EBC Energy Resources Program

Electric Vehicles – Charging Ahead and Gaining Speed
Welcome

John Wadsworth

Chair, EBC Energy Resources Committee
Partner, Brown Rudnick LLP
Program Introduction & Overview

Catherine Finneran

Program Chair

Director of Environmental Affairs
Eversource Energy
KKen’s Chevy Bolt!
New Focus: Transportation is the Problem

Million Short Tons of CO₂

Transportation

Electricity

65% below 1990 levels
Electric Vehicle Global Warming Pollution Ratings and Gasoline Vehicle Emissions Equivalents by Electricity Grid Region

Map showing electric vehicle global warming pollution ratings for different regions in the United States, with a U.S. average (EV sales-weighted) of 73 MPG.

Note: The MPG (miles per gallon) value listed for each region is the combined city/highway fuel economy rating of a gasoline vehicle that would have global warming emissions equivalent to driving an electric vehicle. Regional global warming emissions ratings are based on 2014 power plant data in the EPA's eGRID 2014 database (the most recent version). Comparisons include gasoline and electricity fuel production emissions. The 73 MPG U.S. average is a sales-weighted average based on where EVs were sold in 2016.
Price of EV Lithium-Ion Battery Pack

EV cost parity crossover with gas cars

Projected price, based on 14-19% experience curve

Source: Bloomberg
EV Sales vs. EV Commitments

CA: Current Sales - 211,943
2025 EV Commitments - 1,500,000

East Coast MOU States: Current Sales - 39,364
2025 EV Commitments - 1,688,660
CAP AND INVEST for transportation
Transportation funding from California cap and invest

- Public Transportation: $1.3 billion
- Clean Vehicles: $695 million
- Affordable Housing: $720 million
Transportation funding from Northeast cap and invest

- Public Transportation: $2.3 billion
- Clean Vehicles: $1.2 billion
- Affordable Housing: $1.2 billion
New Allies
Utopia?
Dystopia?
Utopia?
Thank you!
Keynote Presentation

Katie Theoharides

Assistant Secretary, Climate Change
Executive Office of Energy and Environmental Affairs
Commonwealth of Massachusetts
Climate change and transportation

Katie Theoharides, Executive Office of Energy & Environmental Affairs, April 25, 2018
Global Warming Solutions Act of 2008
- Reduce greenhouse gas emissions in MA by:
  - 25% below 1990 baseline level by 2020
  - 80% below 1990 baseline level by 2050
- Establish statewide emission limits for 2030 and 2040

Currently setting a target for emission reduction as directed by EO 569
- Establish statewide emission limits for 2030 by the end of 2020.
- Establish statewide emission limits for 2040 by the end of 2030.
EXECUTIVE ORDER 569: AN INTEGRATED CLIMATE CHANGE STRATEGY FOR THE COMMONWEALTH

- Reducing greenhouse gas emissions to combat climate change

- Protecting life, property, natural resources and our economy from the impacts of climate change
MA GHG Emissions & Reduction Goals

- **MA GHG Inventory**
- **GWSA Emissions Goals**
- **Paris - 26% Reduction below 2005 Levels**
- **Paris - 28% Reduction below 2005 Levels**
- **NEG/ECP - 35% Reduction below 1990 Levels**
- **NEG/ECP - 45% Reduction below 1990 Levels**

GHG Emissions (MMTCO<sub>2</sub>e)
Climate goals and a growing economy

Source: MassDEP
OVERARCHING STRATEGIES TO 2020 AND 2050

- **Reduce:**
  - energy use in all sectors
  - use and leakage of potent GHG gases (e.g. CH₄, SF₆, HFCs)

- **Electrify:**
  - space heating in the Building Sector
  - fleets and infrastructure in Transportation Sector

- **Decarbonize:**
  - energy sources for electric grid
Massachusetts GHG Emissions and Reductions – Sector "MPG"

Gross emissions

GHG Emissions (MMTCO$_2$e)

Reductions from:
- Fuel switching for thermal conditioning
- Cleaner grid
- More efficient vehicles
- Energy efficiency

Sector reductions from changes in carbon intensity of fuels.
Transportation Opportunities & Challenges

2014 MA GHG Emissions by Sector

74.5 MMTCO2e

- Transportation: 39.4%
- Residential: 18.5%
- Commercial: 9.7%
- Industrial: 10.1%
- Electricity: 19.8%
- Other (agri., waste, NG trans./dist.): 2.5%

**Transportation Policy Highlights**

- **EV Rebates & Grants:** >$10 million in consumer rebates issued since 2014
- **EV Charging Network in MA:** 520 public EV charging stations
- **Multi-state ZEV task force:** ZEV Action plan and MOU
- **Northeast Corridor Regional Study:** DC – ME corridor being finalized to drive investment and common goals
- **Mass Drive Clean:** First state supported EV test drive and sustainability showcase; 40 events; 81% of drivers said more likely to purchase; 10-12.5% purchased or leased w/in 6 mos
- **Housing Choice Initiative:** $10 million/year for sustainable housing
- **Complete Streets:** >50% of MA cities and towns have a Complete Streets Policy which facilitates better travel for all users
Transportation Policy Highlights

• Transportation listening sessions
  – **Goal**: Capture ideas & policy solutions to combat climate change and air pollution generated by the transportation sector while also supporting a resilient, equitable transportation network for MA.
  – Over 200 attendees
  – Over 1000 comments submitted

• Commission of the Future of Transportation
  – Climate and resiliency
  – Electrification
  – Autonomous
  – Transit and Mobility
  – Land Use and Demographics

• **VW Settlement**: $75 million mitigation funds directed toward electrification of non-passenger vehicles and light-duty EV infrastructure in MA
Most Frequently Supported Issues

- Expand rail service
- Improve rail service dependability and maintenance
- Improve infrastructure (e.g., dedicated bus lanes, bus shelters)
- Explore a “Cap & Invest” program, such as RGGI for transportation
- Reduce cost of new EVs
- Coordinate with external entities (e.g., other New England states)
- Ensure equity for low-income communities
- Replace diesel buses with electric ones
- Expand bicycle routes and services
- Expand service areas
- Ensure solutions improve resilience and adaptation in our communities
- Expand pedestrian access (e.g., sidewalks)
- Ensure solutions improve public health / air quality
- Electrify rail, trains, and other transit
- Electrify occupational vehicles, freight trains, and trucks
- All others below 100 total responses.
Planning for 2030

- Comprehensive Energy Plan, due September 2018
- 2030 emissions limit, set by 2020
- Clean Energy and Climate Plan for 2030, due 2020
- GWSA Implementation Advisory Committee (IAC)
  - Meeting at least every other month
  - Work plan developed for 2018
  - 4 technical subcommittees
    - Buildings
    - Transportation
    - Electric Generation
    - Natural Systems, including land use
Municipal Perspective

Eric Bourassa

Director, Transportation

Metropolitan Area Planning Council (MAPC)
Charging Ahead and Gaining Speed: Municipal/Regional Perspective

Eric Bourassa
Transportation Director
Metropolitan Area Planning Council

• Municipal Motivation
• Challenges & Opportunities
• MAPC Initiatives
• Planning for the Future

Introduction
Regional planning agency serving the 101 cities and towns of Metro Boston
Our mission is to promote smart growth and regional collaboration
What Motivates Municipalities to Promote Electric Vehicles?

- Local Climate Goals
- Infrastructure for Residents
- Municipal Cost Savings
- Increased Mobility Options
GHG Emissions by Sector

Source: Office of Energy and Environmental Affairs, 2014
## Communities with Climate Change Goals

<table>
<thead>
<tr>
<th>Community</th>
<th>Commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAPC Metro Mayors Coalition</td>
<td>Net Zero/Carbon-Free Region by 2050</td>
</tr>
<tr>
<td>Boston</td>
<td>Carbon-free by 2050</td>
</tr>
<tr>
<td>Cambridge</td>
<td>80% GHG Emissions by 2050, Net Zero Buildings by 2040</td>
</tr>
<tr>
<td>Somerville</td>
<td>Carbon Neutral by 2050</td>
</tr>
<tr>
<td>Lexington</td>
<td>80% GHG Emissions by 2050</td>
</tr>
<tr>
<td>Newton</td>
<td>Advance “Newton Energy $avers” partnership to reduce energy consumption by 20% citywide by 2020</td>
</tr>
<tr>
<td>Wellesley</td>
<td>Reduce GHG below 2017 levels by 2020</td>
</tr>
</tbody>
</table>
Massachusetts has a target to have 300,000 zero-emission (ZEVs) on the state’s roads by 2025. There is still much work to be done to attain this goal.

Source: Multi-State ZEV Task Force
Electric Vehicle Inventory in Massachusetts

2017 includes the first four months of 2018
Source: Department of Energy Resources
537 charging stations* with 1,436 outlets

Level 1
24 stations with 35 charging outlets

Level 2
502 stations with 1,256 charging outlets

DC Fast Charge
60 fast charge with 145 charging outlets

* Some stations may have multiple Levels at the stations.
Federal Tax Incentive

All-electric and plug-in hybrid cars purchased in or after 2010 may be eligible for a federal income tax credit of up to $7,500.

State Rebate through MOR-EV Program

Rebates up to $2,500 are provided for the purchase or lease of zero-emission and plug-in hybrid light-duty vehicles.

Since the program began in June 2014, approximately $12.65 million in rebates has been issued.
Local Challenges to Advancing Electric Vehicles

Locating EV Charging

Garage Orphans

Time Of Use Incentives

Building Codes
Municipal Electric

- Through its Braintree Drives Electric Program, Braintree Electric Light Department encourages customers to attend EV workshops, test drive cars, and acquire EVs.
- The utility offers customers an $8 monthly credit, the equivalent of about 175 free miles, for charging at off-peak times.
- Braintree offers a $250 rebate for Level 2 charger purchases.
- The Town has installed public charging stations and is leasing EVs for its own fleet.
Leveraging Municipal Assets

- Municipal Fleets
- Public EV Parking & EV Car Sharing
- School Buses
VEH-102 Statewide Contract for Advanced Vehicle Technology

Category 1
CHARGING STATIONS

Category 2
IDLE REDUCTION

Category 3
AFTERMARKET CONVERSIONS
VEH-102 Statewide Contract for Advanced Vehicle Technology

Round 1:
Green Mobility Group Purchasing Program with Aggregated Volume-Based Discounts and Accelerated Time-Based Discounts

Category 3
AFTERMARKET CONVERSIONS

28 vehicles/4 fleets

= $11-19\%$ discounts
= 1-2k per vehicle

+ $25-30\%$ average fuel economy improvement
VEH-102 Statewide Contract for Advanced Vehicle Technology

Round 2: Green Mobility Group Purchasing Program for Electric Vehicle Charging Stations

Category 1
CHARGING STATIONS

Category 3
AFTERMARKET CONVERSIONS

Taking place in Newton today!
LEARN MORE

WATCH

Electrify Your Community! EV Charging Station Purchasing 101, February 2018. WATCH

Information Session on Clean Vehicle Purchasing with MAPC, December 2017. WATCH

Green Mobility Group Purchasing Program 201 Webinar: Aftermarket Conversion Bootcamp, June 2017. WATCH

Green Mobility Group Purchasing Program Launch Webinar, February 2017. WATCH

READ

Roadmap to Install EV Charging Stations: Metropolitan Area Planning Council, January 2018. READ

Municipal Green Vehicle Technology Workshops: Metropolitan Area Planning Council, November 2016. READ Worcester Slides or READ Natick Slides

Floets for the Future Best Practices Guides on procurement strategies and policies:

- Electric Vehicle Procurement Best Practices Guide
- Fleet Transition Planning for Alternative Fuels Vehicles
- Gaseous Fuel Vehicle Procurement Best Practices Guide
- Guide to Financing Alternative Fuel Procurement

Education and Training

Ride and Drive Events

Biogen, Weston
Source: Reach Strategies

WPI, Worcester
Source: Worcester Business Journal

Wachusett
Source: Reach Strategies
Convergence of Technologies = Mobility As A Service

- Electric Vehicles
- Autonomous Vehicles
- Ridehailing & Personal Delivery

Planning for the Future
Charging Ahead and Gaining Speed: Municipal/Regional Perspective

Eric Bourassa  
Transportation Director  
Metropolitan Area Planning Council  

ebourassa@mapc.org  
617-933-0740

Thank you!
Infrastructure Industry Perspective

Kevin George Miller

Director, Public Policy
Chargepoint
World’s Leading EV Charging Network

Founded 2007

48,000+
Charging Spots (760+ DCFC)

37,000,000+
Charges delivered; 1M/month

$300,000,000+
Funding, incl. Daimler & Siemens

Reliable & Trusted
Industry leading uptime guarantee
EV Charging Happens Where Life Happens

- At Home
- At Work
- Around Town
- Out of Town

<90% of kWh

>10% of kWh
## EV Charging Basics

<table>
<thead>
<tr>
<th></th>
<th>Level 1</th>
<th>Level 2</th>
<th>DC Fast</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical Specs</strong></td>
<td>110 – 120 Volts AC</td>
<td>208/240 Volts AC</td>
<td>208 to 480 Volts DC</td>
</tr>
<tr>
<td></td>
<td>12 – 16 Amps</td>
<td>32 Amps</td>
<td>70 – 125 Amps</td>
</tr>
<tr>
<td></td>
<td>(home appliance)</td>
<td>(home washer/dryer, commercial standard)</td>
<td>(commercial standard)</td>
</tr>
<tr>
<td><strong>Range Per Hour of</strong></td>
<td>~3 – 5 miles</td>
<td>~12 – 25 miles</td>
<td>100 - 200 miles +</td>
</tr>
<tr>
<td><strong>Charging</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Time for Full Charge</strong></td>
<td>18+ hours</td>
<td>~2 - 4 hours</td>
<td>~15 - 45 mins</td>
</tr>
<tr>
<td><strong>(Avg. for 80-mi range)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Stations for Every Situation

**Single Family Home**
- Home Level 2

**Multi-Family, Fleet**
- CPF25 Level 2

**Commercial/Municipal, Mixed Use**
- CT4000 Level 2

**On-Route, Commercial**
- CPE100 24kW
- CPE200 50kW
- CPE250 62.5kW
- Express Plus 400kW

**Fast DC Chargers**

**Ultra-fast DC Chargers**
Data from “smart”, networked stations creates value

For the Station Owner

For the Driver

For the Stakeholder
Light-Duty Vehicles Are Just the Beginning
ChargePoint Spots in Massachusetts

+ Total ChargePoint Spots: 1,800+
+ ChargePoint site hosts include:
  • UMass, Worcester Polytechnic, MIT
  • MCCA, MBTA, MassPort, MassDOT
  • BU Medical Center, B&W Hospital
  • Municipalities (Somerville, Plymouth, Palmer, Kingston, Amherst, New Bedford, Saugus, Lowell, Boston)
  • Oracle, Gillette, Novartis, Big Y
  • Residential Stations
### ChargePoint Spots in Massachusetts

**EVs in MA**
- Q4 2017: 13,000

**ChargePoint Deployment**
- Charging Spots: 1,800+
- YoY Growth, 2012-17: 35%

**ChargePoint Utilization Statistics**
- Sessions (Total to Date): 700,000+
- Electricity (Total to Date): 5.9 GWh
- GHG Savings (Total to Date): 2.5M kg

*Source: Polk, ChargePoint*
Case Study: EV Ready Building Codes in MA

Annual Costs and Savings for 5% EV Ready Parking Spaces in Massachusetts

© 2018 ChargePoint, Inc.
Smart Charging + Rate Design = Bigger Benefits

Aggregated Charging Profiles by Use Case

- **Workplace**
- **Fleet**
- **Home**
Next Steps

+ Help ensure that we eat our fruits & veggies (building codes)
+ Explore how transportation electrification can be leveraged to support operational needs & provide employee benefits
+ Engaging in opportunities to shape new EV and EV charging programs
+ Encourage electric rate design to (i) incentivize longer-term charging to take place at times that benefit ratepayers and the grid and (ii) support fast charging for drivers, riders, fleets, buses, and trucks
Utility Perspective

Fouad Dagher

Director, Solutions Development
National Grid
Advancing affordable and accessible electric transportation options for our customers, and developing new flexible resources for the grid.
Why Electrification of Transportation?

- Advance public policies as it relates to ZEV goals
- Help in meeting the 80% GHG reduction by 2050
- Provide meaningful and compelling choices to customers
National Grid owns and operates ~50 public charging stations

Developed incentive program for employee

Stand-alone filing submitted January 2017 (DPU 17-13):

- Incentives to help commercial property owners develop public charging for consumers
- Significant education and outreach
- R&D into fast charging impacts and EV DR
- Performance incentive based on sites developed
  - Target of up to 1280 ports (1200 Level 2, 80 DCFC)

- 3-year program

MA Proposal:

- Electric Distribution Company Equipment
- Customer Equipment
  - NG pays rebate
- EV Supply Equipment
  - Site host agrees to operate for 5 years; NG pays partial rebate
## Charging Program Structure

<table>
<thead>
<tr>
<th>Utility Distribution Infrastructure</th>
<th>Customer Site Infrastructure</th>
<th>EV Supply Equipment (EVSE)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overview</strong></td>
<td><strong>Owned by customer, with National Grid incentive</strong></td>
<td><strong>Owned by customer, with potential National Grid incentive</strong></td>
</tr>
<tr>
<td>Constructed or upgraded by National Grid, as needed</td>
<td>National Grid</td>
<td>National Grid</td>
</tr>
<tr>
<td><strong>Funding</strong></td>
<td><strong>NG estimates and builds, up to approved amount (no customer contribution)</strong></td>
<td><strong>NG estimates and provides incentive, up to approved amount</strong></td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td>Customer’s contractor</td>
<td>Customer’s contractor</td>
</tr>
<tr>
<td>National Grid</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NY Electric Transportation Initiative (rate settlement reached)

Included in the rate case settlement agreement (Joint Proposal):

- “Make-ready” capital investment and equipment rebates to help develop public charging for consumers
- Education and outreach
- Performance incentive based on EV adoption above baseline

NY Proposal:
- NG makes investment and earns on capital
- Site host agrees to operate for 5 years; NG pays partial rebate
RI Electric Transportation Initiative (proposed)

Included in RI “Power Sector Transformation” proposal:

- “Make-ready” capital investment and equipment rebates to help develop charging for consumers and fleet/transit operators
- Education and outreach demonstration funds
- Residential off-peak charging rebate pilot
- Temporary discount on DC Fast Charging demand charges
- Company fleet expansion
- Performance incentive based on EV adoption above baseline
- 3-year

RI Proposal:

NG makes investment and earns on capital

Site host option to own, or have Company own and operate
We have identified four key areas that are critical to increasing electrification of the transportation sector either by improving supply or demand of EVs. These four categories are: 1) customer awareness; 2) access; 3) affordability; and, 4) behavior.

**Awareness**
- Champion new regulatory cost recovery authorization for consumer EV education and marketing
- Consider supporting new State incentive for local dealers to sell EVs

**Access**
- Defend existing CAFÉ and GHG Standards
- Defend existing State commitments to 2025 targets
- Champion new reg. cost recovery authorization to own and operate EV charging infrastructure
- Champion mechanisms to provide incentives for increased charging activity

**Affordability**
- Extend existing Federal and State tax credits for EVs and charging equipment
- Champion new regulatory cost recovery authorization for incentives to promote solution that benefit the broad system
- Champion new – Federal and State taxes for corporate fleet electrification

**Behaviors**
- Champion new Time-of-use rates to encourage off-peak private charging
- Engage with national associations to create corporate fleet goals
- Champion new state agency targets for electrification of fleet vehicles
Utility Perspective

Roger Kranenburg

Vice President, Energy Strategy and Policy
Eversource Energy
Moderated Panel Discussion

Maeve Bartlett – Moderator

Director, Strategic Development – NE
AECOM