Final 2023 Transportation Electrification Forecast
Outline

- Introduction
- Electric Vehicle Adoption
- Energy and Demand Modeling Methodology
- Energy Forecast
- Demand Forecast
Acronyms

- **BEV** – Battery Electric Vehicle
- **BTM PV** – Behind-the-meter Photovoltaic
- **CELT** – Capacity, Energy, Loads and Transmission
- **EIA** – Energy Information Agency
- **EV** – Electric Vehicle
- **FCM** – Forward Capacity Market
- **GHG** – Greenhouse Gas
- **HE** – Hour Ending
- **ICR** – Installed Capacity Requirement
- **LDV** – Light-Duty Vehicle
- **LFC-** – Load Forecast Committee
- **PHEV** – Plug-in Hybrid Electric Vehicle
- **RSP** – Regional System Plan
- **TCI** – Transportation Climate Initiative
- **VMT** – Vehicle Miles Traveled
Introduction

• Transportation electrification is expected to play a pivotal role in the achievement of New England state greenhouse gas (GHG) reduction mandates and goals

• Forecasted impacts of transportation electrification on state and regional electric energy and demand are included as part of the 2023 Capacity, Energy, Loads, and Transmission (CELT) forecast

• The ISO’s transportation electrification forecast seeks to forecast the energy and demand impacts associated with the uptake of electric vehicles (EVs) within selected categories of vehicles:
  – Light-duty personal vehicles
  – Light-duty fleet vehicles
  – Medium-duty delivery vehicles
  – School buses
  – Transit buses
Methodology Updates for CELT 2023

• Developed a more consistent approach to generate state-level EV adoption forecasts
  – This effort includes canvasing of all federal, state, and local goals regarding EV adoption
  – Details on state-level adoption forecasting were discussed in the December 9, 2022 transportation electrification adoption forecast presentation

• Enhanced weather sensitivity of the energy and demand impacts of the personal light-duty vehicle portion of the forecast
  – Aligns methodology across all vehicle types
  – Moves from static monthly profiles to dynamic modeling of daily energy consumption based on weather
  – For more information see slides 4-9 of the November 7, 2022 update on the transportation electrification forecast
EV ADOPTION FORECAST
EV Adoption Forecast Overview

- For the CELT 2023 forecast, ISO has developed a more consistent approach for generating state-level EV adoption forecasts
- ISO has developed two adoption scenarios that reflect different assumptions about the pace and extent of transportation electrification within each state
  - "Full Electrification" adoption scenario
    - Intended to represent an upper bound on the pace and extent of EV adoption
    - Reflects comprehensive EV adoption estimates reflective of state emissions goals and associated EV adoption targets will be developed
    - Assumes state ZEV (Zero Emissions Vehicle) goals are met entirely by electric vehicles
    - Assumes all vehicles in each vehicle class are electrified by 2050
    - *This scenario is informational only (not directly used in the forecast)*
  - "CELT 2023" adoption scenario
    - Intended to reflect the likely pace and level of EV adoption over the next 10 years given the current understanding of individual state goals, policies, and programs
    - Reflects uncertainty in the timing of goal achievement and extent to which electric vehicles will be utilized to accomplish goals
    - *This scenario was used to generate the energy and demand impacts for the CELT 2023 forecast*
Federal EV Adoption Considerations

• Inflation Reduction Act
  – Enacts a tiered incentive for the purchase of new personal light-duty EVs meeting increasingly strict vehicle assembly and material sourcing requirements through 2032
  – Includes incentives for the purchase of used EVs through 2032
  – Includes incentives for the purchase of commercial light, medium, and heavy-duty EVs though 2032
  – Impact on regional EV adoption remains uncertain

• Environmental Protection Agency’s (EPA) Clean School Bus Program
  – Funding from the Bipartisan Infrastructure Law provides $5 billion over the next five years (FY 2022-2026) to replace existing school buses with zero-emission and low-emission models
  – A number of New England cities have already been awarded funding during the 2022 selection process and have made clear their intent to apply for future funding

• 2021 White House announcement regarding 2030 goal for light-duty vehicle sales which was applied to the adoption of both personal and fleet light-duty vehicles and aims for:
  “…electric vehicles to make up 50% of all vehicles sold in the United States by 2030.”
State-Specific EV Adoption Considerations

- **Multi-State Zero-Emission Vehicle MOUs**
  - [2013 Multi-State Zero-Emission Vehicle MOU](#) (MA, CT, RI, VT) - goal of 5 million light-duty ZEVs on road by 2025 across the 9 signatory states
  - [2020 Multi-State Medium- and Heavy-Duty Zero Emission Vehicle MOU](#) (MA, CT, RI, VT, ME) - commitment to phase out fossil fuel-burning medium- to heavy-duty truck and bus sales by one hundred percent by 2050, with a target for 30 percent of new truck and bus sales to be zero-emission by 2030 in all 15 signatory states

- **Various individual state and local considerations including**
  - State transportation electrification “Road Maps”
  - Local (usually individual cities) announcements/goals/programs for transitioning public transit and school bus fleets to ZEV
  - State transportation electrification “Action Plans”

- **Existing or anticipated adoption of California rules for ZEVs (MA and VT)**
  - [Advanced Clean Cars II (ACCII)](#) requires by 2035 that 100% of light-duty vehicles sold will be ZEVs
  - [Advanced Clean Trucks (ACT)](#) requires by 2035 that:
    - 55% of Class 2b – 3 truck sales are zero emissions.
    - 75% of Class 4 – 8 straight truck sales are zero emissions.
    - 40% of truck tractor sales are zero-emissions

- **State feedback**
  - The ISO has shared all assumptions and references, along with preliminary adoption figures with each of the six New England states. Guidance was provided on:
    - Reasonableness of the “Full Electrification” scenario
    - Considerations for developing the “Draft CELT 2023” scenario

- **See Appendix I for more details on state-level considerations**
Final 2023 EV Adoption Forecast

Cumulative EV Stock for New England

Vehicle Population:
- Light-Duty Personal: 11,700,000
- Light-Duty Fleet: 724,000
- Medium-Duty Delivery: 20,000
- School Bus: 26,000
- Transit Bus: 3,000

Graphs show the cumulative number of EVs and the percentage of vehicle stock for different categories from 2020 to 2050.
Personal Light-Duty EV Adoption

Cumulative EV Stock

Annual Incremental Increase in EV Stock

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<tr>
<th>Year</th>
<th>CT</th>
<th>MA</th>
<th>ME</th>
<th>NH</th>
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10-year total (2023-2032) | 518,934 | 1,494,004 | 291,071 | 165,953 | 137,080 | 117,884 | 2,724,923 |

Previous 10-year total (2022-2031) | 369,920 | 530,755 | 258,273 | 58,524 | 96,652 | 207,673 | 1,521,796 |

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## Fleet Light-Duty EV Adoption

### Cumulative EV Stock

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10-year total (2023-2032): 28,693 (CT), 155,468 (MA), 29,744 (ME), 12,525 (NH), 8,361 (RI), 5,919 (VT), 240,713 (NE)

### Annual Incremental Increase in EV Stock

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**Graphs:**
- **Cumulative EV Stock:** Line graphs for each state showing the cumulative number of EVs from 2020 to 2050, with annotations for Full Electrification, CELT 2022, and CELT 2023.
Medium-Duty Delivery EV Adoption

### Cumulative EV Stock

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#### 10-year total (2023-2032)

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#### Previous 10-year total (2022-2031)

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### Annual Incremental Increase in EV Stock

- **Full Electrification CELT 2022**
- **CELT 2023**
### School Bus EV Adoption

#### Cumulative EV Stock

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<th>NH</th>
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#### Annual Incremental Increase in EV Stock

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<th>NH</th>
<th>RI</th>
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| Change | +825 | +1,040 | +207 | +94 | +153 | +38 | +2,356 |
## Transit Bus EV Adoption

### Cumulative EV Stock

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### 10-year total (2023-2032)

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### Change

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ENERGY AND DEMAND MODELING METHODOLOGY
Methodology Overview

• Energy and demand impacts are based on analysis of vehicle driving patterns and a sample of vehicle charging data

• Inputs developed specific to each vehicle category
  – Annual vehicle miles traveled (VMT)
  – Monthly allocation of VMT
    • Reflects seasonal driving patterns
    • Allocations for monthly VMT to weekdays/weekends
  – Hourly allocation of daily charging, by month
    • Shapes for Weekdays and weekends
  – Relationship between weather (daily average dry-bulb) and EV efficiency (kWh/mile)

• Monthly energy and demand impacts are developed for each vehicle category
  – Develop VMT assumptions for all days within a month
  – Apply temperature sensitive efficiency relationships to get daily energy
  – Apply daily charging shapes to allocate charging to hours
  – Monthly energy impacts stem from the same 30 year normal period used in the load forecast
  – Monthly demand impacts result from applying the weather distribution used in the load forecast
  – Scale to adoption forecast
## Vehicle Miles Traveled (VMT)

### Annual VMT

<table>
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<th>Vehicle Category</th>
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<tr>
<td>Transit bus</td>
<td>38,488</td>
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<tr>
<td>Medium-duty delivery</td>
<td>13,655</td>
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<tr>
<td>Light-duty fleet</td>
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<tr>
<td>Light-duty personal</td>
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### Day-type VMT Allocation

#### Monthly VMT Allocation

- **Light-Duty Personal**
- **Light-Duty Fleet**
- **Medium-Duty Delivery**

### Monthly VMT Allocation

This profile represents all categories except school buses.
Electric Vehicle Efficiency

*Energy Consumption as a Function of Daily Temperature*

*School bus and transit bus efficiencies reflect an adjustment for the partial use of auxiliary cabin heating systems*
Allocation of Hourly Charging by Month

Non-Holidays & Weekdays
Allocation of Hourly Charging by Month

Holidays & Weekends

- Light-Duty Personal
- Light-Duty Fleet
- Medium-Duty Delivery
- School Bus
- Transit Bus

Graphs showing the percentage of daily charging by hour for each category across different months.
ENERGY FORECAST
Estimating Energy Impacts of EV Adoption

Average Daily Charging Energy – New England

- **Light-Duty Personal**
  - Average Daily Charging (kWh)
  - Chart showing energy consumption by month.

- **Light-Duty Fleet**
  - Average Daily Charging (kWh)
  - Chart showing energy consumption by month.

- **Medium-Duty Delivery**
  - Average Daily Charging (kWh)
  - Chart showing energy consumption by month.

- **School Bus**
  - Average Daily Charging (kWh)
  - Chart showing energy consumption by month.

- **Transit Bus**
  - Average Daily Charging (kWh)
  - Chart showing energy consumption by month.
2023 Transportation Electrification Forecast

Monthly Energy

Monthly Energy (GWh)

Share of Monthly Regional Gross Energy (%)

CT
MA
ME
NH
RI
VT

0 200 400 600 800 1,000 1,200 1,400 1,600

2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033

0 2 4 6 8 10

ISO-NE PUBLIC
Transportation Electrification Energy Forecast

New England Comparison Between CELT 2022 and CELT 2023

[Graph showing monthly energy (GWh) for CELT 2022 and CELT 2023 from 2023 to 2033.]

- CELT 2023
- CELT 2022
## 2023 Transportation Electrification Forecast

### Annual Energy

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<tr>
<th>Year</th>
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### New England

<table>
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<tr>
<th>Year</th>
<th>Personal Light-Duty</th>
<th>Fleet Light-Duty</th>
<th>Medium-Duty Delivery</th>
<th>School Bus</th>
<th>Transit Bus</th>
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<td>34,317</td>
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</table>
DEMAND FORECAST
Estimating Demand Impacts of EV Adoption

- For applications that include hourly analysis, EV demand will be modeled hourly
  - E.g., probabilistic ICR analysis

- Other forecast applications and reporting require a deterministic peak value (e.g., CELT report), and for which:
  - Winter peak demand:
    - Use the monthly average EV demand from HE 18-19
    - January-April, October-December
  - Summer demand impacts should reflect expectations of peak shifting due to increasing BTM PV penetrations

- Weather-sensitive demand impacts
  - Hourly weekday allocation of daily energy is used to estimate demand impacts
  - Daily energy is derived using VMT and temperature responsiveness of electric vehicle efficiency
Summer Peak Net Load as BTM PV Increases

- Hourly net load and BTM PV data from the summers (July/August) of 2014-2021 were analyzed to simulate net loads with increasing penetrations of BTM PV.

- Scatter plot shows the hour ending (HE) and magnitude (in GW) of net peak load as BTM PV increases.

- Gray areas reflect estimated window of hours peak load may occur.
  - Yellow areas highlight peak hours.
Interaction of EV Summer Demand and BTM PV

• For forecast applications and reporting that require a deterministic peak value, EV demand during the summer months is estimated as the average monthly EV demand during the summer peak hours tabulated to the right—May through September—Hours reflect effect of shifting peak demand due to BTM PV

• Used for forecasts of fleet vehicles and personal light-duty personal vehicles

<table>
<thead>
<tr>
<th>Year</th>
<th>PV Nameplate Bin (GW)*</th>
<th>Summer Peak Hours</th>
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<td>[18,19,20]</td>
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<td>[18,19,20]</td>
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<td>[18,19,20]</td>
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<td>[18,19,20]</td>
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<td>[18,19,20]</td>
</tr>
<tr>
<td>2032</td>
<td>11</td>
<td>[18,19,20]</td>
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</table>

*Based on 2022 PV forecast values
2023 Transportation Electrification Forecast

Monthly 50/50 Peak Demand by State
### 2023 Transportation Electrification Forecast

#### 50/50 Summer Peak Demand

<table>
<thead>
<tr>
<th>Year</th>
<th>CT</th>
<th>MA</th>
<th>ME</th>
<th>NH</th>
<th>RI</th>
<th>VT</th>
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<td>96</td>
<td>2,346</td>
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</table>

#### New England (July)

- **Personal Light-Duty**
- **Fleet Light-Duty**
- **Medium-Duty Delivery**
- **School Bus**
- **Transit Bus**

![Summer Peak Demand (MW) chart](chart.png)
## 2023 Transportation Electrification Forecast
### 50/50 Winter Peak Demand

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<th>RI</th>
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### New England (January)

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<th>Medium-Duty Delivery</th>
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Transportation Electrification Demand Forecast
50/50 New England Comparison Between CELT 2022* and CELT 2023

Summer (July) Demand

Winter (January) Demand

* CELT 2022 values have been adjusted to begin accumulating 2023
APPENDIX I

State-Specific EV Adoption Forecast Considerations
Massachusetts

**EV Adoption Forecast Drivers**

- **2013 Multi-State Zero-Emission Vehicle MOU**
  - Collective target among initial signatory states to achieve a goal of 3.3 million EVs on the road by 2025

- **2020 Multi-State Medium- and Heavy-Duty Zero Emission Vehicle MOU**
  - Goal that all new medium- and heavy-duty vehicle sales in each of 15 state jurisdictions be zero-emission vehicles by 2050, with an interim goal of 30% of new vehicle sales by 2030

- **MA Decarbonization Roadmap**
  - Reducing emissions 45% below 1990 levels by 2030 would require that about 1 million of the 5.5 million LDVs projected to be registered in the Commonwealth in 2030 be ZEVs

- **City of Boston - Mayor’s Office Announcement (2022)**
  - Electric school bus pilot program, deploying 20 buses during the 2022-2023 school year
  - Goal to electrify all 700 of the city’s school buses by 2030

- **MBTA Procurement of 40-Foot, Low Floor, Battery Electric Buses (issued April 2022)**
  - MBTA is soliciting bids from manufacturers to obtain up to 460 new battery-electric buses starting in 2023

- **MBTA Bus Electrification Plan (May 2022)**
  - The MBTA is working to convert it’s entire bus fleet of 1,150 buses to battery electric buses by 2040

- **Adoption of California’s Clean Trucks Act** requires by 2035 that:
  - 55% of Class 2b – 3 truck sales are zero emissions
  - 75% of Class 4 – 8 straight truck sales are zero emissions
  - 40% of truck tractor sales are zero-emissions

- **Advanced Clean Cars II (ACCII)** requires by 2035 that:
  - 100% of light-duty vehicles sold will be zero emissions

- **2021 White House announcement regarding 2030 goal for light-duty vehicle sales**
  - Aims for “…electric vehicles to make up 50% of all vehicles sold in the United States by 2030.”
Massachusetts

*EV Adoption Forecast Assumptions*

- **“Full Electrification” scenario**
  - Assumes all state and local policy, programs, goals and announcement targets are achieved in the listed timeframe solely through the adoption of electric vehicles

- **“CELT 2023” scenario**
  - School buses, transit buses, and medium-duty delivery
    - Maintains that the 2030 MDHD ZEV goal (30% of new truck and bus sales) is met by EVs
  - Personal and fleet light-duty vehicles
    - Assumes ACCII rule is met (100% of new vehicle sales by 2035) by EVs
Connecticut

EV Adoption Forecast Drivers

- **2013 Multi-State Zero-Emission Vehicle MOU**
  - Collective target among initial signatory states to achieve a goal of 3.3 million EVs on the road by 2025

- **2020 Multi-State Medium- and Heavy-Duty Zero Emission Vehicle MOU**
  - Goal that all new medium- and heavy-duty vehicle sales in each of 15 state jurisdictions be zero-emission vehicles by 2050, with an interim goal of 30% of new vehicle sales by 2030

- **Electric Vehicle Roadmap for Connecticut**
  - Goal of putting 125,000 to 150,000 EVs on the road in CT by 2025 per the 2013 ZEV MOU (annual LDV sales are roughly 150,000-180,000 vehicles)

- **Public Act No. 22-25**
  - Mandates targets for the procurement of state owned or leased light-duty vehicles
    - State fleet is roughly 3,500 out of almost 3 million light-duty vehicles state-wide
  - **Transit Buses**
    - After January 1, 2030, at least 30% of all buses purchased or leased by the state shall be zero-emission buses
    - Public transit bus fleet is roughly 400 of all 770 total state-wide
  - **School buses**
    - 100% of all school buses in environmental justice communities must be ZEV by 1/1/2030
    - All school buses must be ZEV (all electric or alternative fuel) by 1/1/2040
    - Roughly 1800 school buses are considered to be within environmental justice communities out of 5,300 state-wide

- **2021 White House announcement regarding 2030 goal for light-duty vehicle sales**
  - Aims for “...electric vehicles to make up 50% of all vehicles sold in the United States by 2030.”
Connecticut

EV Adoption Forecast Assumptions

• “Full Electrification” scenario
  – Assumes all state and local policy, programs, goals and announcement targets are achieved in the listed timeframe solely through the adoption of electric vehicles

• “CELT 2023” scenario
  – Medium-duty delivery
    • Maintains that the MDHD MOU ZEV goal (30% of new truck and bus sales by 2030) is met by EVs
  – School buses and transit buses
    • Reflects EV adoption beyond the MDHD ZEV MOU, shadowing the trajectory of EV adoption for these vehicles outlined in Public Act No. 22-25
  – Personal and fleet light-duty vehicles
    • Split between the CELT 2022 forecast and the “Full Electrification” scenario, recognizing the EV goals currently in place, but reflecting the fact that there is significant uncertainty in the timing of progress toward these goals over the next decade
Vermont

EV Adoption Forecast Drivers

- **2013 Multi-State Zero-Emission Vehicle MOU**
  - Collective target among initial signatory states to achieve a goal of 3.3 million EVs on the road by 2025

- **2020 Multi-State Medium- and Heavy-Duty Zero Emission Vehicle MOU**
  - Goal that all new medium- and heavy-duty vehicle sales in each of 15 state jurisdictions be zero-emission vehicles by 2050, with an interim goal of 30% of new vehicle sales by 2030

- **Initial Vermont Climate Action Plan (2021)**
  - Modeling indicates that in order to achieve the state’s emissions reduction requirements
    - Approximately 170,000 light-duty EVs will need to be deployed by 2030
    - Approximately 50,000 medium and heavy-duty EVs will need to be deployed by 2030

- **Advanced Clean Cars II (ACCII) and Advanced Clean Trucks (ACT) rules**
  - State of VT is considering adopting these by the end of 2022

- **2021 White House announcement regarding 2030 goal for light-duty vehicle sales**
  - Aiming for “…electric vehicles to make up 50% of all vehicles sold in the United States by 2030.”
Vermont

EV Adoption Forecast Assumptions

• “Full Electrification” scenario
  – Assumes all state and local policy, programs, goals and announcement targets are achieved in the listed timeframe solely through the adoption of electric vehicles

• “CELT 2023” scenario
  – Personal and Fleet light-duty vehicles
    • Reflects anticipated adoption of the Advanced Clean Cars II (ACCII) and Advanced Clean Trucks (ACT) rules, but at a lagged pace 3-5 years behind the targets listed in the rules
  – School buses, transit buses, and medium-duty delivery
    • Maintains that the 2030 MDHD ZEV goal (30% of new truck and bus sales) is met by EVs
New Hampshire

**EV Adoption Forecast Drivers and Assumptions**

- In New Hampshire, although there are a number of utility incentive programs offering rebates for charger installations, documentation pointing to specific expectations about EV adoption is scarce
  - There does not appear to be any guidance about EV targets needed to meet decarbonization goals

- “Full Electrification” scenario
  - The only explicit driver incorporated into the “Full Electrification” scenario is the [2021 White House announcement regarding 2030 goal for light-duty vehicle sales](https://www.whitehouse.gov/) aiming for “…electric vehicles to make up 50% of all vehicles sold in the United States by 2030.”
  - In the remaining 3 vehicle categories (medium-duty delivery, school buses, and transit buses) the “Full Electrification” scenario traces very closely to the CELT 2022 forecast through 2031, and is extrapolated out until all vehicles in each category are electrified

- “CELT 2023” scenario
  - Personal and Fleet light-duty vehicles
    - Split between the CELT 2022 forecast and the “Full Electrification” scenario
  - School buses, transit buses, and medium-duty delivery
    - Aligns with the CELT 2022 forecast and the “Full Electrification” scenario
Maine

EV Adoption Forecast Drivers

• In Maine, in addition to incentive programs offering rebates for EV purchases and charger installations, the state also has a number of references that mandate or suggest specific expectations about EV adoption

• **2013 Multi-State Zero-Emission Vehicle MOU**
  — Collective target among initial signatory states to achieve a goal of 3.3 million EVs on the road by 2025

• **2020 Multi-State Medium- and Heavy-Duty Zero Emission Vehicle MOU**
  — Goal that all new medium- and heavy-duty vehicle sales in each of 15 state jurisdictions be zero-emission vehicles by 2050, with an interim goal of 30% of new vehicle sales by 2030

• **Maine Won’t Wait**
  — State climate action plan setting a goal of 41,000 light-duty EVs on the road in Maine by 2025 and 219,000 by 2030

• **Greater Portland Transit District (Metro) ZEV Goal**
  — Metro’s Board of Directors passed a resolution committing to be zero emissions by 2040
  — Metro oversees approximately 29 out of the state’s 194 transit buses
Maine

EV Adoption Forecast Assumptions

• “Full Electrification” scenario
  – Assumes all state and local policy, programs, goals and announcement targets are achieved in the listed timeframe solely through the adoption of electric vehicles

• “CELT 2023” scenario
  – Aligns with the “Full Electrification” scenario and state confidence that the goals it reflects will be achieved
Rhode Island

*EV Adoption Forecast Drivers*

- In Rhode Island, in addition to incentive programs offering rebates for EV purchases and charger installations, the state also has a number of references that mandate or suggest specific expectations about EV adoption.

- **2013 Multi-State Zero-Emission Vehicle MOU**
  - Collective target among initial signatory states to achieve a goal of 3.3 million EVs on the road by 2025.

- **2020 Multi-State Medium- and Heavy-Duty Zero Emission Vehicle MOU**
  - Goal that all new medium- and heavy-duty vehicle sales in each of 15 state jurisdictions be zero-emission vehicles by 2050, with an interim goal of 30% of new vehicle sales by 2030.

- **RIPTA Sustainable Fleet Transition (2020)**
  - Considers nine technology deployment scenarios for converting RIPTA’s bus fleet to ZEV.
    - Include a baseline diesel case and four scenarios that are based on combinations of technologies.
    - “100% Depot Charging Scenario” is utilized to develop the “Full Electrification” scenario listed in this presentation.
    - RIPTA’s current diesel fleet is transitioned to depot-charged battery-electric buses by 2032.

- **Electrifying Transportation (2021)**
  - Strategic policy guide for improving public access to EV charging infrastructure in Rhode Island.
  - RIPTA has plans to purchase and deploy 16-20 electric buses as permanent additions to its fleet by 2023.

- **2021 White House announcement regarding 2030 goal for light-duty vehicle sales**
  - Aiming for “…electric vehicles to make up 50% of all vehicles sold in the United States by 2030.”
Rhode Island

EV Adoption Forecast Assumptions

• “Full Electrification” scenario
  – Assumes all state and local policy, programs, goals and announcement targets are achieved in the listed timeframe solely through the adoption of electric vehicles

• “CELT 2023” scenario
  – Medium-duty delivery and school buses
    • Maintains that the MDHD MOU ZEV goal (30% of new truck and bus sales by 2030) is met by EVs
  – Transit buses
    • Reflects EV adoption beyond the MDHD ZEV MOU, assuming near-term RIPTA goals are met (deployment of 16-20 EV buses by 2023)
  – Personal and fleet light-duty vehicles
    • Split between the CELT 2022 forecast and the “Full Electrification” scenario, recognizing the EV goals currently in place, but reflecting the fact that there is significant uncertainty in the timing of progress toward these goals over the next decade