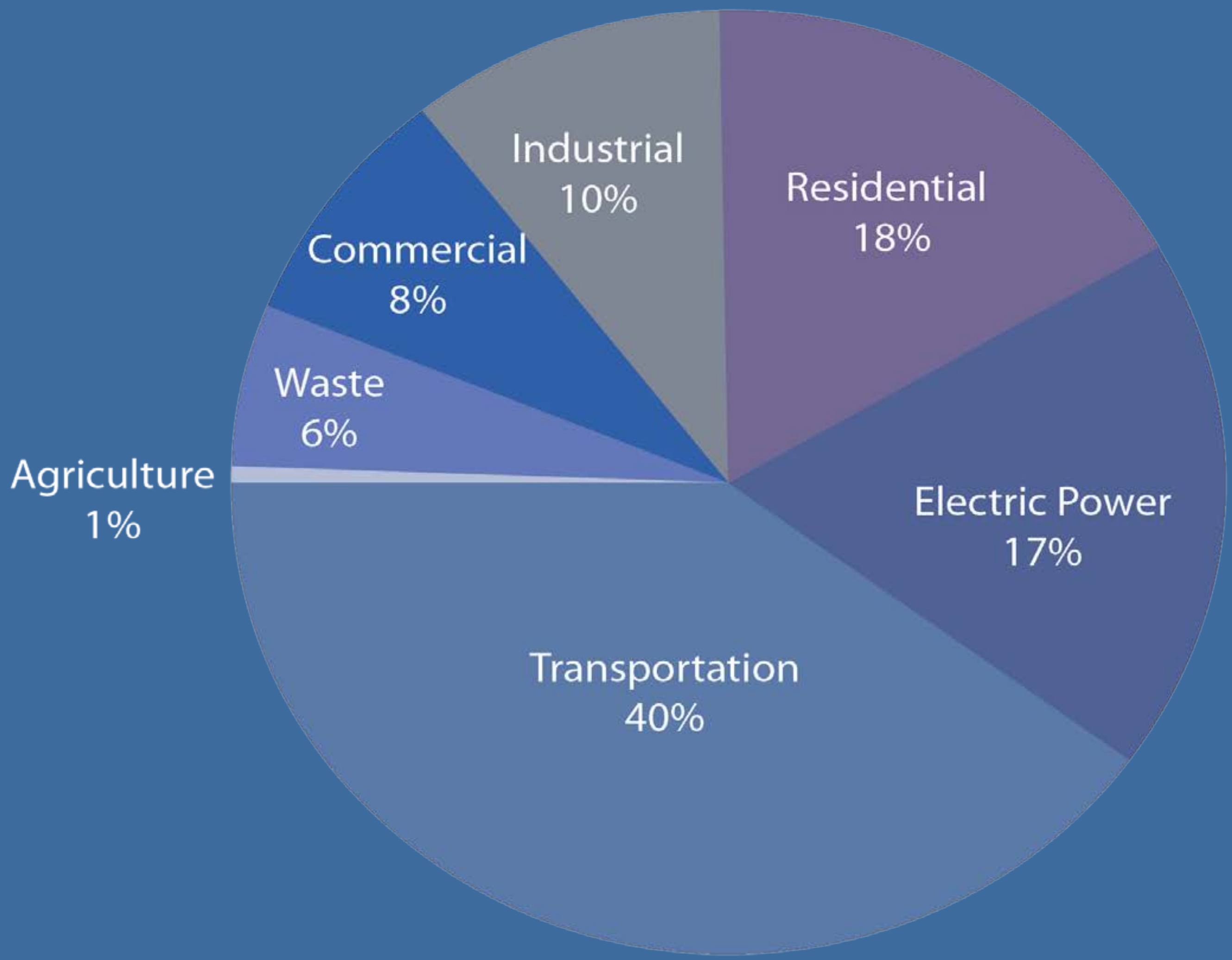
Meeting Goals

- Review of GHG contributors and broad strategies for reducing emissions
- Summarize the foundation in place in CT to promote the technology transformation needed to achieve climate goals
- Insights from CA PATHWAYS analysis

CT GHG Emissions 2012



4 Key Energy Transitions

1. Efficiency and conservation across all energy use sectors (includes VMT, building energy use, vehicle efficiency, etc.)
2. Fuel switching in transportation/buildings
3. Decarbonize electricity
4. Decarbonize fuels (gas/liquids)

Source: E3, California PATHWAYS, 2015

CT Has Building Blocks in Place

- ZEV mandate and incentives programs
- RGGI
- Renewable portfolio standard
- Solar installations
- Energy efficiency programs

CT ZEV Purchasing Incentives

Point-of-Sale Consumer Incentives

- Up to $3,000 for purchase or lease of new ZEV
- $1 million dollar seed fund with an additional $1 million dedicated in November

Dealership Sales Incentives

- $300 for each ZEV sold or leased

CT Charging Infrastructure Incentives

Fleet and Workplace Charging Incentive Program

EV connecticut
The Path to a Clean Vehicle Future

- Available to state agencies and municipalities
- A reimbursement of up to $15,000 per vehicle and up to $10,000 per charger

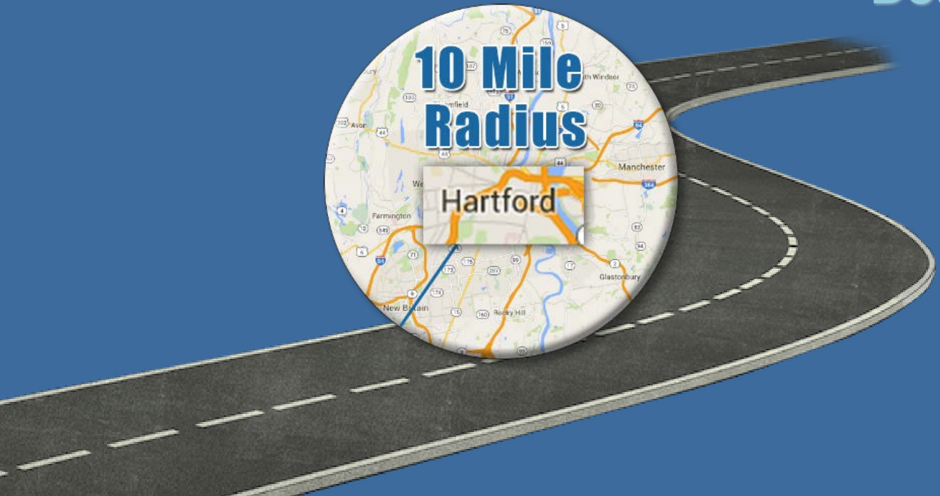
Charging Station Incentive Program for Businesses

- Awards of $2,000 to $5,000 per charging station
- Must be available to public free of charge

H2 Fueling Stations Incentives

- Allocation of state grant funds to leverage private investment
- Locate in the greater Hartford area
- Three bids for construction of two publically available fueling stations
- Expect awards by year's end
- Stations projected to be operational in 2017

Boston

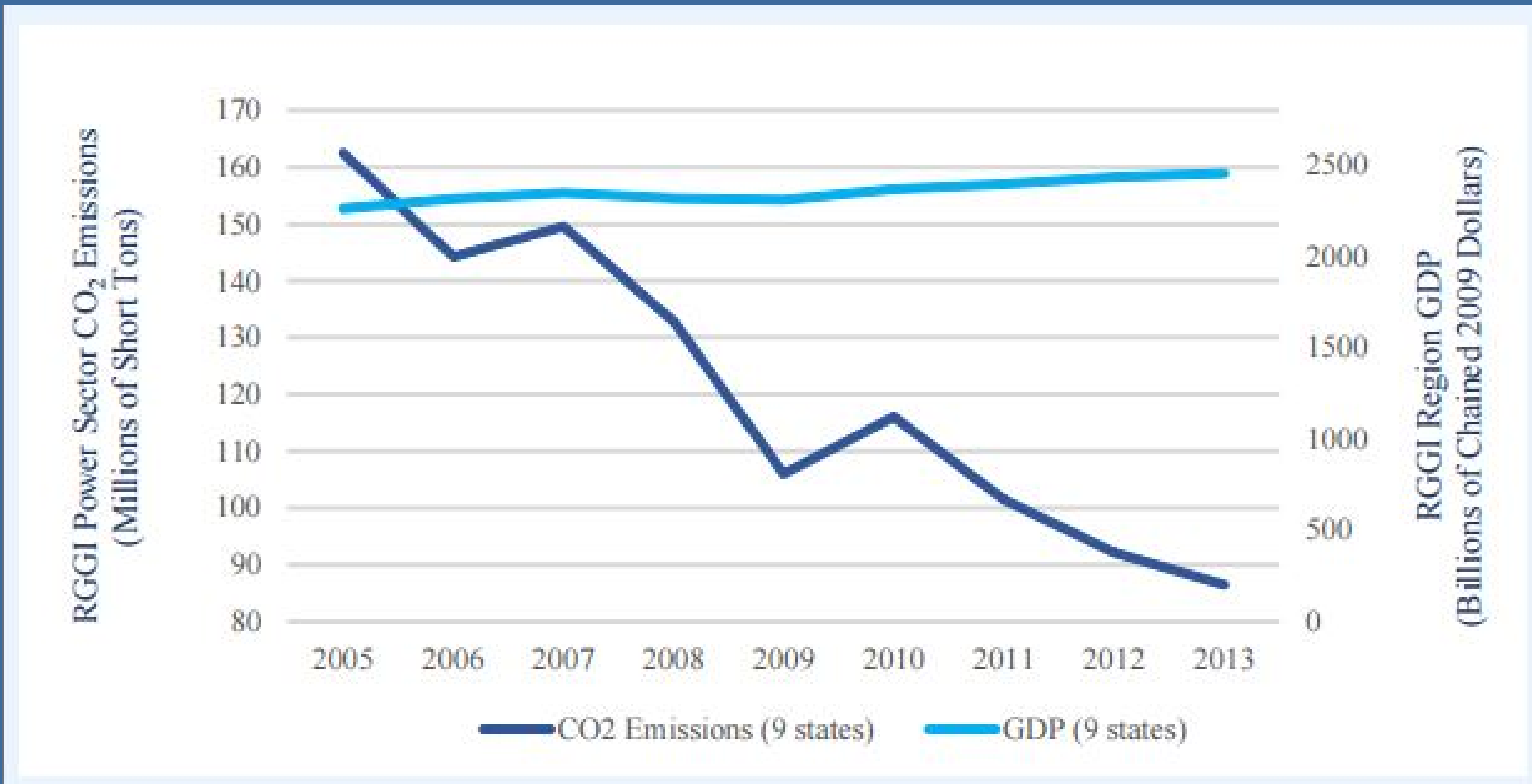


New York

Role and Opportunities for Utilities in Transportation Electrification

- Charging infrastructure deployment
- Variable rate pricing
- New demand to make up for downward trend
- More efficient generation through load balancing

RGGI Power Sector CO_2 Emissions



Source: RGGI and UCS

State Renewable Energy Targets

State	Standard or Goal
CA	RPS: 33% by 2020
CT	RPS: 20.0% Class I + 3% Class I or II + 4% Class III by 2020
MA	RPS: Class I (New Resources): 15% by 2020 + 1% each year thereafter Class II (Existing Resources): 5.3% in 2014 (1.8% renewables and 3.5% waste-to-energy) and 5.5% in 2015 (2.0% renewables and 3.5% waste-to-energy)
RI	RPS: 14.5% by 2019
VT	CEP sets goal of 90% renewable energy by 2050
NY	RPS: 50% by 2030

State Solar PV Installation and Capacity Rankings

State	National Rank Installed Systems	National Rank Capacity (MW)
CA	1	1
CT	6	12
MD	9	13
MA	4	4
NJ	3	2
NY	5	5

Source: NREL, *The Open PV Project*, Dec. 2015 (https://openpv.nrel.gov/rankings)

ACEEE Statewide Efficiency Rankings

Table 2. Summary of state scores in the 2014 State Scorecard

Rank	State	Utility & public benefits programs & policies (20 pts.)	Trans-portation policies (9 pts.)	Building energy codes (7 pts.)	Combined heat & power (5 pts.)	State government initiatives (7 pts.)	Appliance efficiency standards (2 pts.)
1	Massachusetts	20	7	5.5	4.5	5	0
2	California	12.5	8.5	7	4	6.5	2
3	Oregon	15	7	5.5	3.5	5.5	1
3	Rhode Island	20	5	6	3	3	0.5
3	Vermont	18.5	6	6	3	4	0
6	Connecticut	14	5	5	4.5	6	1
7	New York	13.5	8	5.5	2	6	0
8	Washington	13	7	6	2.5	4.5	0.5
9	Maryland	10.5	5	6	3	5	0.5
10	Minnesota	14	3.5	4.5	1.5	5.5	0
11	Illinois	9	5	6	1.5	5.5	0
12	Michigan	12.5	4	3.5	1.5	4.5	0
13	Colorado	10.5	4	5	1	4	0
14	Iowa	12	2	6	0.5	3.5	0
15	Arizona	12	3	3	2	3	0.5
16	Maine	8	5	3.5	3	3	0
17	Hawaii	12	3.5	2.5	1	2.5	0
17	Wisconsin	8.5	2.5	4	2.5	4	0
19	New Jersey	8.5	5	3	2	2.5	0
20	Pennsylvania	5	5.5	4	1	5	0
21	District of Columbia	5.5	5	5	1.5	2.5	0.5
22	New Hampshire	8.5	1.5	4	1.5	2.5	0.5

Table 4. Leading states in the State Scorecard, by years at the top

State	Years in top 5	Years in top 10
California	8	8
Oregon	8	8
Massachusetts	7	8
New York	6	8
Vermont	6	8
Connecticut	4	8
Rhode Island	1	7
Washington	0	8
Minnesota	0	7
Maryland	0	4
Maine	0	2
New Jersey	0	2
Wisconsin	0	1
Illinois	0	1

Path Forward

- 2050 climate goals require fundamental restructuring of CT’s energy system
- Rate of GHG reductions must significantly increase to meet 2050 goal
- Insights from CA PATHWAYS approach

Key Assumptions in CA PATHWAYS

- Continuation of current lifestyle & economic growth
- Technological conservatism, plus key emerging technologies with low carbon intensity
- Natural retirement of equipment (<u>not early replacement</u>) and penetration of new technology consistent with history
- Biomass use is limited based on DOE estimate of sustainable supply
- Advanced biofuels are assumed to have net-zero carbon emissions

CA PATHWAYS Approach

Four major energy transformations needed to meet CA's 2050 climate goals:

- Total energy-use efficiency needs to *improve* by additional 1.3%/year over 30 years
- Electricity supply is nearly decarbonized
- Most existing direct fuel use needs to be electrified
- Fuel-switching, with some "forks in the road"
  - Electrification vs. biogas in buildings?
  - All-electric vehicles vs. hydrogen fuel cell?

→*Without electrification, no feasible way to meet the GHG reduction target*

Sources: Williams, J. *et al.* 2011; Energy + Environmental Economics 2015

CA PATHWAYS Electricity Supply

Three forms of decarbonized electricity each of which has potential to dominate CA electricity production:

- Renewable energy (*intermittent*) - 74% max. feasible
- Nuclear (*baseload*)
- Carbon capture and storage (CCS) (*dispatchable*)

Each source also has varying need for: supporting infrastructures, transmission, energy storage, land/water, and siting

- RE has highest needs for installed capacity, transmission, and storage
- Nuclear needs largest export market and fuel cycle infrastructure
- CCS requires construction of CO2 transport and storage

CA PATHWAYS Cost Assumptions

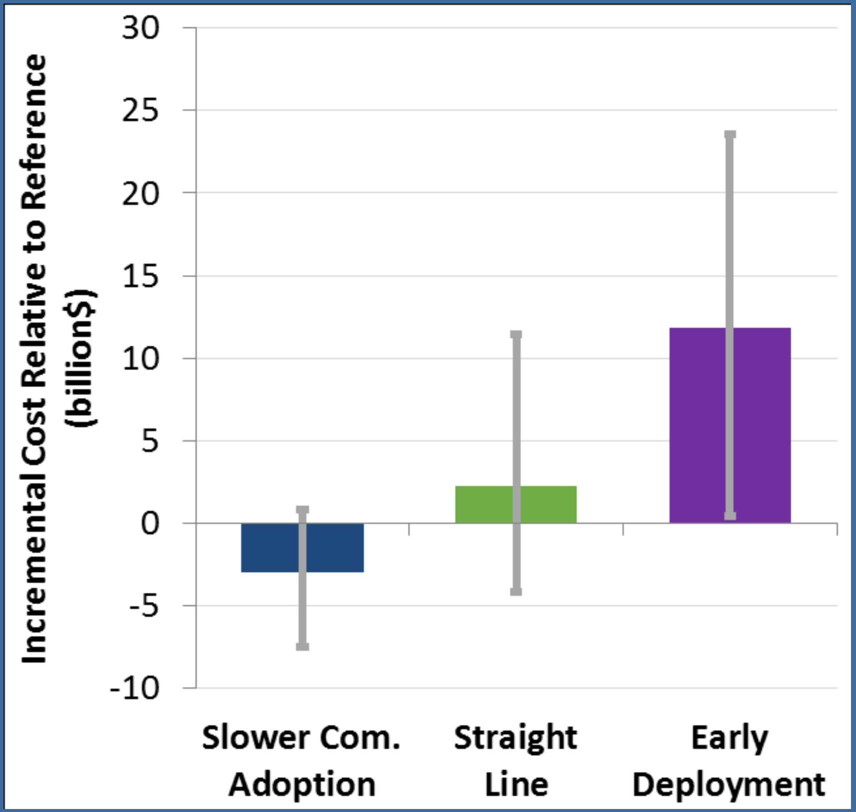
Core analysis uses conservative estimates of future costs of technology

Key uncertainties exist in future costs of technologies, fossil fuels, and cost of capital:

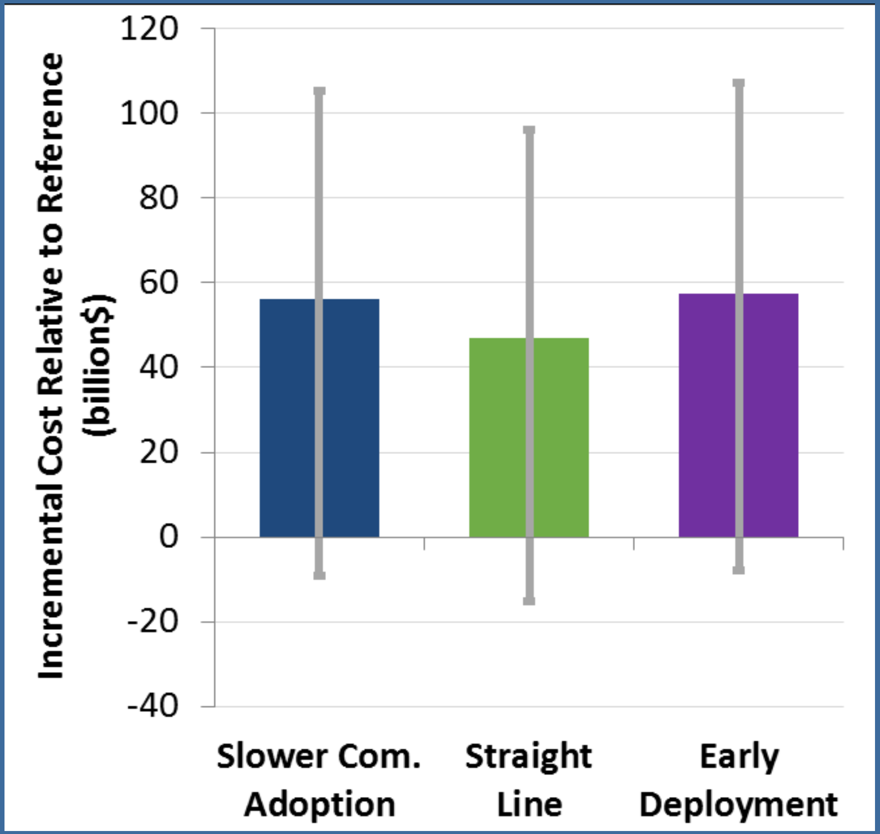
- Solar PV: -50%
- Electric heat pumps: -20%
- LED lighting: -20%
- Grid electrolysis: -20%
- Wind power: -5%
- Fuel cell vehicles: -5%
- Battery and plug-in electric vehicles: -5%
- Electric boilers: -5%

CA PATHWAYS Costs for 2030 and 2050

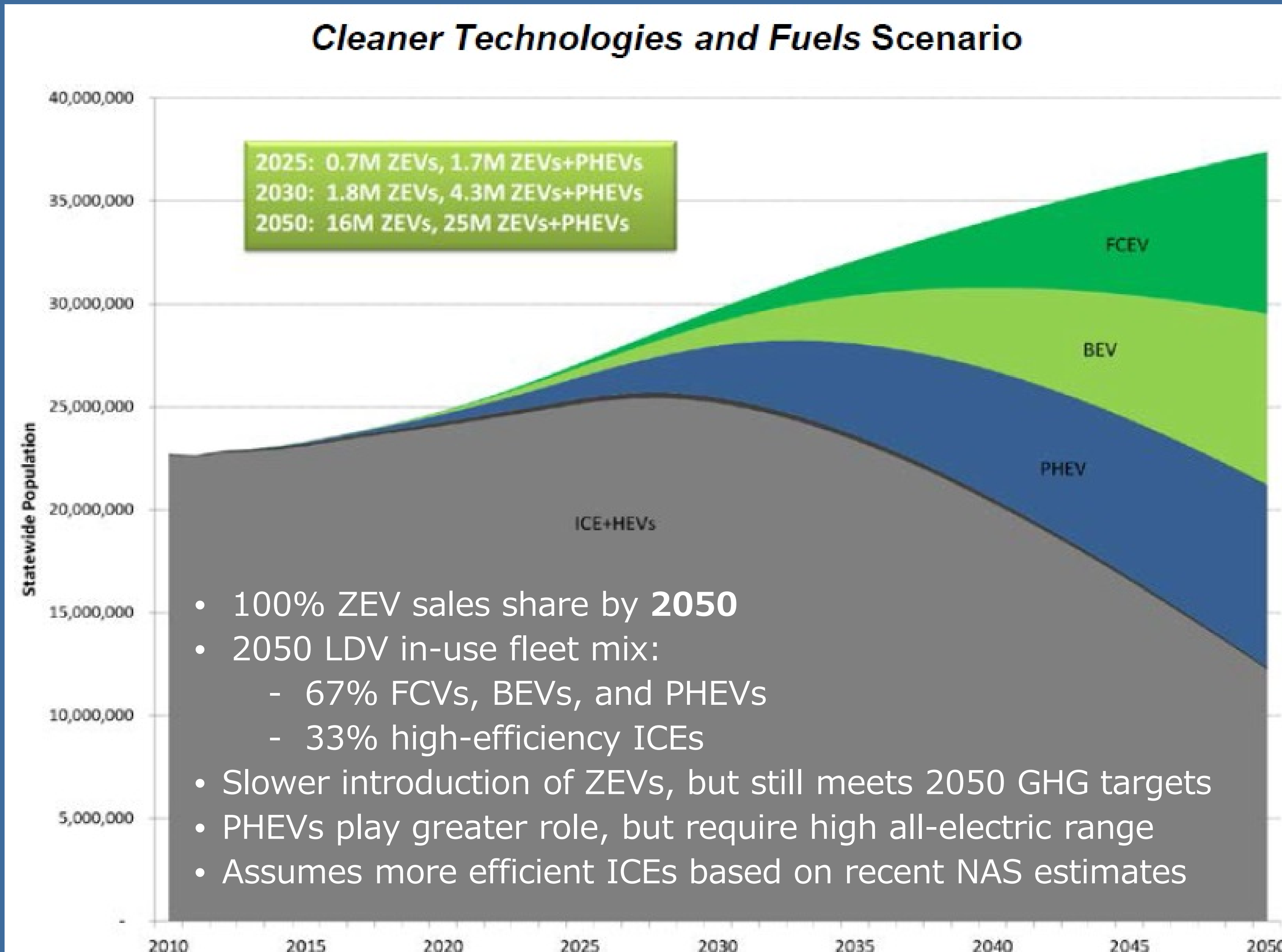
2030



2050



CA Vision 2 Scenario (2015)



- 100% ZEV sales share by **2050**
- 2050 LDV in-use fleet mix:
  - 67% FCVs, BEVs, and PHEVs
  - 33% high-efficiency ICEs
- Slower introduction of ZEVs, but still meets 2050 GHG targets
- PHEVs play greater role, but require high all-electric range
- Assumes more efficient ICEs based on recent NAS estimates

Concluding Thoughts

- CT has developed a strong foundation to build upon
- CT's approach parallels California's
- Deeper efficiency across all sectors and decarbonization of fuels is necessary
- Sequencing of strategies can lead to lower costs
- A regional approach will help to tackle difficult to implement strategies

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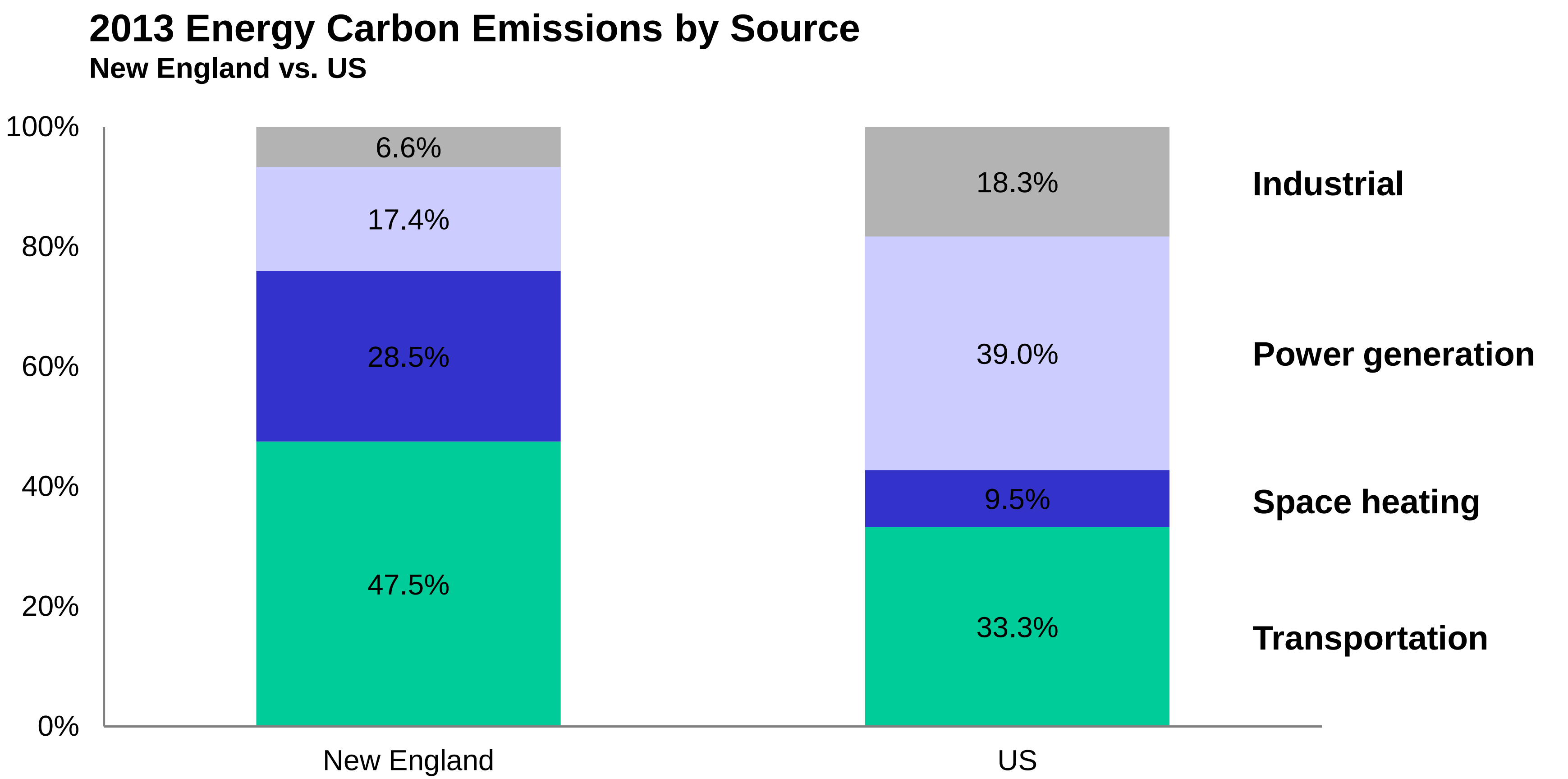
Role of electric utilities in deploying electric vehicles

Governor's Council on Climate Change (GC3)
Analysis, Data and Metrics Working Group Meeting

December 3, 2015

Carbon Emissions by Source

Regional discussion around carbon has focused on power generation, the largest source of GHG emissions in the US…but only the third largest source of emissions in New England and Massachusetts.



Source: EIA.

Carbon Emissions Trajectory

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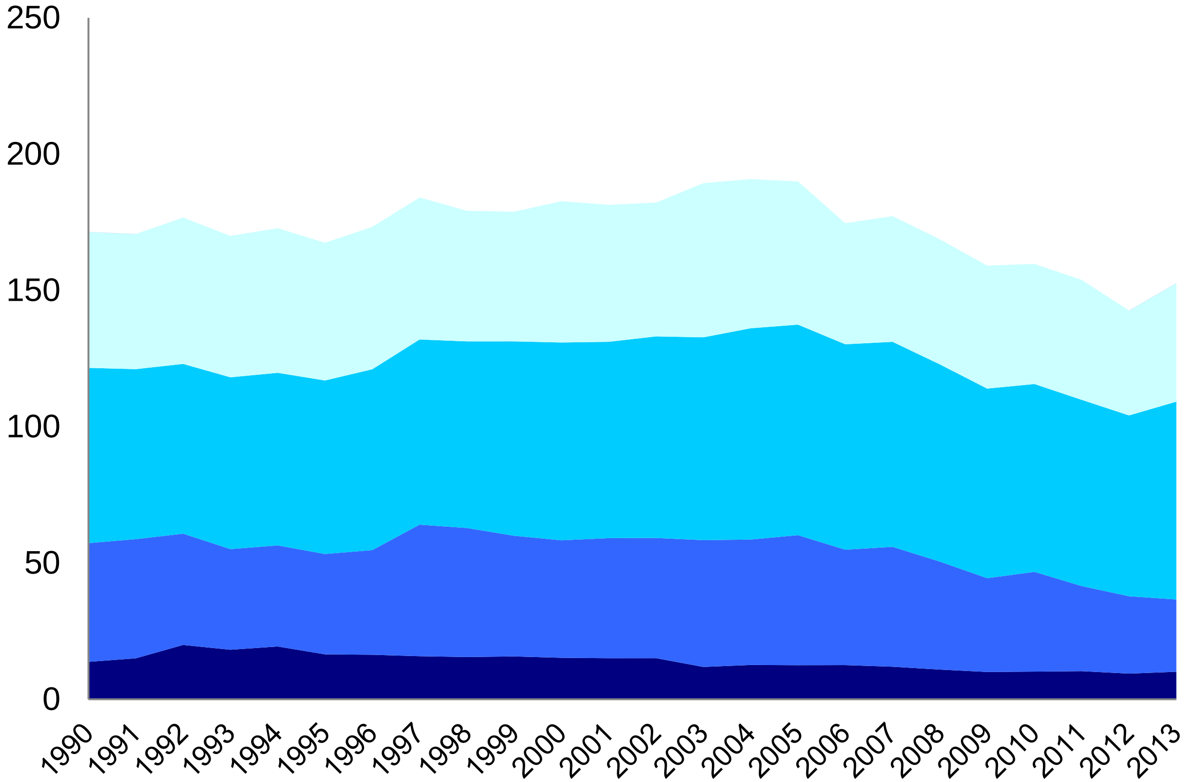
Since 1990, New England has already reduced emissions by 11%, driven primarily by a reduction of power generation sector emissions of 40%. In the same time, the transportation sector has increased emissions by 13%.

New England Energy CO2 Emissions
Millions of metric tons of CO2

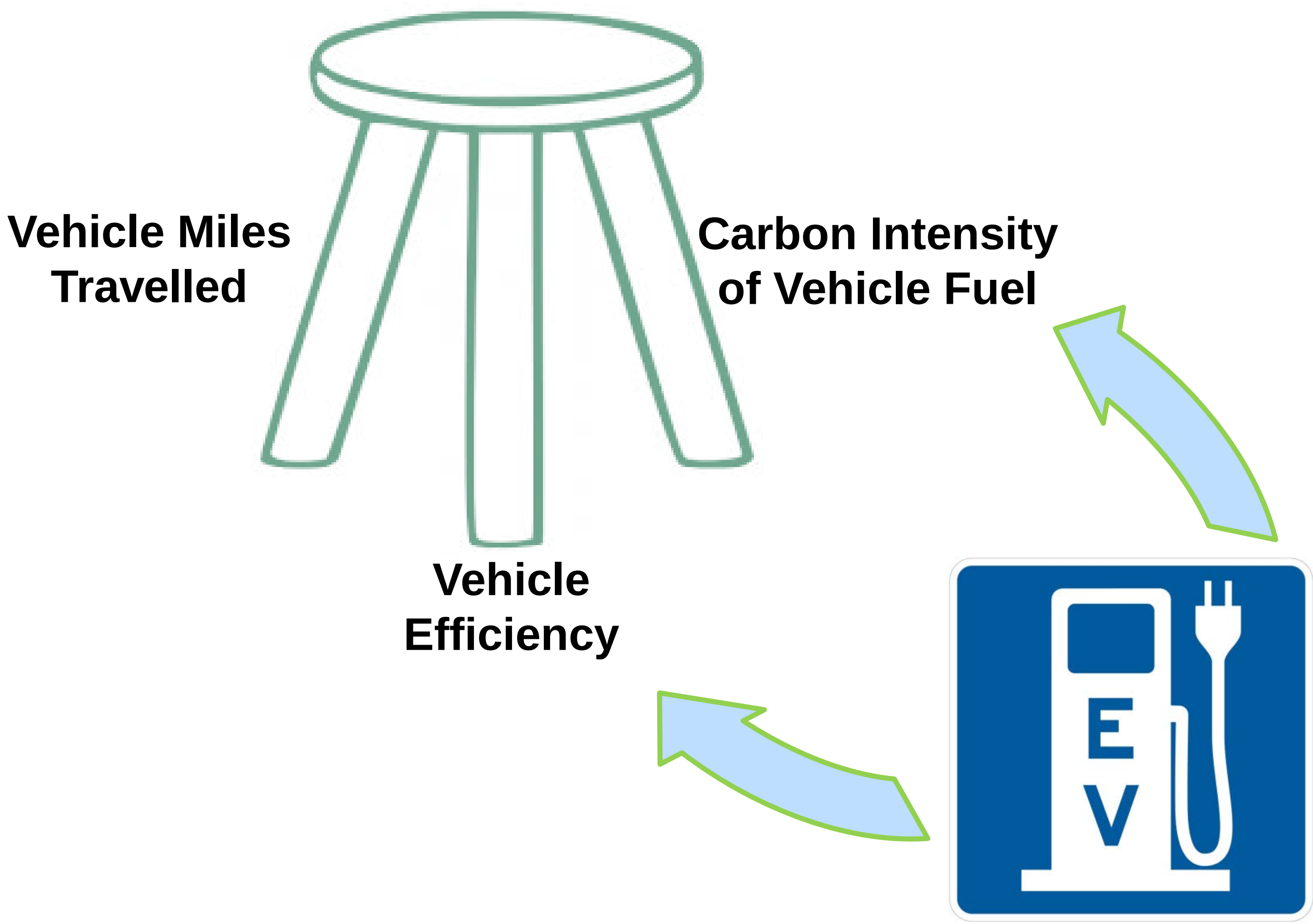


	Change '90 to '13
Total	**(11%)**
Space Heating	(13%)
Transportation	13%
Power Generation	(39%)
Industrial	(26%)

Source: EIA.

Drivers of Carbon Emissions in Transportation

Plug-in Electric Vehicles (PEVs) are important in reducing carbon emissions



PEVs Will Lead to Deep Reductions in Carbon Emissions

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Lifetime Greenhouse Gas Emissions

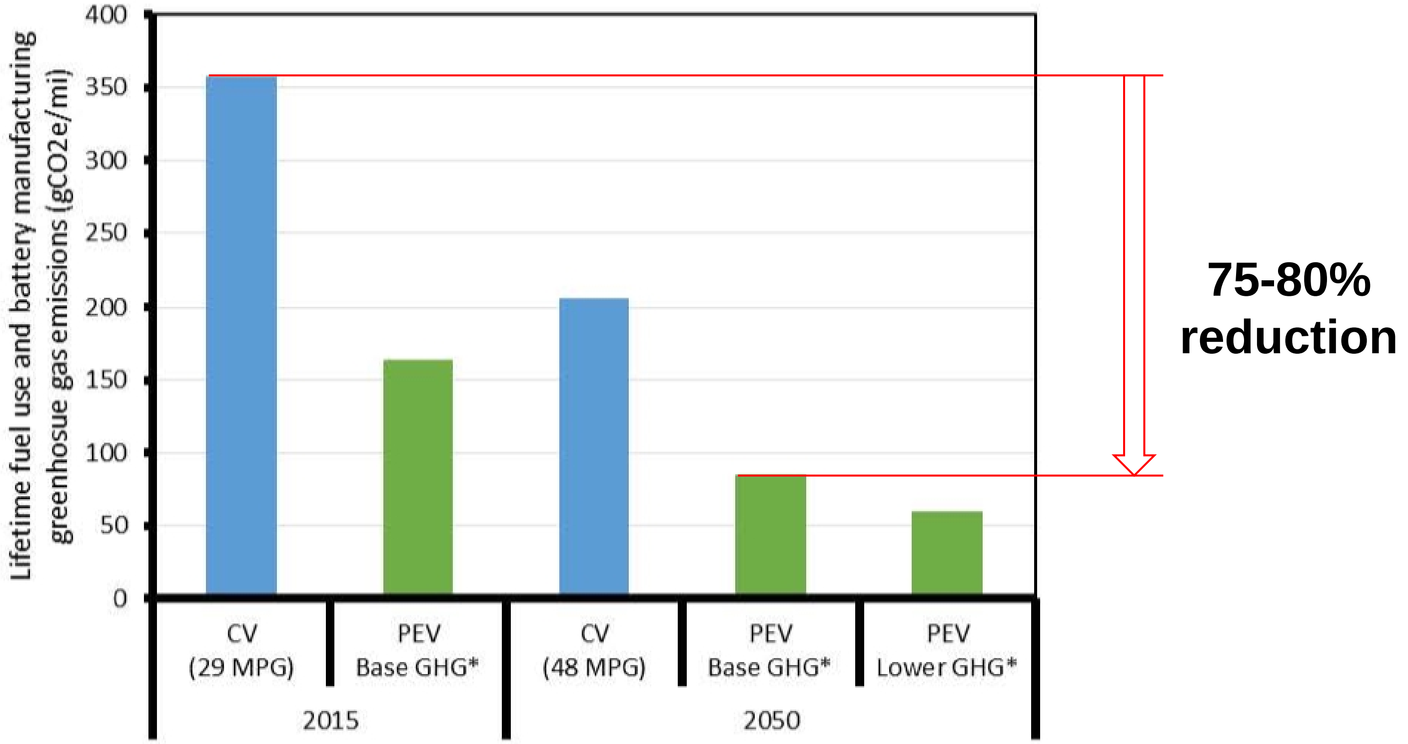


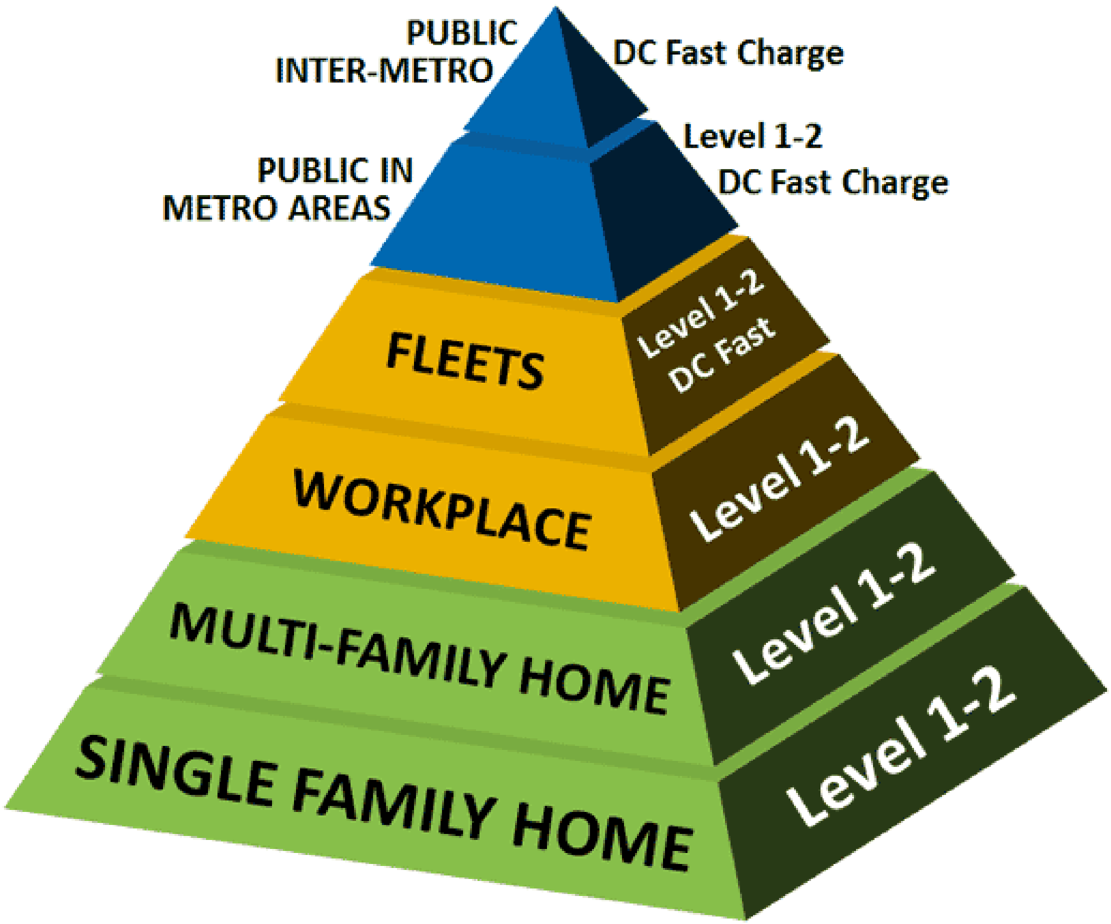
Figure 3
Relative vehicle emissions for the passenger car class for 2015 and 2050

* PEV emissions include battery-manufacturing emissions and full-fuel-cycle emissions for electricity and gasoline, averaged over a 150,000-mile vehicle lifetime. The utility factor for the PEV is 87%.

Source: EPRI & NRDC

PEV Charging Segments

The infrastructure and integration with the grid is different for each of these segments



Home: EV Integration Pilot

Plug My Ride At Home

Plug My Ride at Home is a pilot program open to NSTAR Electric customers who own a plug-in electric vehicle. By participating, EV owners can be part of valuable research, while also having the opportunity to purchase a Level 2 EV Charger for the reduced price of $500.

Learn more about your charging routine by downloading and viewing data about your charging behaviors using Itron cloud software on your home computer, tablet or hand held device. You'll also have the opportunity to see charging routines of other pilot participants as another benefit.

Discounted pricing of $500 for Level 2 Charger for home (retail value of $2,500).

Getting Started

Plug My Ride at Home Pilot Program is open to all qualified NSTAR residential customers with a plug-in vehicle, or those customers in the process of purchasing one. Here's a checklist of pilot requirements to help get you started:

- ☐ Own a plug-in electric vehicle or hybrid, or be in the process of purchasing one.
- ☐ Be a residential NSTAR Electric customer
- ☐ Complete pilot documentation from our web site or from your dealer.
- ☐ Ensure your vehicle is registered in Massachusetts
- ☐ Install WIFI at home
- ☐ Contact NSTAR Electric Vehicle Information Center with:
  - NSTAR account number
  - Vehicle Identification number (VIN)
  - Copy of your vehicle registration
  - Copy of bill of sale for plug-in vehicle

From there, NSTAR will contact Clipper Creek, our pilot partner and EV charging manufacturer. A representative from Clipper Creek will contact you to review order status, installation process, and delivery date. You will need to contact your licensed electrician for installation of the charger at your home.

PLUG MY RIDE AT HOME

Estimated Cost Per Mile	
Electricity	Gasoline
$0.04	$0.25

Electric Vehicle Information Center

1-885-463-6438

www.nstar.plugmyride.org

NSTAR
A Northeast Utilities Company

Pilot Description

- Pilot for 105 residential customers in the eastern Massachusetts service territory
- Participants get a "grid aware" charging station for a discounted price of $500
- The "grid aware" charging station can manage the timing of charging (hour of the day) but more importantly it can also manage the speed of charging (kW).
- Now two aspects of PEV charging, timing and speed of charging, can be used combination to integrate PEVs into the grid.
- While not the focus of the pilot, the Plug My Ride @ Home hardware can also be used for demand response

Enables the PEV to be made grid friendly today while still being future ready

Multi-Family Home: Infrastructure Studies

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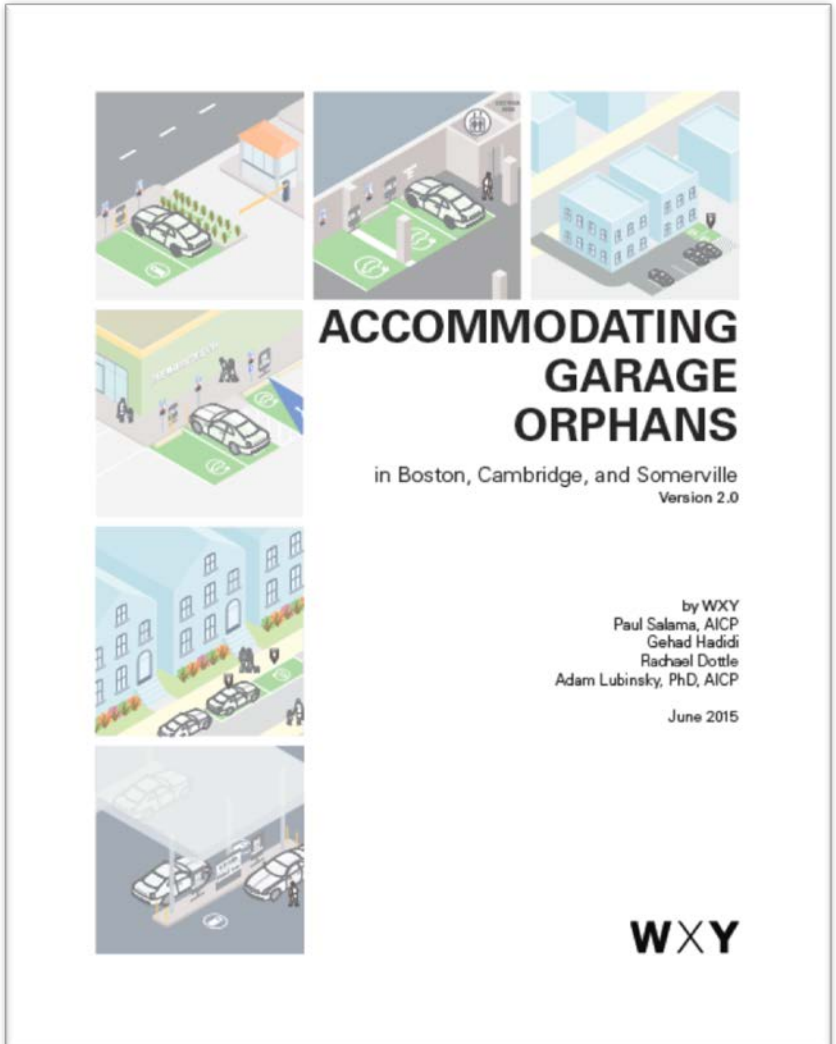

ACCOMMODATING GARAGE ORPHANS

in Boston, Cambridge, and Somerville

Version 2.0

by WXY

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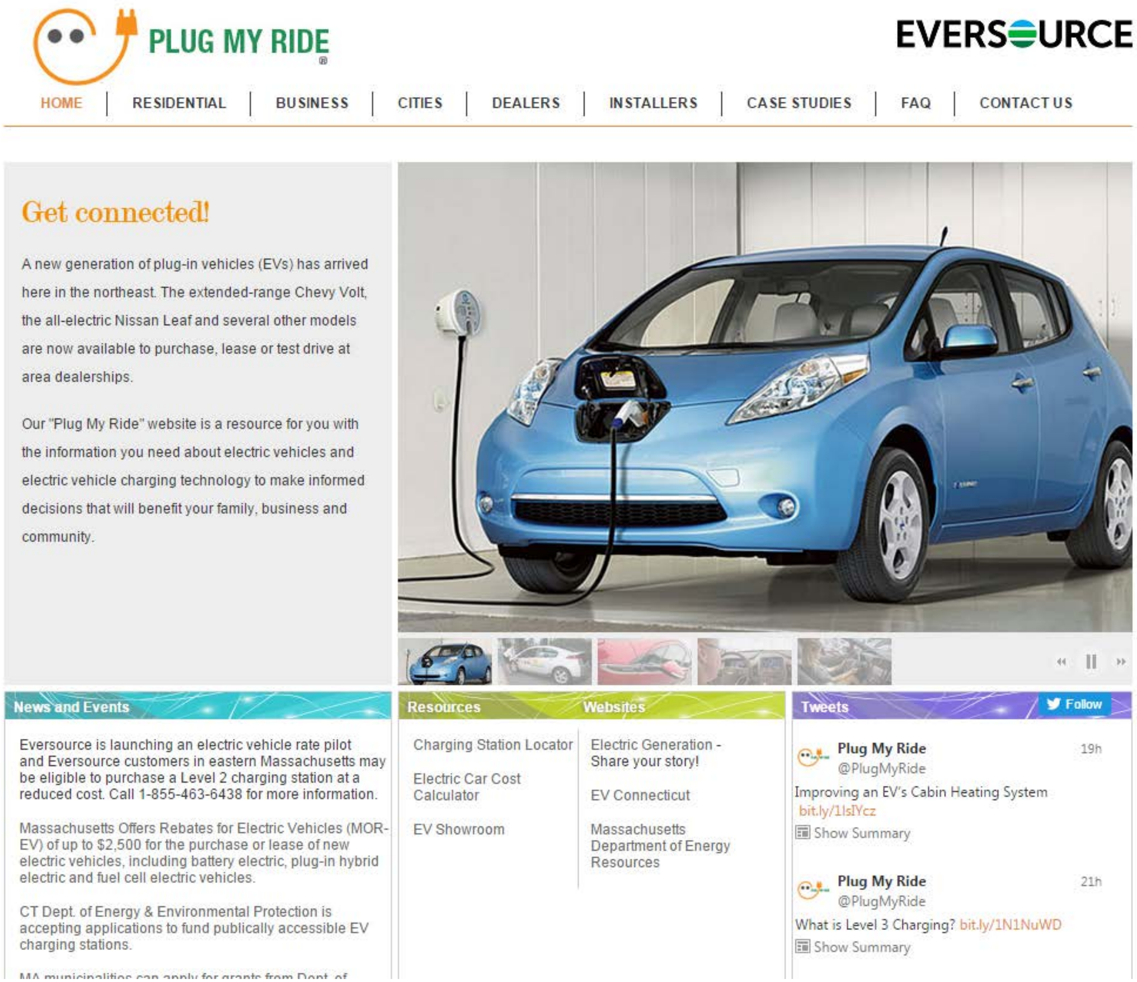
June 2015

WXY

Workplace & DC Fast Charging: Infrastructure and EV Integration

- Over 30 charging spots at Eversource locations, 25 added in 2015
- Deploying DC Fast Chargers in collaboration with Connecticut DEEP and DOT
- DC Fast Charger Technical Planning Study in Massachusetts
- Rate Pilot for DC Fast Chargers in Connecticut

Outreach



www.PlugMyRide.org

855-463-6438

@PlugMyRide

Moving Forward

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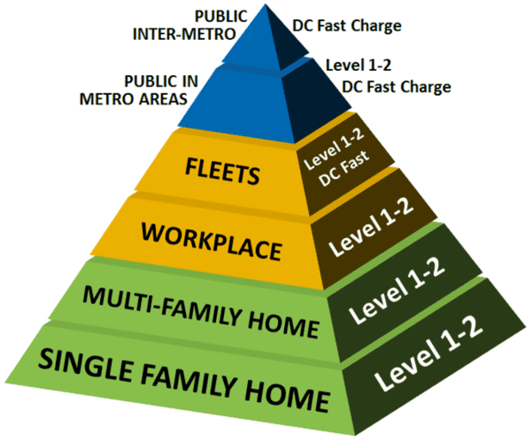
- Achieving scale
- Threshold issues
- Infrastructure needs
- Economic value
- EV grid integration
- Awareness



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