New Hampshire's EV Infrastructure Commission

Kick-off Meeting

Presentation by Sarah McKearnan, NESCAUM

August 24, 2018

EVSE REFRESHER

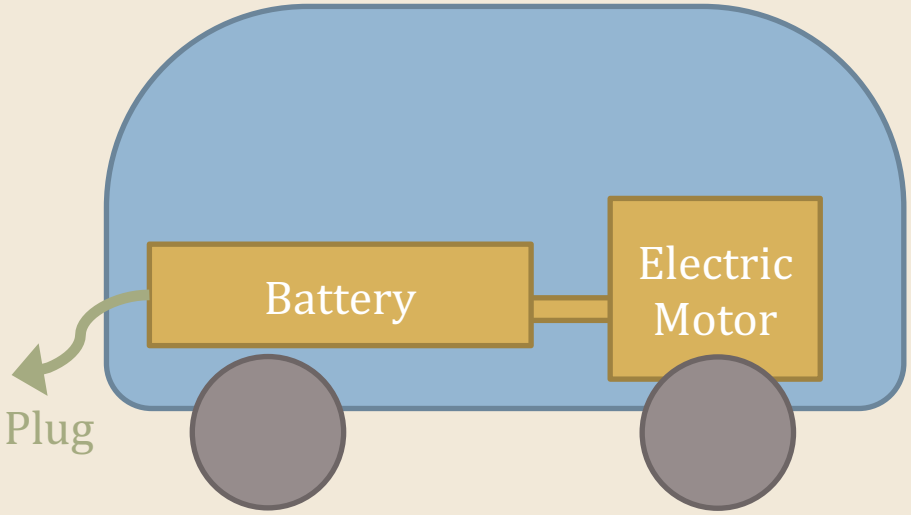
Current Technology Offerings

4 electric vehicle technology options:

- Plug-in hybrid electric vehicles (PHEVs)
- Battery electric vehicles (BEVs)
- Battery electric vehicles with a range extender (BEVx)
- Hydrogen fuel cell vehicles (FCEVs)

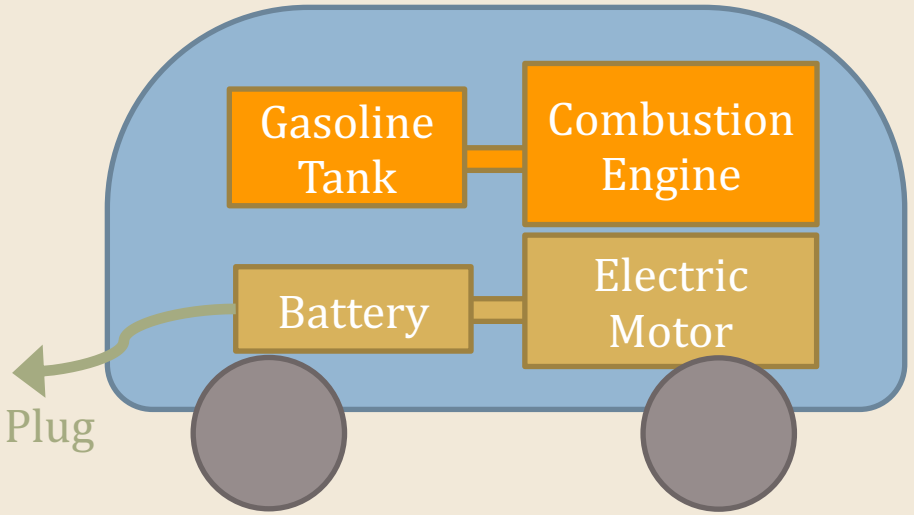
Types of Plug-in Vehicles

- All Electric



80 to 335 Mile Range on Battery

Plug-in Hybrid



6 to 53 Mile Range on Battery

+

300 or More Miles on Gasoline

Courtesy of VEIC

Plug-in Hybrid Electric Vehicles (PHEVs)

- Equipped with a battery and a gasoline engine

Chevy Volt

- Can run on gasoline when battery range is exhausted and to boost power

Ford Fusion Hybrid

- All-electric range varies from 6 to 53 (mi)

Battery Electric Vehicle (BEV)

- Runs solely on battery power

Nissan Leaf

- Electric ranges of current models between 80 and 335 miles

Chevy Bolt

Battery Electric Vehicle with Gasoline Range Extender (BEVx)

- Battery electric vehicle equipped with range extending gasoline generator
- Range extender kicks in when battery is low
- BMW-i3 example
  - 97 (mi) all-electric range
  - 180 (mi) extended range

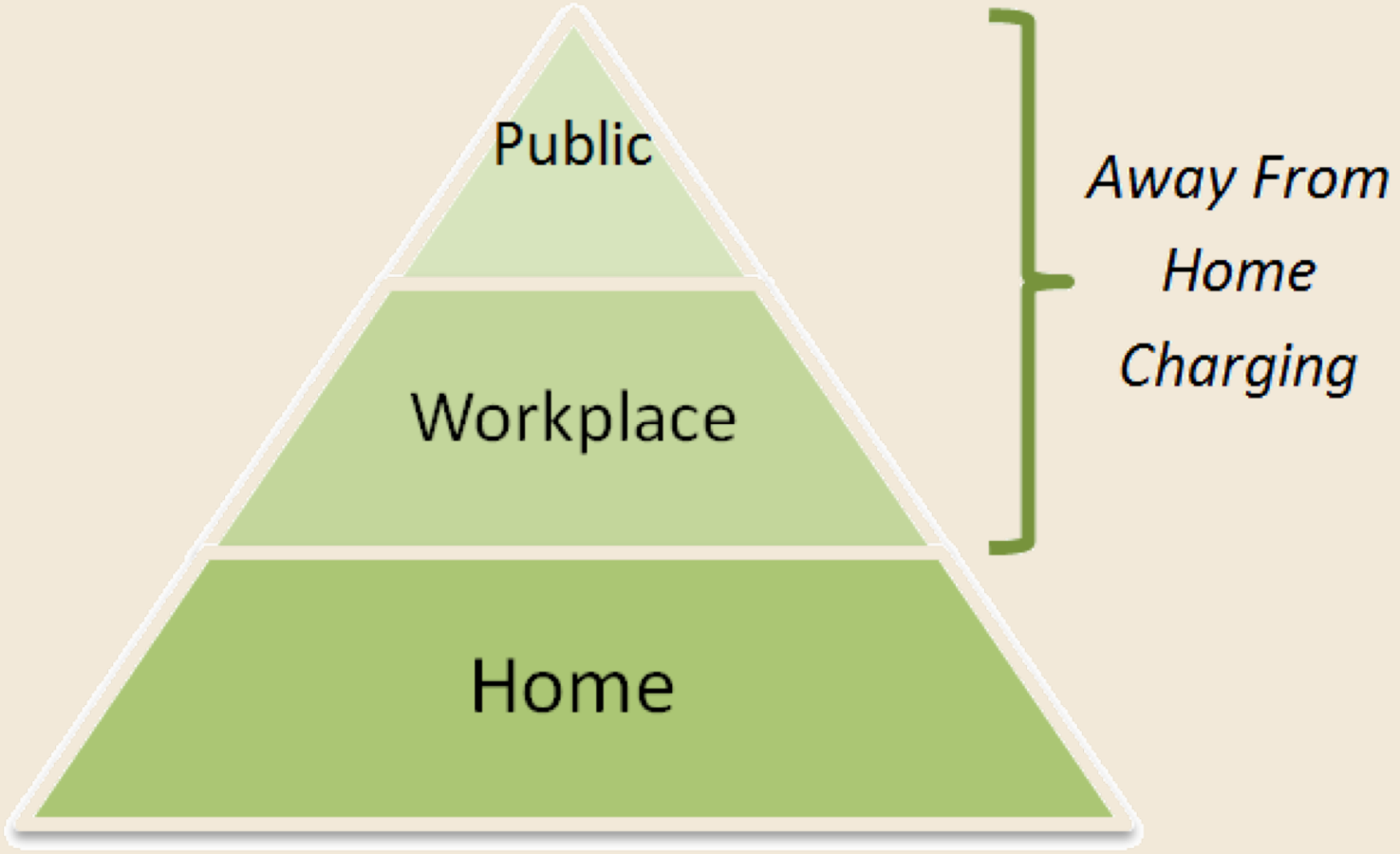
BMW i3

Hydrogen Fuel Cell Vehicle (HFCV)

- Fueled by hydrogen
- Has zero emissions
- Range of more than 300 miles
- Re-fueling time is comparable to a gasoline vehicle

Toyota Mirai

EV Charging



Charging Options: Level 1

Standard 120v AC Wall Outlet

- L1 works best for home charging or locations with long dwell times
- EVs equipped with cord set and standard SAE J1772 plug for Level 1
- 2 to 5 miles of range per hour of charging
- Often no additional installation costs

Charging Options: Level 2

Requires 208v electrical service and dedicated 40 amp circuit

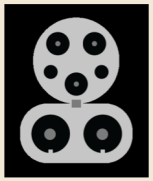
- Supports home, workplace and public charging

- Uses standard SAE J1772 connector and charge port
- 10 to 20 miles of range per hour of charging
- Average cost of a single ports range from $5000 to $15,000 (average $9,000)

Charging Options: DC Fast Charging

Requires 208/480V AC three-phase electrical current

- Three types of charging systems/ ports for corridors and downtown



J1772 combo (used by BMW, GM, VW)

CHAdeMO (used by Nissan, Mitsubishi, Toyota, Kia, Honda)

Tesla (used exclusively by Tesla)

- 60-80 miles of range per 20 minutes of charging
- Costs range from $40,000 to $100,000 (average $60,000)

Charger Installation Costs

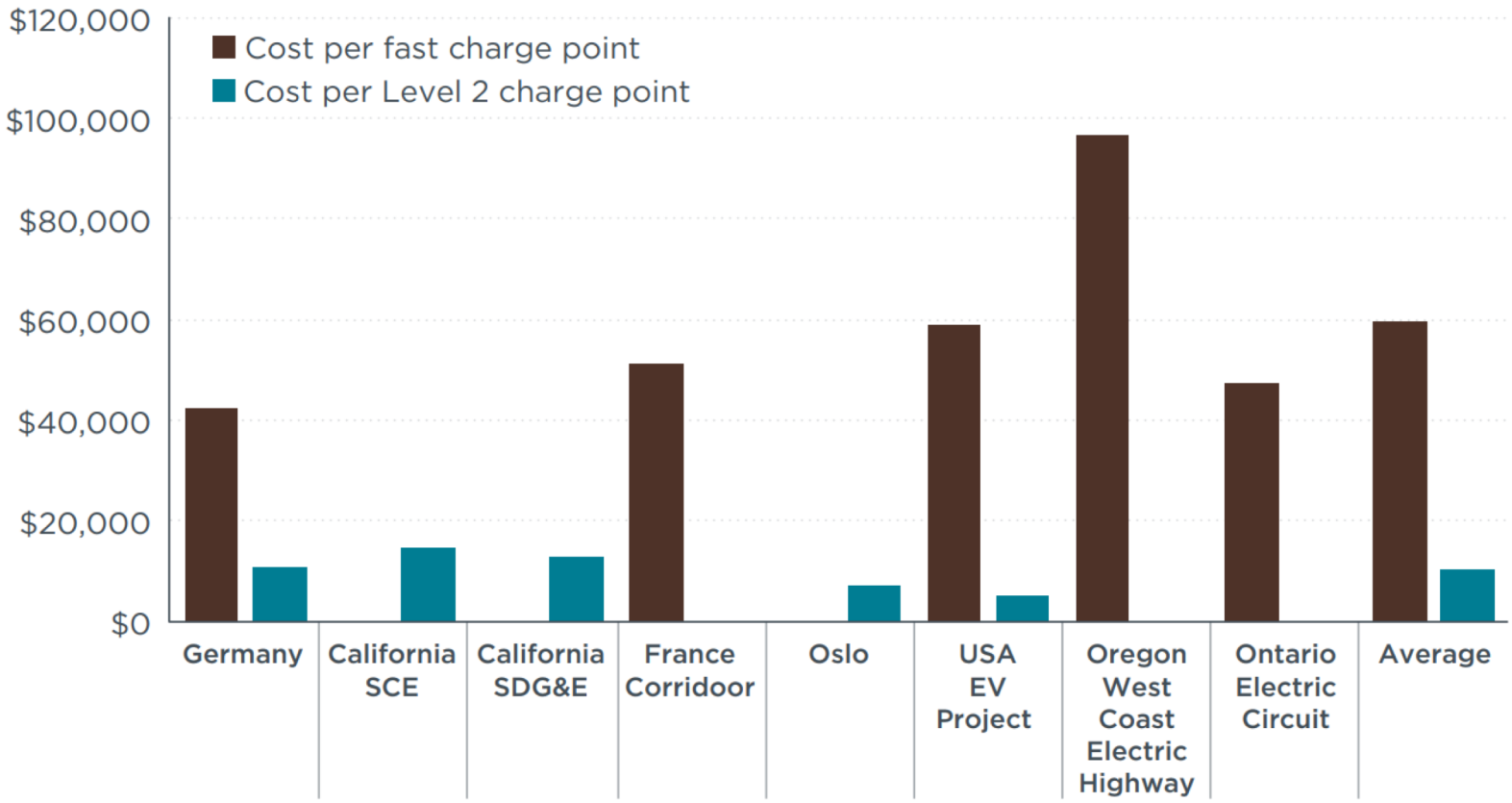
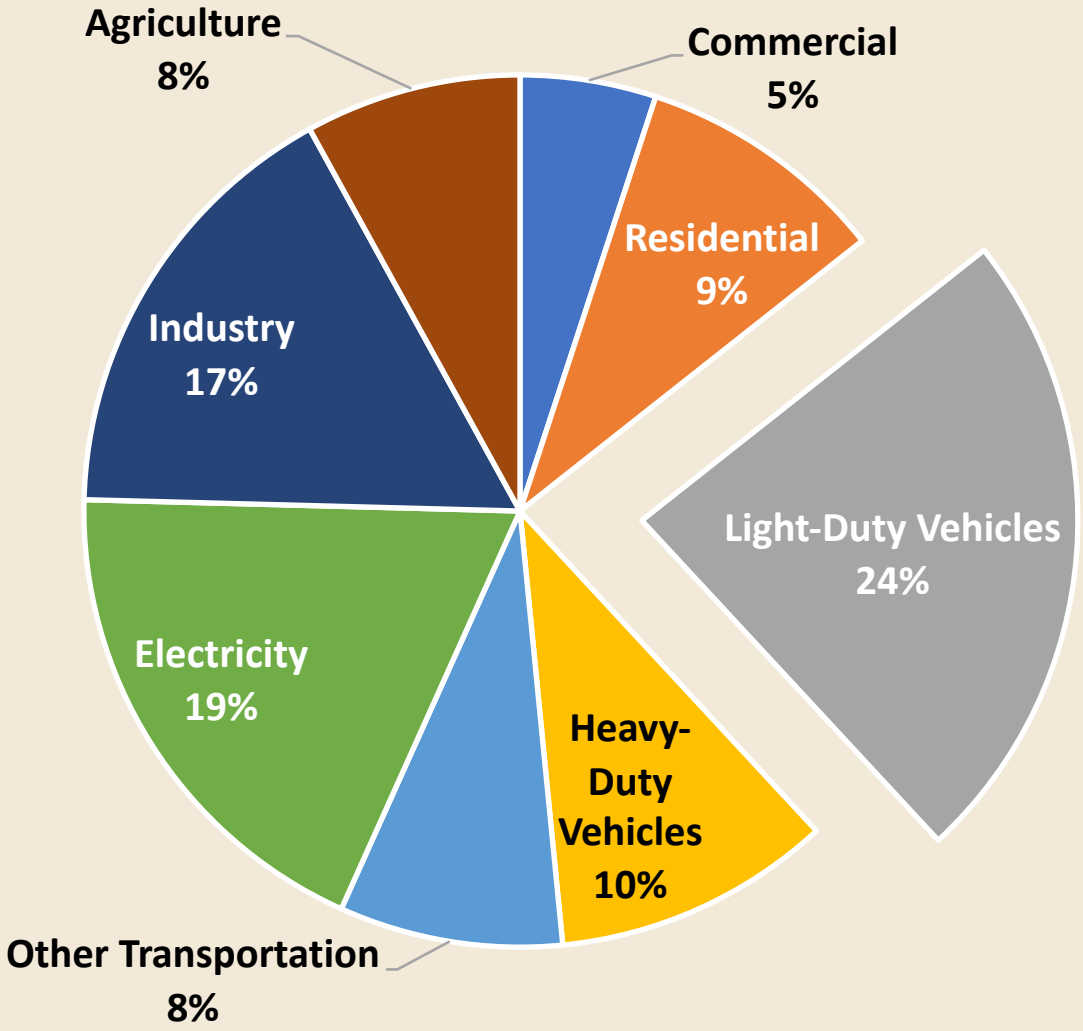


Figure 5. Approximate program-level costs of Level 2 and DC fast charging stations from selected major government charging infrastructure programs.

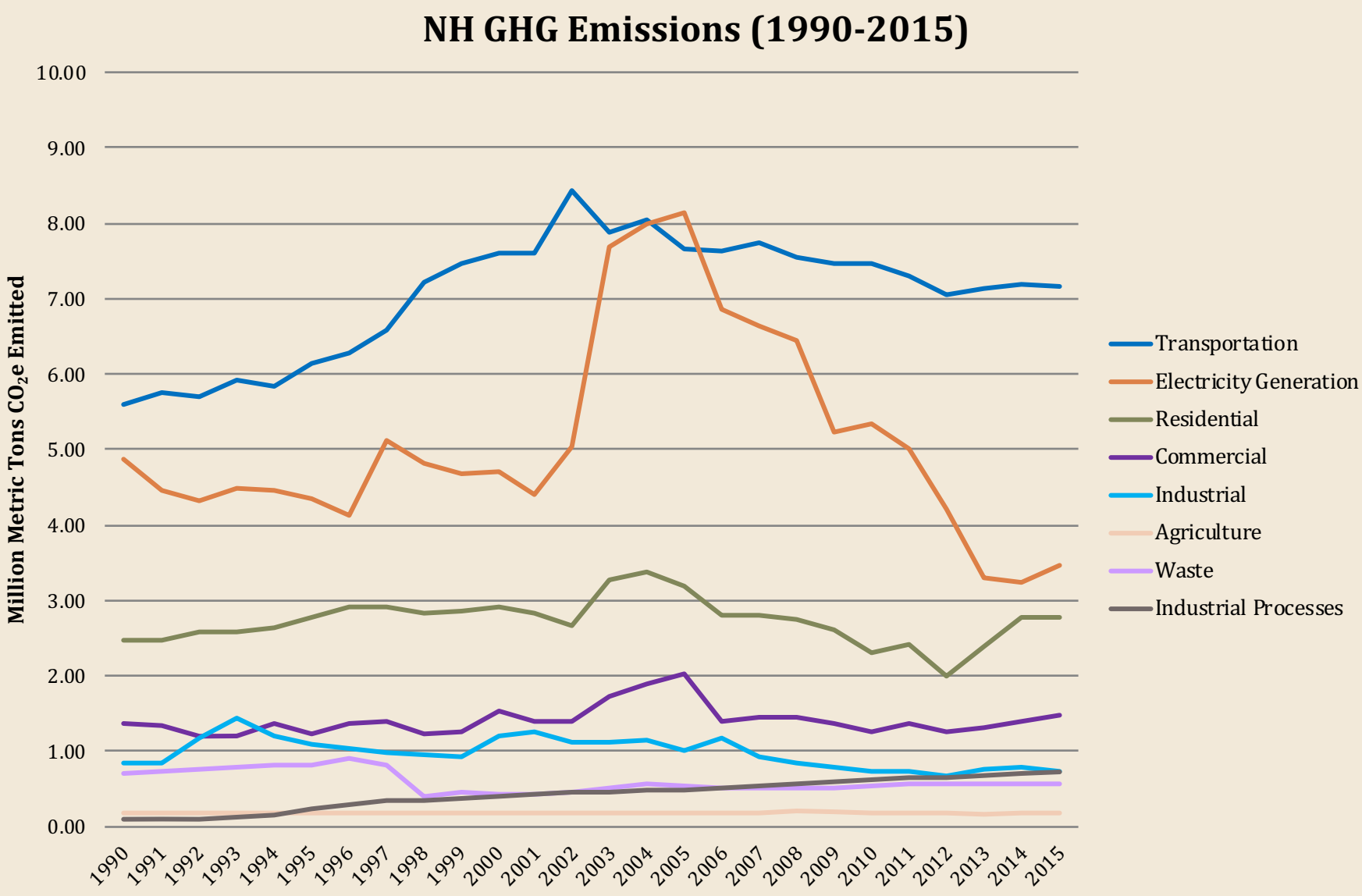
https://www.theicct.org/sites/default/files/publications/EV-charging-best-practices_ICCT-white-paper_04102017_vF.pdf

HOW MUCH EVSE IS NEEDED?

2015 GHG Emissions in 9 States



Data Source: 2018 EPA State Inventory Tool, default inputs


NH GHG Emissions (1990-2015)
Million Metric Tons CO_2e Emitted
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1990
1991
1992
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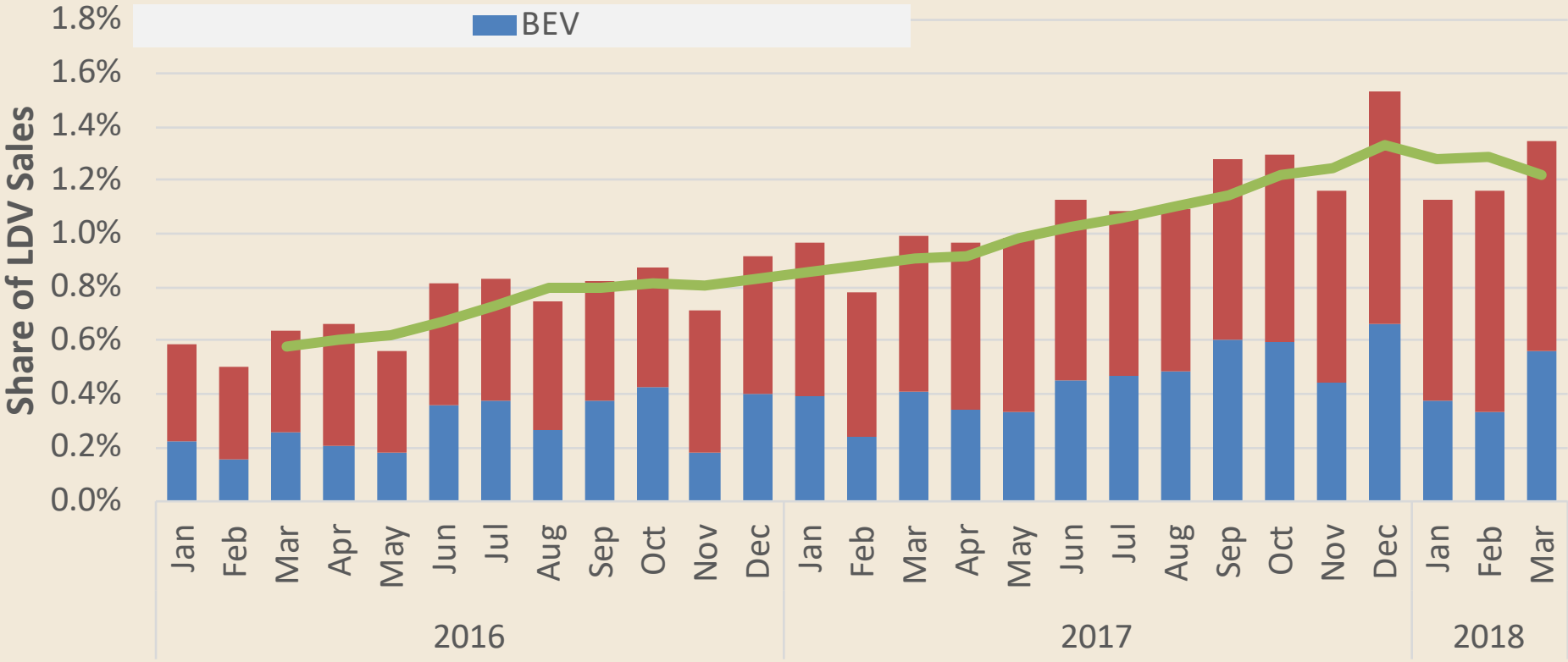
2013
2014
2015
Transportation
Electricity Generation
Residential
Commercial
Industrial
Agriculture
Waste
Industrial Processes

Share of LDV Sales in §177 ZEV States



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Source Data: IHS Polk
§177 ZEV States are: CT, ME, MD, MA, NJ, NY, OR, RI, and VT

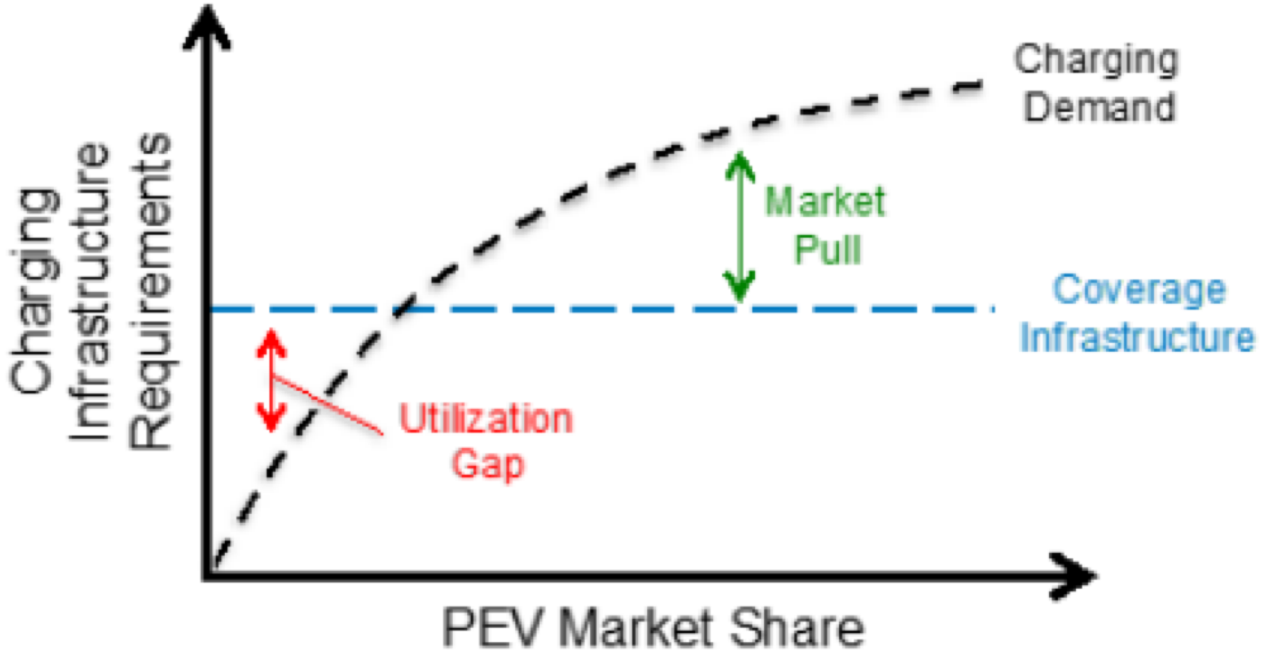
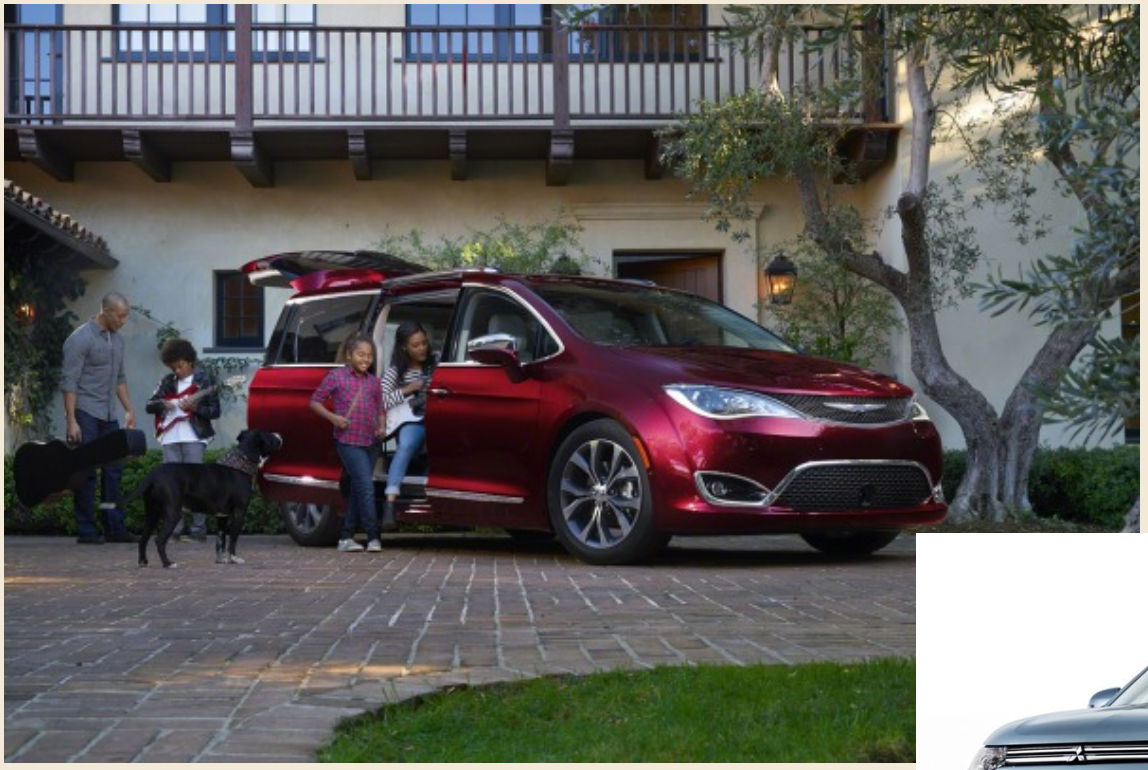
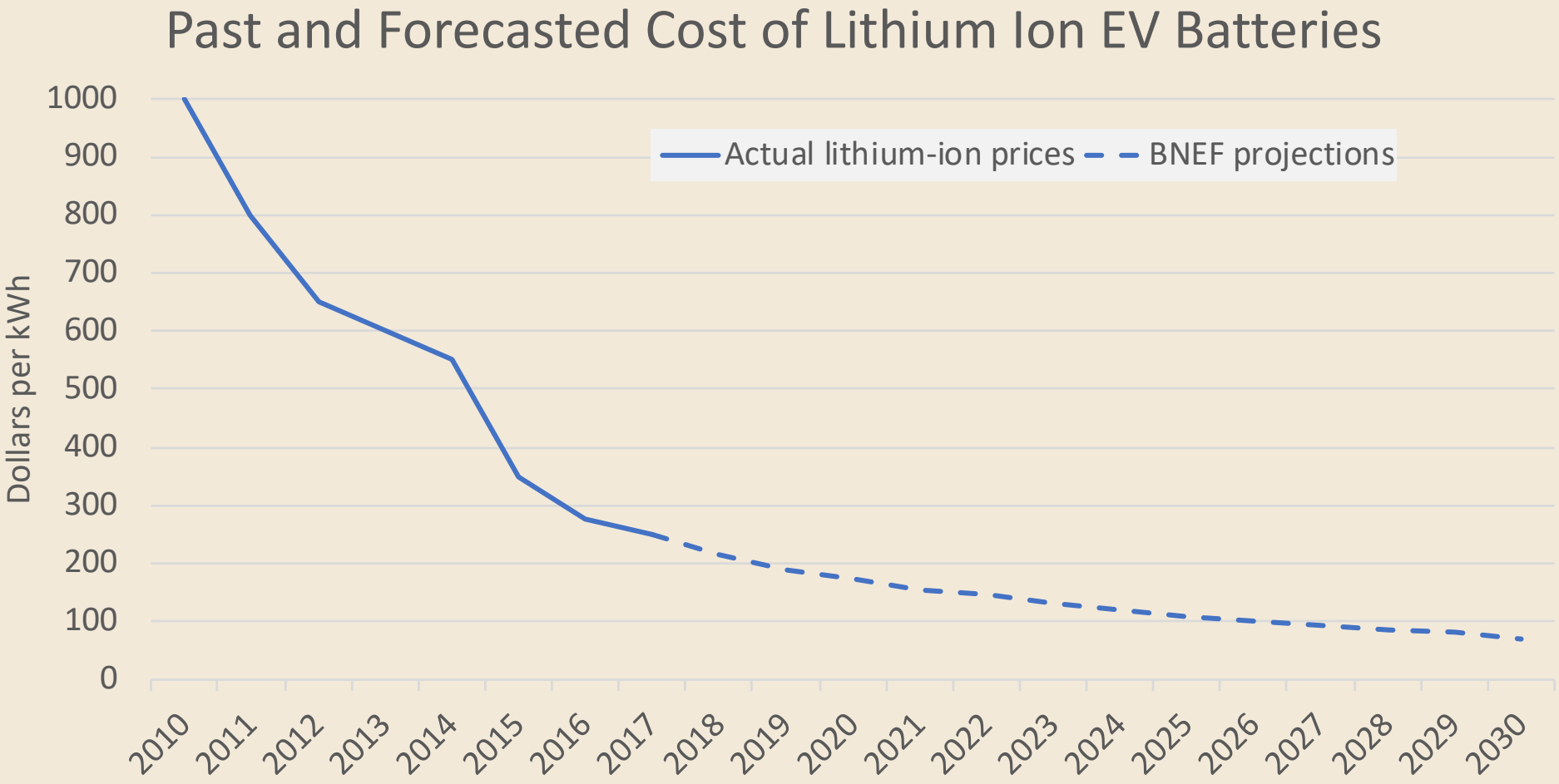


Figure 1. PEV charging requirements evolution as a function of PEV market share.

An Expanding Array of EV Models Coming to the NE

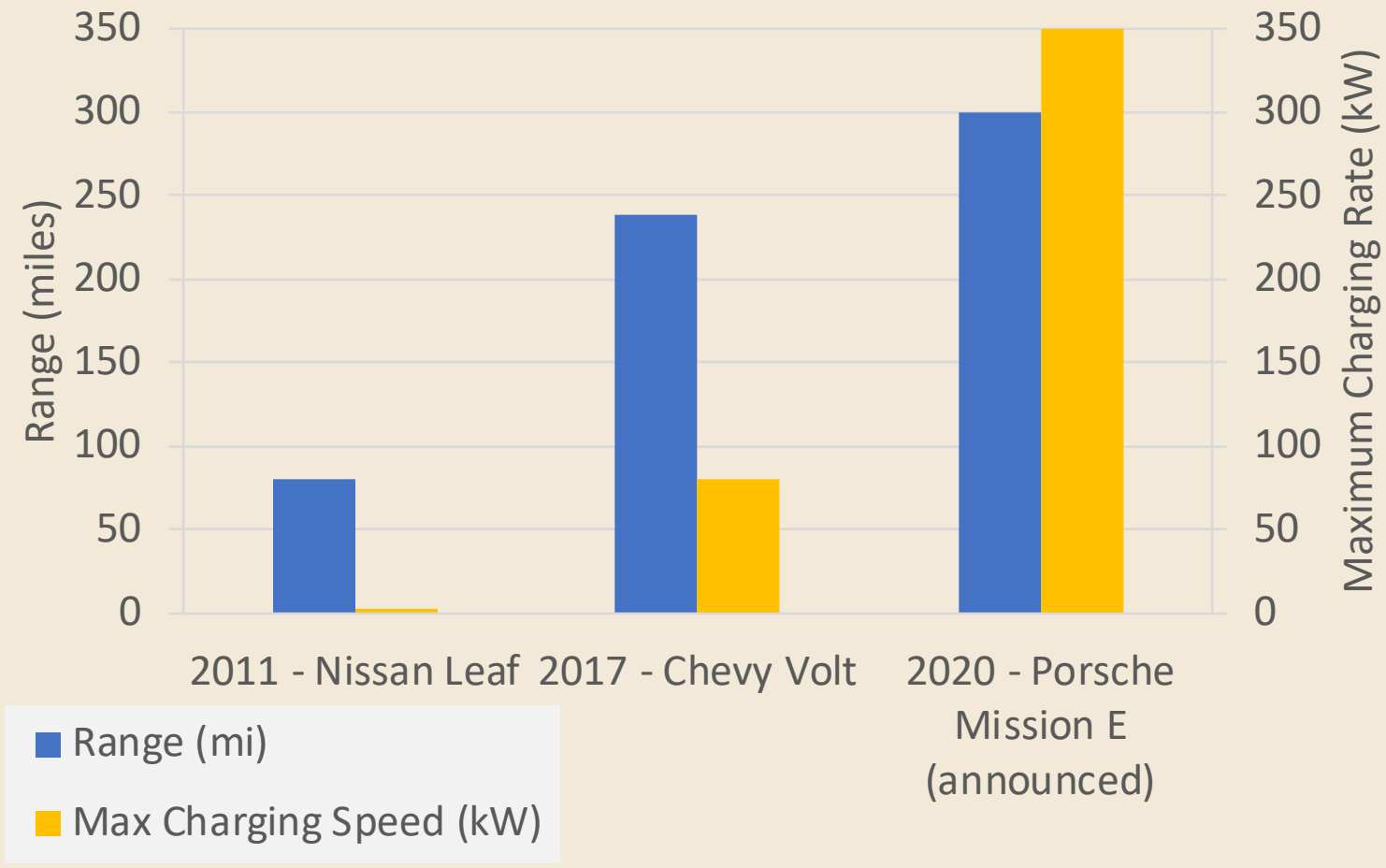




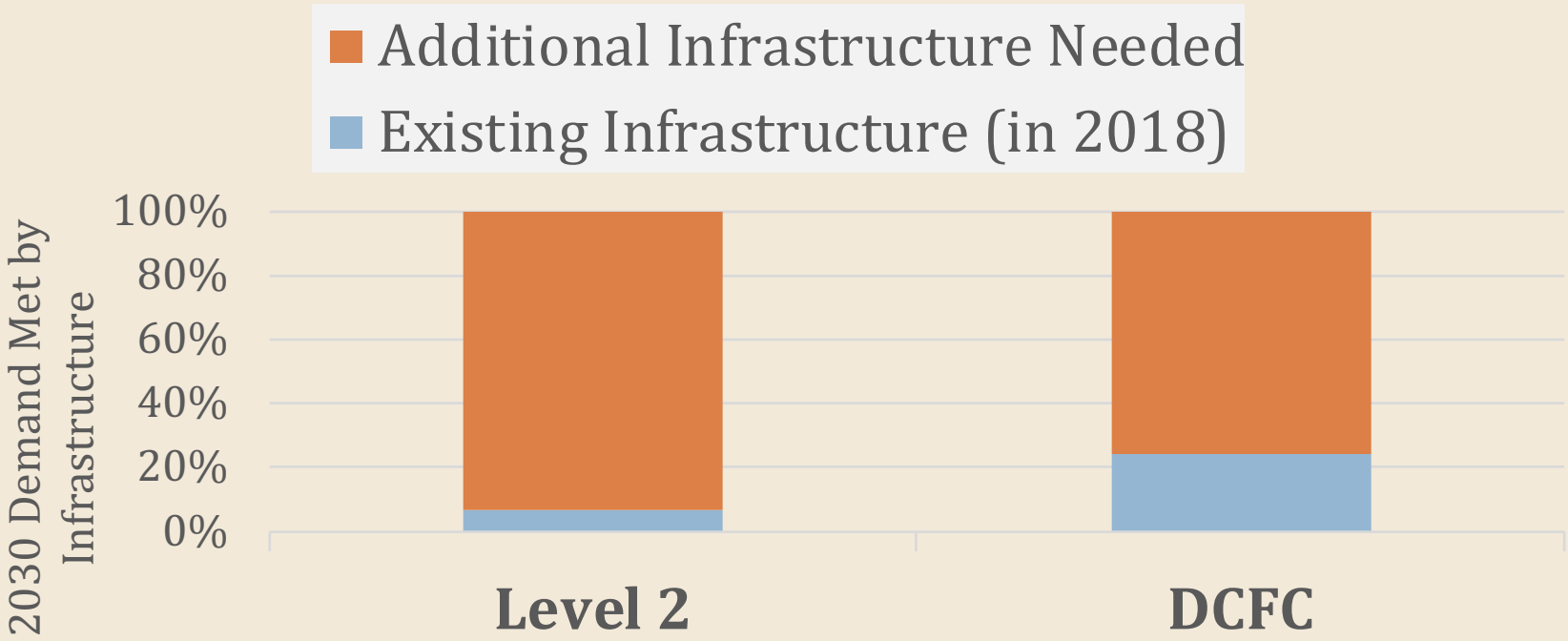
Data Source: Bloomberg New Energy Finance – November 28, 2017

https://www.bloomberg.com/news/articles/2017-11-28/electric-cars-need-cheaper-batteries-before-taking-over-the-road

Increases in BEV Range and Charging Speeds



What % of estimated charging demand in 2030 would be met by existing EVSE*



*Based on a nationwide charging gap analysis conducted by NREL: https://www.nrel.gov/docs/fy17osti/69031.pdf

Sources: https://www.afdc.energy.gov/

PLANNING

To Support Strategic Infrastructure Investment

Multi-ZEV Action Plan

FIVE CORE STRATEGIES

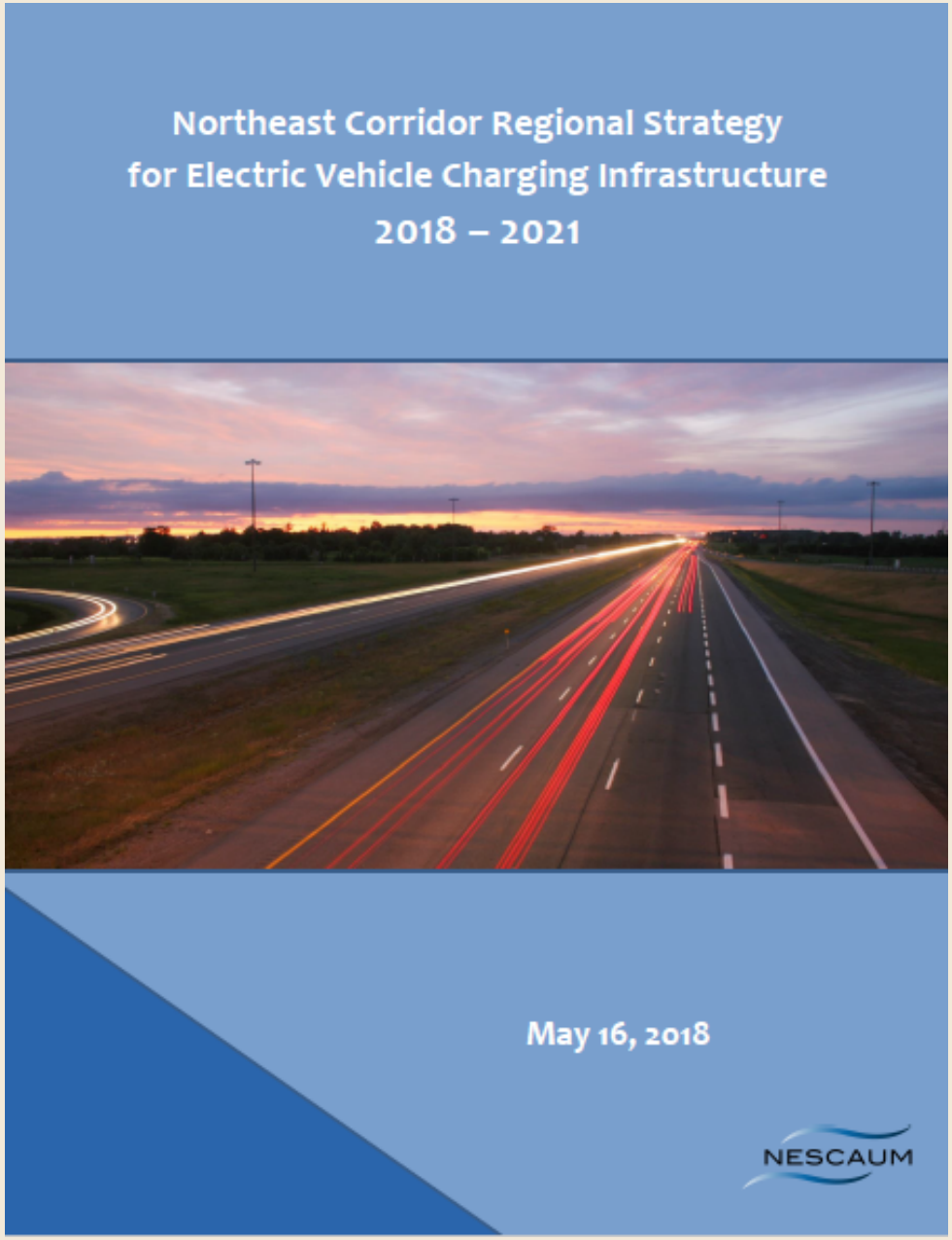
1. Raising consumer awareness and interest in electric vehicle technology;

2. **Building out a reliable and convenient residential, workplace and public charging/fueling infrastructure network;**

3. Continuing and improving access to consumer purchase and non-financial incentives;

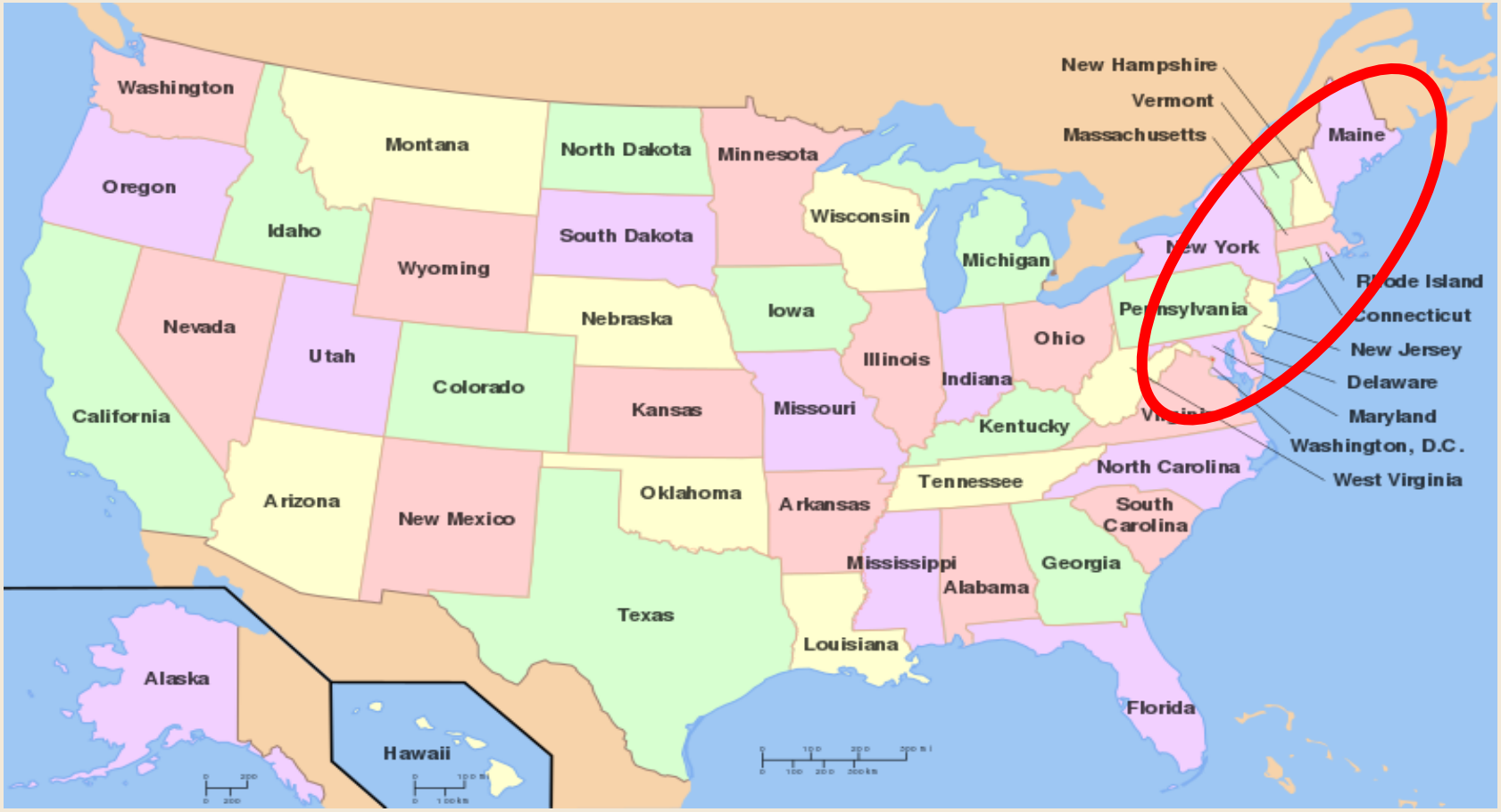
4. Expanding public and private sector fleet adoption; and

5. Supporting dealership efforts to increase ZEV sales.



- Participating States included CT, DE, MA, ME, NH, NY, PA, RI, VA, VT and District of Columbia
- Strategy implementation is getting underway
- **DOWNLOAD AT WWW.NESCAUM.ORG**

Developing a REGIONAL Infrastructure Strategy?



New Opportunities to Coordinate Infrastructure Investments

APPENDIX D FUNDS

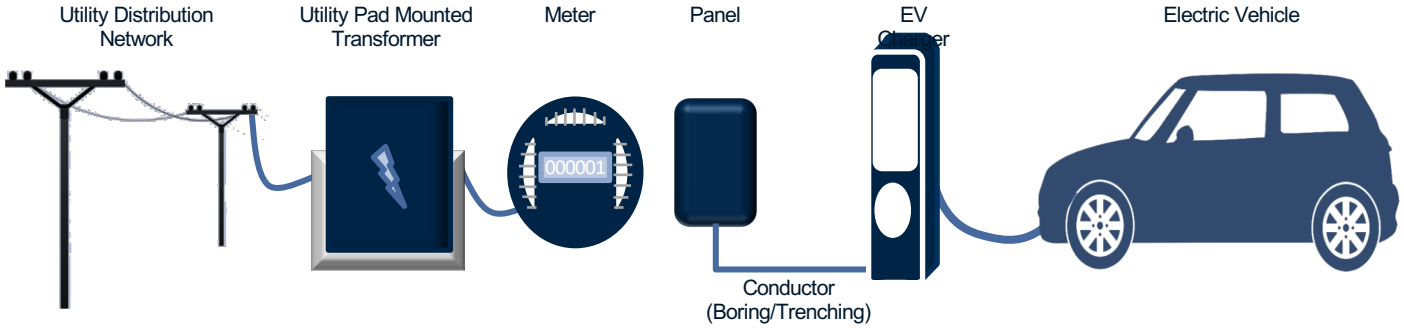
Under the Volkswagen settlement, the Northeast Corridor States may invest up to $108 million on ZEV charging and hydrogen fueling infrastructure.

Pursuant to the Volkswagen settlement, Electrify America is investing $2 billion to promote ZEVs, which will include substantial infrastructure investments in the Northeast Corridor.

UTILITY PROPOSALS

Utilities in the region are starting to invest in transportation electrification, with proposals in DE, DC, MD, MA, NJ, NY and RI, representing an investment of roughly $750 million.

Utility Investment Options in EV Charging Infrastructure



Business as Usual

Utility Investment → Host Site Investment

Make-Ready

Utility Investment → Host Site Investment

Owner-Operator

Utility Investment

Utility Incentive

Host Site / Third Party Investment

Utility Incentive Payment

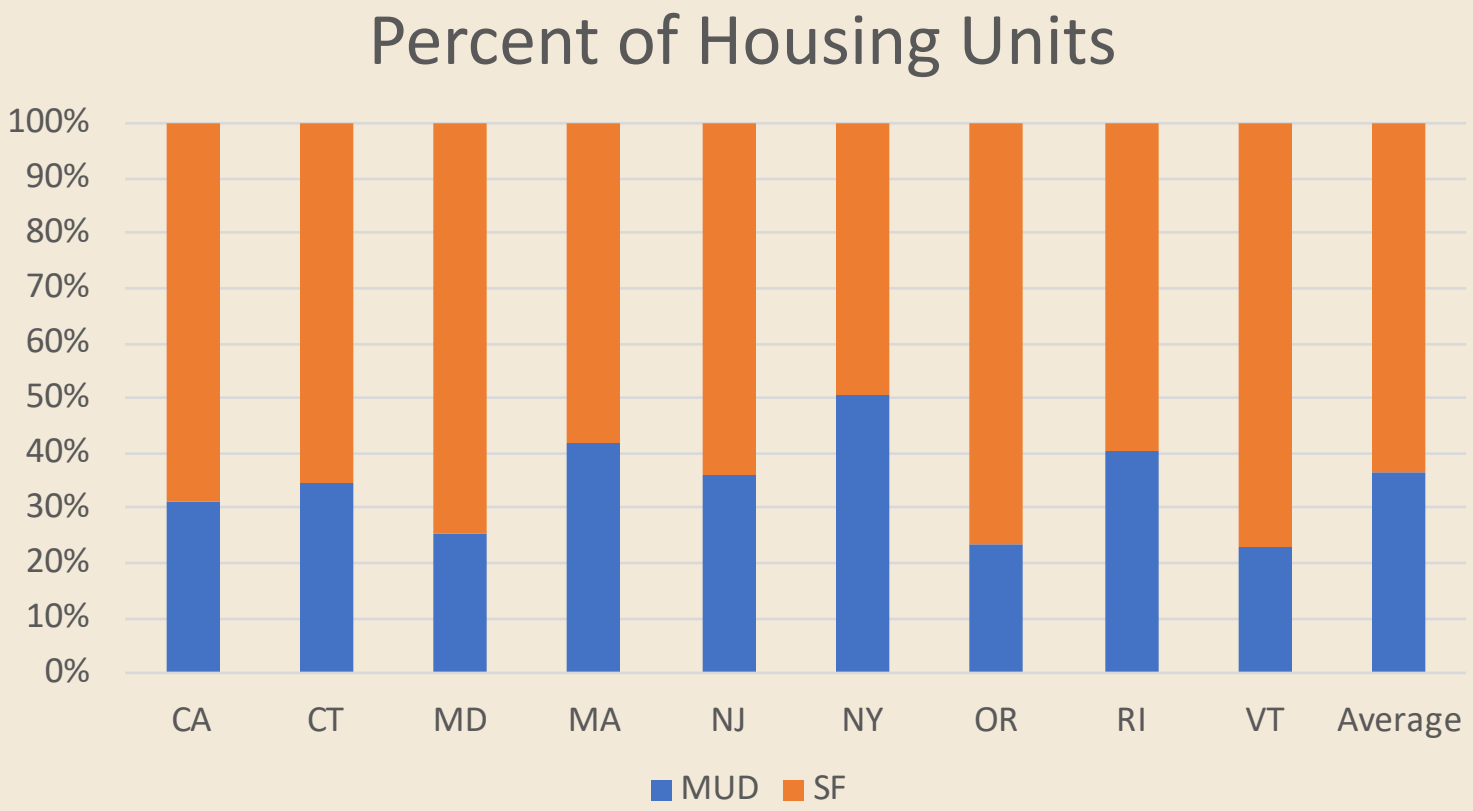
MJB & A

Utility Incentive Payment

Charging at Home

- Single Family Homes
  - L1 and L2 chargers offer ease, convenience
  - But…few consumers understand the options

- Multi-Family Dwellings (MUDs)
  - Much higher costs – upgrades to infrastructure, wiring, trenching
  - Many options for integrating stations into designated MUD parking when it exists
  - MUD residents without designated parking will need access to hubs



Data notes: Housing units in multi-unit structures, percent, 2009-2013

Source: U. S. Census Bureau, American Community Survey, 5-Year Estimates. Updated every year. http://factfinder2.census.gov

Example Recommendations

- Increase education for consumers about home charging options (utilities, states, EVSE providers)
- Investment in make-ready infrastructure and charging stations at MUDs is a key role for utilities
- Pilot innovative solutions for MUDs without off-street parking (e.g. downtown charging hubs)

Charging at Work

- Supports fleet electrification
- Employees with EVs can increase electric miles driven
- Businesses can demonstrate environmental leadership
- Creates virtual showrooms for electric vehicles

Barriers

- Costs for installation and maintenance
- Establishing the value proposition for businesses
- Supporting decision-making by busy corporate leaders and fleet managers

Example Recommendations

- Conduct outreach to employers, and consider launching high-profile recognition programs
- States should lead by example on fleet electrification and workplace charging
- Establish workplace charging incentives (utilities, states)

Engaging and Recognizing Employers: MA and VT

Public Charging, Around Town

- Raises awareness and encourages uptake of electric vehicles
- Provides charging to those who can't charge at home, or to those who want to extend e-miles
- Many potential investors from governments to utilities to EVSE providers

Barriers

- Costs for installation and maintenance
- Finding hosts and establishing the business case
- Lack of strategic placement has sometimes inhibited utilization

Example Recommendations

- States should encourage private investment e.g. with low-cost, long-term leases or no-cost use permits

- States / local gov’ts / transit authorities should focus investments on highly visible L2 chargers in transit areas and at popular public parking areas with longer dwell times (e.g. downtowns)

- Charging hubs (DCFC & Level 2) should be sited near commuting travel corridors within metropolitan areas to serve long distance and local drivers. Electrify America, utilities, EVSE providers are well suited to serve this need.

Charging On the Road

- A well-developed, reliable and convenient network of stations on heavily travelled corridors is essential to facilitate growing long distance travel in EVs.

- New tools are available to support strategic siting, e.g. TCI's tool for assessing corridor station locations

- Corridor charging stations (including in rural areas) will support convenient interstate travel throughout the region and avoid the potential challenge of increasing wait times on interstates

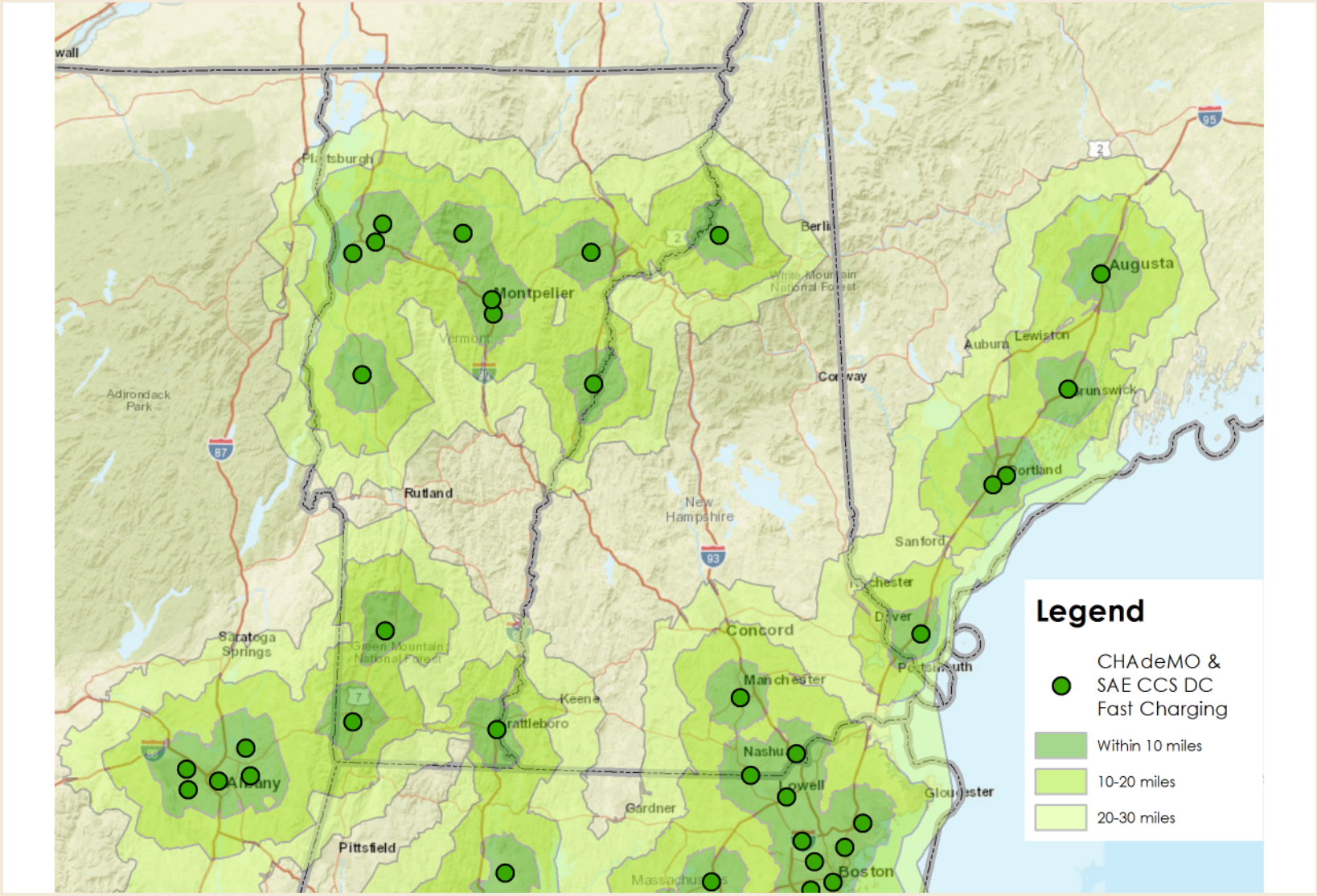
<u>Barriers</u>

- Capital-intensive
- Predictable, reliable, convenient use for consumers
- Need for future proofing

Example Recommendations

- EVSE investors (e.g. Electrify America) are critical for building robust charging on interstates, state highways and destination corridors
- States can support expanded DCFC investments by helping identify sites and site owners
- States can also invest in filling gaps unlikely to see near term private investment (e.g. some rural areas)
- Utilities can play a key role by helping identify sites, fund make-ready work etc.

DC Fast Charging Along Corridors



US DOE,, VEIC

Charging at Destinations

- Charging at heavily visited destinations (beaches, resorts, historic sites) builds range confidence and makes EVs more practical
- Visible locations can consumer exposure/awareness among *millions* of visitors.

<u>Barriers</u>

- Choosing priority locations can be challenging
- Visitation and utilization may vary widely across seasons

Example Recommendations

- Tourism boards, regional planning commissions and MPOs can help select and communicate priorities
- EVSE providers (e.g. EA) should install DCFC along highly traveled destination corridors and charging hubs at popular destinations
- States can install L2 chargers at popular destination locations and provide incentives for private investment (e.g. low-cost, long-term leases)

Overarching Issues: Consumer Access and "Interoperability"

- Consumers want charging to be easy and convenient regardless of what charging station they are using

- **Possible solutions:** Grant programs can require EVSE to enable universal payment options *(Model in MD)*

Overarching Issues: Building Codes

- Retrofitting existing multi-family or commercial buildings for charging equipment is costly!
- States can adopt code amendments to facilitate EVSE readiness in new construction and during renovation/retrofitting
- **Possible solutions**: States can adopt code provisions to ensure basic readiness for circuitry, designated parking spots or actual stations
  (CA and VT have models)

Overarching Issues: Utility Rate Structures

- Time of use rates can provide clear grid-beneficial price signals to EV owners about when to charge
- Demand charges could become a disincentive to private EVSE investment
- **Possible solutions**: PUC proceedings to consider new rate structures

Potential Discussion Questions

- Where has NH made the most progress to date on deploying EVSE to meet current and future charging needs?
- What are some possible ways that charging infrastructure in NH be expanded?
- What kinds of information would support further discussion about expanding EVSE in New Hampshire?