Appendix 1. Summary of Progress Since the Initial Assessment

This Appendix provides an overview of the progress made to date on the recommendations included in the Initial EVICC Assessment. Chapter 8 of this Assessment proposes additional actions to further address these initial recommendations and/or to build on the progress made to date as necessary.

Recommendation	Progress
Recommended legislative actions	
Legislation should require publicly accessible EV chargers to register with the Division of Standards (DOS) so that they can be regularly inspected; DOS will develop new regulations to ensure that publicly accessible EV chargers are registered, inspected, and tested.	The 2024 Climate Act requires DOS to develop regulations to (1) inventory EV charging stations and (2) ensure the accuracy of pricing and volumes of electricity purchased at public EV chargers.[1] Separately, the Executive Office of Energy and Environmental Affairs (EEA) is required to develop regulations to (1) monitor EV charger utilization, (2) monitor EV charger reliability, and (3) require data sharing by public EV chargers.[2] DOS and EEA are currently developing regulations to address these requirements. More information on these efforts can be found in Chapter 6.
The Healey-Driscoll Administration will work with the legislature to pass "right to charge" legislation that will help tenants and people living in condominiums install charging infrastructure.	The 2024 Climate Act passed into law a "right to charge" rule that prohibits historic district commissions, neighborhood conservation commissions, and condominium or homeowners' associations from unreasonably restricting EV charger installations by property owners. In addition, the bill authorizes condo boards to install EV chargers on community parcels.[3]
The Department of Energy Resources (DOER) will work with the legislature to update appliance standards for EV chargers to the latest ENERGY STAR standards.	The 2024 Climate Act updated the appliance standards for EV chargers to the latest ENERGY STAR standard, Version 1.2. [4]
EEA, DOER, and DOS will coordinate with the legislature to ensure that there are no overlapping or contradictory provisions between existing language in M.G.L. c. 25A and any new legislation that is enacted to provide DOS with the requisite authority to carry out inspections of publicly available EV chargers.	The 2024 Climate Act requires DOS to promulgate regulations to inventory the number and location of charging stations.[5] This does not conflict with M.G.L. c. 25A, which requires owners and operators of public charging stations to register with the Department of Energy's Alternative Fuels Data Center.

[1] An Act Promoting a Clean Energy Grid, Advancing Equity, and Protecting Ratepayers, ch. 239, § 42, Acts of 2024 (Mass.), https://malegislature.gov/Laws/SessionLaws/Acts/2024/Chapter239.

[2] An Act Promoting a Clean Energy Grid, Advancing Equity, and Protecting Ratepayers, ch. 239, § 5, Acts of 2024 (Mass.), https://malegislature.gov/Laws/SessionLaws/Acts/2024/Chapter239.

[3] An Act Promoting a Clean Energy Grid, Advancing Equity, and Protecting Ratepayers, ch. 239, §§ 85–86 (Mass. 2024), https://malegislature.gov/Laws/SessionLaws/Acts/2024/Chapter239.

[4] An Act Promoting a Clean Energy Grid, Advancing Equity, and Protecting Ratepayers, ch. 239, § 30 (Mass. 2024), https://malegislature.gov/Laws/SessionLaws/Acts/2024/Chapter239.

[5] An Act Promoting a Clean Energy Grid, Advancing Equity, and Protecting Ratepayers, ch. 239, § 42 (Mass. 2024), https://malegislature.gov/Laws/SessionLaws/Acts/2024/Chapter239.

Agency-specific recommendations	
DOER will work with municipalities to develop guidance and support for programs to expand curbside charging and overnight charging infrastructure for tenants and garage orphans.	EVICC provided the Massachusetts Clean Energy Center (MassCEC) with $11.2 million in American Rescue Plan Act (ARPA) funding to launch a new On-Street Charging Solutions Program to support municipalities in installing on-street charging and to develop a guidebook to equip all municipalities to successfully develop on-street charging programs.
Executive branch agencies will focus the deployment of publicly available funds for environmental justice EJ populations and into rural areas, with a particular focus on reaching low-income residents, to ensure that the transition to electric vehicles is equitable.	EVICC provided MassCEC with additional ARPA funding to launch several new programs that prioritize charger deployment in EJ populations and low-income communities. The On-Street Charging Solutions Program focuses on municipalities with high populations of renters, multi-unit dwelling residents, and EJ populations. Additionally, the Ride Clean Mass: Charging Hubs program is prioritizing charging station deployment in EJ populations with high amounts of rideshare drivers. OEJE, in coordination with EVICC, recently developed a guide to provide a comprehensive framework for advancing EJ and equity in the planning, implementation, and operation of publicly accessible EV charging stations.
Massachusetts Department of Transportation (MassDOT) will pursue options to communicate EV charging station locations on highway signage and/or elsewhere.	MassDOT enacted a new policy allowing EV chargers to be advertised on state highway signs.[6]
EEA and other state agencies will develop programs to reduce the transmission and distribution infrastructure burden of electric vehicle chargers by using policies such as time-of-use rates and technologies such as on-site storage and bidirectional charging to turn electric vehicles and electric vehicle charging stations into grid assets.	Funded by $6.1 million from EVICC, MassCEC launched its Vehicle-to-Everything (V2X) Demonstration program to deploy bi-directional charging infrastructure to improve grid resilience, reduce energy costs, and increase renewable energy integration. Further, the state Interagency Rates Working Group (IRWG) issued a Long-Term Rates Strategy in March 2025 that outlines recommendations for time-of-use rates, and is currently meeting with stakeholders to develop a more granular set of recommendations. Relatedly, in December 2024, Eversource, National Grid, and Unitil filed petitions to expand managed charging opportunities across all three companies in D.P.U. 24-195, 24-196, and 24-197, respectively.[7]
EEA, DOER, and DPU will encourage electrification of alternative vehicle ownership modes, such as electric vehicle car sharing and electrification of ride-hailing services.	Funded by $7.2 million from EVICC, MassCEC launched its Ride Clean Mass: Charging Hubs program to pilot EV charging station hubs for TNC and taxi drivers.

[6] See, MassDOT, MassDOT EV Charging Sign Policy, EVICC Public Meeting, September 4, 2024, available at: https://www.mass.gov/doc/evicc-meeting-9-4-24-massdot-presentation/download.

[7] Visit the DPU file room and insert 24-195, 24-196, or 24-197 as the "Docket No." to access information related to these filings and corresponding DPU proceedings. See Appendix 3 for more information on the D.P.U. 24-195, 24-196, and 24-197.

DOS will also develop new regulations that apply consumer protections to EV chargers, including, but not limited to signage and price disclosure requirements; protections against price gouging; standardized EV charging connection equipment; and limiting the sale of consumer data collected.	As noted above, the 2024 Climate Act requires DOS to develop regulations to ensure the accuracy of pricing and volumes of electricity purchased at public EV chargers, among other requirements. DOS is currently developing regulations to address these requirements. More information on these efforts can be found in Chapter 6.
EEA and DOER will work with other agencies (e.g., Operational Services Division (OSD), MassDEP, the Department of Capital Asset Management and Maintenance (DCAMM), the Massachusetts Clean Energy Center (MassCEC), MassDOT, and the MBTA) and cities and towns responsible for procuring EV chargers to coordinate procurement processes, and, if necessary, develop recommendations for the legislature to align processes.	The 2024 Climate Act clarified the treatment of EV and EV charging procurements for government entities (e.g., state and municipal government)[8] Section 32 of the Energy Affordability, Independence, and Innovation Act filed on May 13, 2025, would clarify the range of options that PowerOptions can provide its nonprofit and public sector clients.
EVICC next steps	
EEA will lead the EVICC in developing a plan to use the $50 million in the Charging Infrastructure Deployment Fund. This plan will be developed consistent with the recommendations in this initial assessment and will draw from future EVICC findings.	The Administration awarded $50 million to initiatives to build out EV charging infrastructure across Massachusetts, increase access to charging infrastructure for more residents, electrify the state fleet, improve operation of public charging stations, manage the impact of charging infrastructure on the electric grid, and provide charging solutions for difficult to electrify vehicle types.
The EVICC will refine its assessment of charging station needs by providing focused attention on the need for public fast charging to support long distance trips, including on peak travel days.	With its consultants, EVICC completed analysis of public fast charging infrastructure needed to support long-distance travel. A summary of this analysis can be found in Chapter 4. The methodology for this analysis can be found in Appendix 7.
The EVICC will incorporate data on the need for charging station and infrastructure upgrades associated with electrification of medium- and heavy-duty fleets.	EVICC's estimates of the number of charging stations in 2030 and 2035 that would support the Clean Energy and Climate Plan EV adoption rates include a focus on charging infrastructure to support medium-and heavy-duty fleets. A summary of this analysis can be found in Chapter 4.

[9]An Act Promoting a Clean Energy Grid, Advancing Equity, and Protecting Ratepayers, ch. 239, § 103 (Mass. 2024), https://malegislature.gov/Laws/SessionLaws/Acts/2024/Chapter239.

The EVICC will continue work with the Grid Modernization Advisory Council, utilities, and other stakeholders to proactively manage the grid impacts of expanded EV charging infrastructure.	The 2024 Climate Act required a new grid planning process to accommodate forecasted EV charging demand.[9] Additionally, EVICC's consultant team analyzed the impact of forecasted EV demand on the electric distribution grid in 2030 and 2035. A summary of this analysis can be found in Chapter 5. As noted above, MassCEC recently launched its Vehicle-to-Everything (V2X) Demonstration program, the state Interagency Rates Working Group (IRWG) issued a Long-Term Rates Strategy in March 2025 that outlines recommendations for time-of-use rates, and Eversource, National Grid, and Unitil filed petitions in December 2024 to expand managed charging opportunities in service territories.
EVICC will consider establishing a transportation clearinghouse website for information on EVs, EV chargers, and funding opportunities for stakeholders in the Commonwealth.	MassCEC developed a new, one-stop webpage for EV programs and information on Clean Energy Lives Here. Additionally, MassCEC launched a call center to answer questions about EVs and incentives.
EVICC will further research EV chargers and related infrastructure costs and how those costs will be allocated between the public and private domains.	EVICC is continuing to explore different models for sharing costs between private investors, public funds, and EV drivers. Chapter 7 provides an overview of EVICC's analysis on this topic and areas of focus to further unlock private investments, including promoting the Charging-as-a-Service and similar business models.
EVICC will collaborate with state fleet operators, not including MBTA or RTA fleets, to collect data to determine the highest priority locations for EV charging at state facilities and direct resources to facilitate charging installations at those locations.	EVICC allocated $9.5 million to DCAMM and $1.5 million to DOER's Leading By Example Program to deploy fleet charging at state-owned sites that the Office of Vehicle Management identified as high priority.
EVICC will work with MassCEC and the Executive Office of Labor and Workforce Development (EOLWD) to ensure there is a trained workforce of licensed electricians with an Electric Vehicle Infrastructure Training Program (EVITP) certification ready to deploy new EV chargers, ensuring populations historically left out of the clean energy workforce are offered opportunities.	The International Brotherhood of Electrical Workers (IBEW) and the National Electrical Contractors Association (NECA) offer EVITP certifications through the Greater Boston Joint Apprentice Training Center (JATC). Upper Cape Cod Technical School and Black Economic Council of Massachusetts also offer workforce development programs for EV charging-related work. MassCEC and EOLWD also support training pathways for EV charging-related work through IBEW's Clean Energy Pre-Apprenticeship program. More information on IBEW and NECA's work in the EV space and a list of EVITP-certified contractors can be found at WePlugYouIn.org.

Appendix 2. MassEVIP Charging Infrastructure Program Details

This Appendix provides additional detail about the MassEVIP Charging Infrastructure Programs. Further information about the MassEVIP programs can be found at the following links:

- MassEVIP Public Access Charging
- MassEVIP Workplace & Fleet Charging
- MassEVIP Multi-Unit Dwelling & Educational Campus Charging
- MassEVIP Fleets
- MassEVIP Programs Summary Matrix

A summary of the various MassEVIP Charging Infrastructure Programs (see Table 2.1), the funding sources for MassEVIP programs (see Table 2.2), and the impact of MassEVIP programs as demonstrated by the number of electric vehicle charging ports deployed (Tables 2.3 and 2.4) are provided below. Additional information on funding for the MassEVIP Charging Infrastructure Programs can be found on the Massachusetts Department of Environmental Protection website.

Table 2.1. MassEVIP charging infrastructure programs

	Workplace and Fleet Charging	Multi-Unit Dwelling and Educational Campus	Public Access Charging	DCFC Charging (program closed as of 2021)
Eligibility	• workplaces with >15 employees on-site • EV fleet vehicles garaged in Massachusetts • in non-residential areas • Charging stations must be practically accessible to all employees • light-, medium-, and heavy-duty fleets all eligible	• multi-unit dwellings with 5 or more units • Campuses with 15 or more students on-site • charging stations must be practically accessible to all students, staff or residents	• Charging stations must be practically accessible to the public for a minimum of 12 hours a day, 7 days a week. • The location must be non-residential	• Property owners or managers of non-residential locations accessible to the public 24/7 or educational campuses with at least 15 students on-site • Charging stations must be publicly accessible
Charger Type(s)	Level 1 or Level 2	Level 1 or Level 2	Level 1 or Level 2	DCFC stations
Covered Expenses	EVSE + make-ready costs (only for non-Eversource/ National grid customers)	EVSE + make-ready costs (only for non-Eversource/National grid customers)	EVSE + make-ready costs (only for non-Eversource/National grid customers)	EVSE + make-ready costs (only for non-Eversource/National grid customers)
Percentage of Expenses Covered	60%	60%	80-100%	Up to 100%, max $50,000 per charging station

Table 2.2. Partial List of MassEVIP Funding Sources

Funding Source	Amount
American Electric Power Settlement	$1,364,689.36
Motor Vehicle Inspection Trust Fund	$826,347.83
Consent Judgment in Commonwealth of Massachusetts v. EthosEnergy Power Plant Services, LLC, et al.[1]	$110,000
Volkswagen Group of America (VW) settlement (settlement + interest)	$12,487,796.54
Climate Protection and Mitigation Expendable Trust (CMT)	$20,306,495.27
GHG Expendable Trust pursuant to now sunsetted provisions of 310 CMR 7.29 (Emissions Standards for Power Plants)	$96,394

Table 2.3. Ports Funded by MassEVIP Programs (complete and in-progress projects as of April 22, 2025)

MassEVIP Program	Funding Dispersed	Ports
Direct Current Fast Charging (DCFC)	$7,276,912	179
PAC (Public Access Charging Program)	$14,743,538	2,502
MUDC (Multi-Unit Dwelling and Educational Campus Charging Program)	$3,589,502	1012
WPF (Workplace and Fleet Charging Program)	$9,581,771	3,275
Total	**$35,191,723**	**6,968**

[1]Mass. Super. Ct., Suffolk Cty., No. 16-1020A.

Table 2.4 MassEVIP Program Impact Table (Data in Table 2.4 is current as of April 22, 2025)

MassEVIP Program	Status	Program	Amount	# of Ports
DCFC	Contract Sent	Public DCFC	$4,828,735.50	116
	Grant Paid	Public DCFC	$2,448,176.48	63
PAC	Contract Sent	Public Level 2	$6,257,771.25	1,211
	Grant Paid	Public Level 2	$8,485,766.64	1,291
MUDC	Contract Sent	Educational campus	$560,477.43	82
		MUD	$1,228,194.17	347
	Grant Paid	Educational campus	$578,396.89	124
		MUD	$1,222,433.76	459
WPF	Contract Sent	Govt. Fleet	$485,899.59	143
		Private Fleet	$212,082.89	30
		Workplace	$1,018,843.18	352
	Grant Paid	Govt. Fleet	$1,234,423.32	218
		Private Fleet	$294,400.95	59
		Workplace	$6,336,121.44	2,473
Subtotal	Contract Sent[2]		$14,592,004.01	2,281
Subtotal	Grant Paid[3]		**$20,599,719.48**	**4,687**
Grand Total			**$35,191,723.49**	**6,968**

[2] "Contract Sent" is projects underway for which payment has not been issued.

[3] "Grant Paid" is completed projects for which payment has been issued.

MassEVIP Incentive Programs Matrix

	Workplace & Fleet (WPF)			Multi-Unit Dwelling & Educational Campus (MUDC)		Public Access Charging (PAC)
Application deadline	Rolling			Rolling		Rolling
Who may apply	Private, public and non-profit workplace	Private or non-profit fleet owner with 15+ employees on-site	Municipal, public university and college or state agency fleet owner	Public DCFC	$2,448,176.48	Private, public or non-profit
Eligible Location Types	Non-residential workplace with at least 15 employees on-site	Non-residential location where applicant garages fleet vehicle	Non-residential location where applicant garages fleet vehicle	Dwelling with 5 or more residential units	Educational campus with at least 15 students on-site	Non-residential location available for public use
Who must be allowed to use charging station?	All employees who drive an EV	Applicant's EV fleet users	Applicant's EV fleet users	All residents who drive an EV	All students/ staff who drive an EV	Anyone who drives an EV
Maximum level of funding	60%			60%		100% at government owned property; 80% at all other locations
Minimum required hours of availability	N/A			N/A		24 hours/day unless location has restriction, then 12 hours/day
Charging station type	Level 1 or Level 2			Level 1 or Level 2		Level 1 or Level 2
Time to complete project – existing locations/new construction	18 months/ 24 months (plus 3 months to complete contracting)			18 months/ 24 months (plus 3 months to complete contracting)		18 months/ 24 months (plus 3 months to complete contracting)

For all programs:

- For National Grid, Eversource, and Unitil program participants, funding covers equipment only; for all others, funding covers both equipment and Installation
- Charging station must be able to charge EVs produced by multiple manufacturers
- A parking spot must be clearly marked as EV-only with permanent signage for each port installed
- The applicant must own the location or provide written permission from the location owner to install charging station

Appendix 3. Massachusetts Utility EV Charging Incentive Programs Information

This Appendix provides additional details about the EV charging infrastructure programs administered by the state's investor-owned utilities (Eversource, National Grid, and Unitil) and approved by the Massachusetts Department of Public Utilities (DPU).

Incentive Programs Overview

Below is a summary of the incentives provided by the state's investor-owned utilities for residential, public, workplace, and fleet segments of the electric vehicle (EV) market (Table 3.1). The Eversource and National Grid incentive programs are approved through 2026; the Unitil incentive program is approved through 2027. The proposed mid-term modifications to the EDCs' respective programs are currently under review by the DPU in D.P.U. 24-195 (Eversource), D.P.U. 24-196 (National Grid), and D.P.U. 24-197 (Unitil) (Table 3.2).

[1] Visit the DPU file room and insert 24-195, 24-196, or 24-197 as the "Docket No." to access information related to these filings and corresponding DPU proceedings.

Table 3.1 Massachusetts Utility Incentive Programs Overview

	Residential	Public & Workplace	Fleet
Program term	Eversource: $53M National Grid: $58M Unitil: $300k	Eversource: $109M National Grid: $93M Unitil: $538k	Eversource: $4M National Grid: $33M Unitil: N/A
Who may apply		Eversource: 2023-2026 National Grid: 2023-2026 Unitil: 2023-2027	
Funding available	All Companies: 1 4-unit homes Eversource and National Grid: 5+ unit homes	All Companies: public sector Eversource and National Grid: workplace sector	Eversource and National Grid: light-duty fleets Eversource's EJ pilot and National Grid: medium- and heavy-duty fleets
Minimum required	All Companies: Make-ready rebates;1 EVSE rebates3,5 (low-income only) Eversource and National Grid: EVSE rebates (5+ unit homes); energy management system ("EMS") rebates (case-by-case, 5+ unit homes only); 20+ unit dwelling site plans	All Companies: Make-ready rebates2 Eversource and National Grid: EVSE rebates3,5 (publicly accessible sites only); EMS rebates (case-by-case) National Grid: Make-ready rebates for Level 1 charging at long-dwell time parking	Eversource: Make-ready rebates (light-duty fleets only); public light duty fleet EVSE rebates;4,6 public fleet assessments National Grid: Make-ready rebates; public fleet EVSE rebates;4,6 public fleet assessments
Minimum required hours of availability	N/A	Public sector ports must be available to the public 12 hours per day, 7 days per week	N/A
Charging station type	Level 2	Level 1 (National Grid only at long-dwell time parking); Level 2; DCFC	Level 2; DCFC

Notes:

1. For multi-unit dwellings, Eversource and National Grid may provide up to 150 percent of the average cost of customer-side infrastructure, not to exceed actual installation cost, on a case-by-case basis.
2. For the public and workplace segment, Eversource and National Grid may provide up to 150 percent of the average cost of customer-side infrastructure, not to exceed actual installation cost, on a case-by-case basis.
3. For the publicly accessible public and workplace segment and multi-unit dwelling Level 2 ports: (1) a 100 percent EVSE rebate in EJ populations that meet the EJ criteria based on income; (2) a 75 percent EVSE rebate in EJ populations that meet any of the other EJ criteria; and (3) a 50 percent EVSE rebate for non-EJ neighborhoods. For public segment DCFC ports, rebates of $40,000/port in all communities and $80,000/port for ≥150kW ports in EJ populations, up to a maximum of $400,000/site. More information on public, workplace, and residential multi-unit dwelling segment EVSE rebate structures can be found here:
    a. Eversource: pages 45, 59-61
    b. National Grid: pages 45, 65-66
4. For public fleets: (1) a 100 percent EVSE rebate for public fleets that are registered in an EJ population that meets the EJ criteria based on income or operate more than 50 percent of the time within census block groups that meet the EJ criteria based on income; (2) a 75 percent EVSE rebate for public fleets that are registered in an EJ population that meets the EJ criteria based on any of the other EJ criteria or operate more than 50 percent of the time within census block groups that meet the EJ criteria based on any of the other EJ criteria; and (3) a 50 percent EVSE rebate for public fleets in non-EJ neighborhoods.
5. For the public and workplace segment and multi-unit dwellings, the port deployment targets in EJ populations are 35 percent and 28.5 percent for Eversource and National Grid, respectively.
6. For the fleet segment, the port deployment targets in EJ populations are 40 percent for both Eversource and National Grid.

Utility Company Mid-term Modification Requests

In late 2024, each of the three utility companies submitted mid-term modification proposals for their EV charging infrastructure incentive programs. At the time of the Second Assessment's publishing, the mid-term modification proposals are still under review by the DPU. Final briefs are due in D.P.U. 24-195, D.P.U. 24-196, and D.P.U. 24-197 on August 15, 2025. The DPU will carefully review the information provided in these proceedings and will issue an order as expeditiously as possible.

The proposed changes to incentive programs are summarized in Table 3.2. Each of the full mid-term modification proposals are linked below:

- Eversource
- National Grid
- Unitil

Table 3.2 Summary of Utility Midterm Modification Proposals

Description	Eversource	National Grid	Unitil
Allow Third-Party Incentive Stacking	Third-party funding deducted from EV program incentives only if designated for the same purpose and the combined third-party funding and EV program incentives would exceed 100% of the customer's actual and eligible costs	Third-party funding deducted from EV program incentives only if designated for the same purpose and the combined third-party funding and EV program incentives would exceed 100% of the customer's actual and eligible costs	Third-party funding deducted from EV program incentives only if designated for the same purpose and the combined third-party funding and EV program incentives would exceed 100% of the customer's actual and eligible costs
Managed Charging	New residential managed charging program (active and passive components)	Eliminate cap on the number of participants in its Off-Peak Charging Rebate Program	DCFC stations
Extend Off-Peak Charging Rebate Program through 2026	New residential managed charging program (passive)	EVSE + make-ready costs (only for non-Eversource/ National grid customers)	EVSE + make-ready costs (only for non-Eversource/ National grid customers)
Downward Adjustment to Direct Current Fast Charger Rebate Levels	Reduce DCFC rebate levels	Reduce DCFC rebate levels	N/A
Medium and Heavy Duty-Fleet Program Expansion	Request for a $5 million increase to the fleet segment budget to provide support for approximately six medium- and heavy-duty fleets	N/A	N/A
Bidirectional Charger Incentive Pilot Program	Implement pilot program to support the purchase of approximately 25 bidirectional chargers	N/A	N/A

Description	Eversource	National Grid	Unitil
Eliminate the 15% Cap on Budget Shifting	N/A	Allow budget shifting of more than 15% between program segments	N/A
Increased Workplace and Public Segment Funding	N/A	Request for a $34 million increase to the public and workplace segment budget	N/A
Suspend Requirement for Residential Customers to Enroll in EV TOU Rates	N/A	N/A	Suspend the requirement for residential customers to enroll in EV TOU rates
Customer Choice Pathway	N/A	N/A	Allow customers to hire their own contractors to install the infrastructure on the customer side of the meter

Utility Company Demand Charge Alternative Rates

In addition to infrastructure incentive programs, the utility companies offer Demand Charge Alternative Rates to reduce potentially high demand charges for commercial EV charging site owners. Rates vary by utility company and are summarized in Tables 3.3, 3.4, and 3.5 below.

Table 3.3: Demand Charge Alternative Rates for Eversource

Rate	Rate Components	Eligibility
EV-1	• Customer charge • Base distribution charge	Customers with a billing demand of 200 kW or below for twelve consecutive billing months
EV-2	• Customer charge • Base distribution charge • Demand charge	Customers with a billing demand above 200 kW for twelve consecutive billing months

Table 3.4: Demand Charge Alternative Rates for National Grid

Rate	Rate Components	Eligibility
G-2	• Customer charge • Base distribution charge • Demand charge	Customers with a billing demand of 200 kW or below for twelve consecutive billing months and a monthly usage greater than 10,000 kWh
G-3	• Customer charge • Base distribution charge • Demand charge	Customers with a billing demand above 200 kW for twelve consecutive billing months

Table 3.5: Demand Charge Alternative Rates for Unitil

Rate	Rate Components	Eligibility
GD-2	• Customer charge • Base distribution charge • Demand charge	Customers with a billing demand of 4 kW or above and a monthly usage between 850 kWh and 120,000 kWh
GD-3	• Customer charge • Base distribution charge with different per kWh charges for peak and off-peak • Demand charge	Customers with a monthly usage above 120,000 kWh

Appendix 4. State Fleets Eligible for LBE Fleet EVSE Grant Program

This Appendix provides a complete list of State fleets that are eligible for the Department of Energy Resources (DOER) Leading By Example (LBE) Fleet Electric Vehicle Supply Equipment (EVSE) grant program. There are a total of 92 eligible fleets (Table 4.1).

Table 4.1 State fleets eligible for the LBE fleet EVSE grant program

State Fleets	
Barnstable Sheriff's Department	Holyoke Soldiers' Home
Berkshire Community College	Mass College of Art and Design
Berkshire Sheriff's Department	Mass. College of Liberal Arts
Bridgewater State University	Mass. Emergency Management Agency
Bristol Community College	Mass. Gaming Commission
Bristol Sheriff's Department	Mass. Lottery Commission
Bunker Hill Community College	Mass. Maritime Academy
Bureau of the State House	Mass. Port Authority
Cannabis Control Commission	Mass. Rehabilitation Commission
Cape Cod Community College	Mass. Water Resources Authority
Chelsea Soldiers' Home	Massasoit Community College
Chief Medical Examiner	MassBay Community College
Department of Agriculture	MassDOT - Highway
Department of Conservation & Recreation	MBTA Non-Revenue
Department of Correction	Middlesex Community College
Department of Criminal Justice Information Services	Middlesex Sheriff'S Department
Department of Developmental Services	Military Division
Department of Environmental Protection	Mosquito Control Board
Department of Fire Services	Mt. Wachusett Community College
Department of Fish & Game	Municipal Police Training Committee
Department of Mental Health	Nantucket Sheriff's Department
Department of Professional Licensure	Norfolk Sheriff's Department

Department of Public Health	North Shore Community College
Department of Public Utilities	Northern Essex Community College
Department of Revenue	Office of the Attorney General
Department of State Police	Office of the Inspector General
Department of Transitional Assistance	Office of the State Treasurer
Department of Youth Services	Operational Services Division
Division of Capital Asset Management & Maintenance	Parole Board
Division of Standards	Plymouth Sheriff's Department
Division of Unemployment Assistance	Quinsigamond Community College
Dukes Sheriff's Department	Roxbury Community College
Environmental Police	Salem State University
Essex Sheriff's Department	Secretary of State
Executive Office of Energy & Environmental Affairs	Springfield Tech. Community College
Executive Office of Health & Human Services	State 911 Department
Executive Office of Housing & Livable Communities	Suffolk Sheriff's Department
Executive Office of Technology Services & Security	Trial Court
Executive Office of Veterans' Services	UMass Amherst
Fitchburg State University	UMass Boston
Framingham State University	UMass Dartmouth
Franklin Sheriff's Department	UMass Lowell
Greenfield Community College	UMass Medical School
Hampden Sheriff's Department	Westfield State University
Hampshire Sheriff's Department	Worcester Sheriff'S Department
Holyoke Community College	Worcester State University

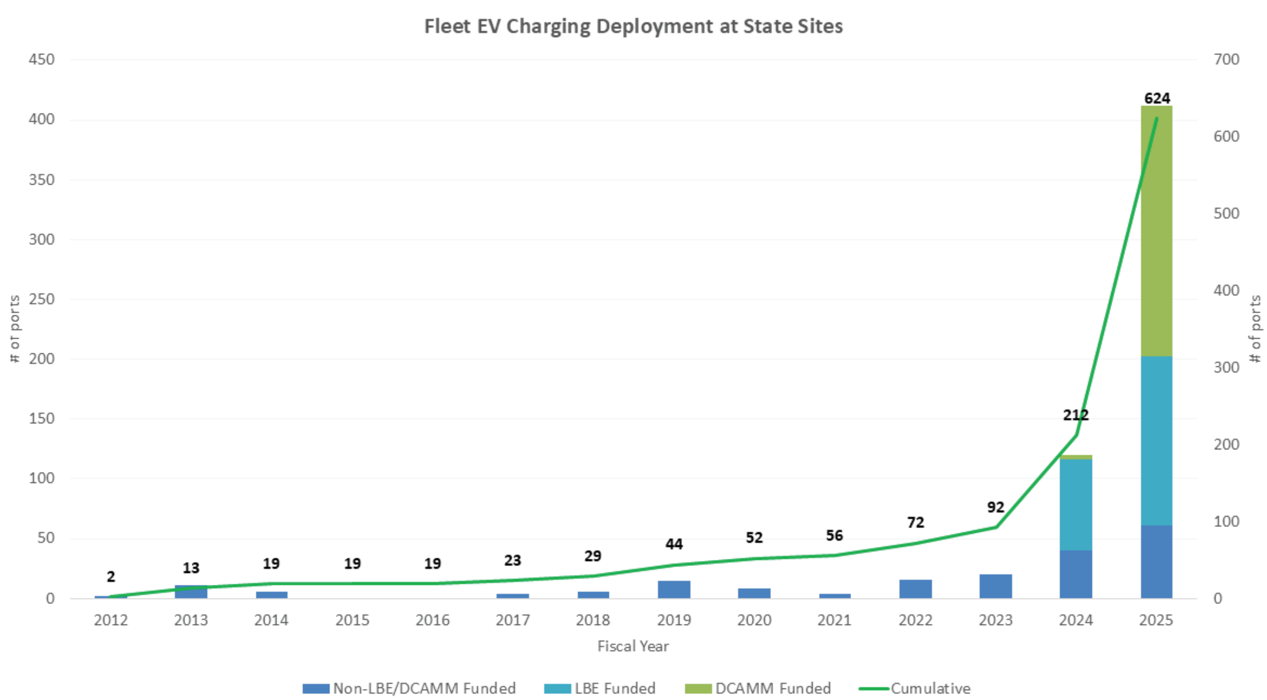
Appendix 5. Summary of Ports Funded by LBE and DCAMM Programs and Annual Fleet Charging Port Deployment by Funding Type

This Appendix provides additional detail about the Department of Energy Resources (DOER) Leading By Example (LBE) and Division of Capital Asset Management and Maintenance (DCAMM) incentive programs that support deployment of EV charging infrastructure for state fleets. Details on funding allocated and charging ports funded by each program are summarized in Table 5.1 and Figure 5.1.

Table 5.1. Ports funded by LBE and DCAMM programs

Program	Funding Source(s)	Amount Awarded	Ports Funded[1]
DCAMM LBE	American Rescue Plan Act (ARPA)	$9,500,000	212
Level 1 or Level 2	ARPA, Regional Greenhouse Gas Initiative (RGGI), Fiscal Year (FY) 24 Capital Investment Plan (CIP), FY25 CIP	$3,336,987	240
Total		**$12,836,987**	**452**

Figure 5.1. Annual fleet charging port deployment by funding type (state program or individual entity)



[1]Number of ports noted in Table 5.1 are installed or projects to be installed by the end of FY25, subject to minor changes pending final project completion.

Appendix 6. Early Learning from MassCEC Innovative Programs

The Massachusetts Clean Energy Center is a state energy and economic development agency which administers several programs designed to pilot and support rollout for innovative EV charging strategies. A summary of MassCEC's early learnings from the following programs is provided below: On-Street Charging Solutions; Ride Clean Mass: Charging Hubs; Vehicles-to-Everything Demonstration Projects; and Medium- and Heavy-Duty Charging.

Curbside Charging

The On-Street Charging Solutions Program provides no cost EV charging infrastructure planning support and feasibility studies to a representative subset of 25 municipalities, as well as funding and technical support to install on-street charging projects in 15 municipalities.

Early Lessons Learned

1. As of Spring 2025, MassCEC is not likely to pursue pole-mounted charging models in National Grid and Eversource territories as pole-mounted charging face unique challenges in these service territories due to complex ownership structures and competition for pole space amongst the municipalities, electric utility companies, and network service providers. MassCEC is more likely to pursue pole-mounted charging in Municipal Light Plant (MLP) territories and at sites with municipality-owned poles.

2. Municipal zoning regulations must be considered when siting and right-sizing on-street charging. Municipalities with restrictions on overnight parking have expressed interest in higher powered level 2 chargers for quicker charger turnover, while municipalities without restrictions on overnight parking may opt for lower-powered (7.2 kW) chargers given that users are allowed to charge for longer durations.

3. The program received 51 applications, of which 36 requested EVSE installation funding. The program has funding available to support 15 municipalities with installation and 25 municipalities with feasibility studies. This high demand indicates a strong interest from municipalities and need for widely available on-street charging.

Transportation Network Company (TNC) Charging Hubs

MassCEC's Ride Clean Mass: Charging Hubs program is piloting EV charging station hubs for TNC and taxi drivers. Implementation will include the purchase and installation of publicly accessible Level 2 and DCFC charging stations at approximately six sites across the Commonwealth.

Early Lessons Learned

1. Based on survey responses, many drivers would be interested in using public chargers located at grocery stores, gas stations, or other areas with large parking spaces and access to bathrooms. Low cost of charging and fast charging speeds ranked as the top two priorities for both current EV drivers and non-EV drivers.

2. Based on survey responses, drivers would prefer charging stations sited closer to where they live rather than where they pick up or drop off riders. Gateway cities would be strong candidates for EV charging stations since respondents largely reported living in zip codes located within Gateway Cities such as Brockton, Lynn, and Worcester.

3. The program has received interest from companies that manage supermarkets and shopping locations across the Commonwealth. Should these pilots prove successful, there is significant interest from this sector in hosting EV chargers.

Vehicle-to-Grid

MassCEC's Vehicle-to-Everything (V2X) Demonstration program launched in early 2025 and will ultimately deploy bi-directional charging infrastructure across the Commonwealth to improve grid resilience, reduce energy costs, and increase renewable energy integration. The program will explore a variety of use cases by deploying approximately 100 bi-directional chargers at residential, commercial, and school sites, and will prioritize locations in EJ populations.

Early Lessons Learned

1. The definition of V2X and its associated use cases varies. Common terminology should be developed to improve coordination between groups working with V2X and to better communicate potential benefits to stakeholders.

2. The V2X landscape is constantly shifting as new technology is being developed and commercialized. For example, CHAdeMO charging ports, which have allowed for bidirectional charging for several years, are being phased out even though they support inexpensive electric vehicles. NACS and CCS ports are being quickly adopted but there are limited compatible bidirectional vehicles. Flexibility is needed in this pilot program to allow for a wide range of electric vehicles to be eligible.

3. Many bidirectional chargers, vehicles, and software systems are just reaching commercialization. The V2G market is still developing and many bidirectional EVs are exclusively compatible with the bidirectional systems developed by their manufacturer, leading to limitations in EV charger procurement within the program.

Mobile Charging for Medium- and Heavy-Duty Vehicles

MassCEC's MHD Mobile Charging Solutions Program will pilot semi-permanent, off-grid, and grid-flexible charging solutions with four (4) MHD fleets domiciled and operating throughout the Commonwealth to test the capabilities and benefits of mobile charging solutions. Mobile charging solutions can minimize the complexity of EV charger installation, making it an increasingly appealing option for fleet owners and operators looking to test out and right size MHD ZEVs.

Early Lessons Learned

1. The definition of "mobile charging" can vary and range from EV chargers that are 100% mobile and do not interact with the grid to EV chargers that require minimal installation and are semi-grid tied. To assist in clearly describing the potential benefits, and as mobile charging technology and demand expands, a common terminology should be developed.

2. Common challenges to MHDV electrification and mobile charging justifications cited by fleets in the applications include leased facilities and lack of authority to make permanent infrastructure decisions, delays and/or long lead times for permanent EV charger installation, and desire to test out and right size EV chargers before permanent installation. While fleets express strong interest in electrification, EV charger installation poses the most significant challenge.

3. The program received 18 applications, however, program funding only allows for four fleets to be supported through the program. Applicants represented a variety of fleet types, duty cycles, and stage of fleet electrification from large business chains with existing EVs to small businesses interested in deploying an EV for the first time. This demand indicates the challenges fleets face with EV charger installation, the uniqueness of each fleet electrification scenario, and the need for alternative solutions.

Additional Resources

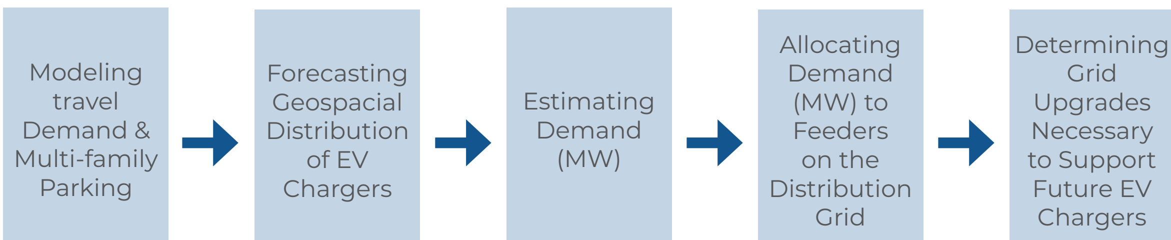
More information on these programs can be found in Chapter 3 and on MassCEC's EV Charging Infrastructure webpage.

Appendix 7. Analytical Approach to Charger Needs and Methodology for Estimates of 2030 and 2025 EV Charger Deployment and Associated Grid Impacts

Detailed 2030 and 2035 EV charger needs projections and grid impacts methodology

High-Level methodology and approach

The analysis of charger needs and projections for 2030 and 2035, and the associated electricity grid impacts was developed through five key steps, as shown below. These are each discussed in turn throughout Chapter 4, Chapter 5, and this Appendix.



This Appendix includes information on the analytical approach and methodology used to develop the detailed estimates of future electric vehicle (EV) charger deployment to meet the EV adoption rates included in the Massachusetts Clean Energy and Climate Plans[1] (CECP) and associated grid impacts in 2030 and 2035. The estimated EV charger deployment amounts and associated grid impacts are summarized in Chapter 4 and Chapter 5 of this Assessment, respectively.

The Electric Vehicle Infrastructure Coordinating Council (EVICC) technical consultants, Synapse Energy Economics (Synapse), Resource Systems Group (RSG), and Center for Sustainable Energy (CSE), combined several data sets and modeling approaches to determine future charging demand and to develop a geospatial forecast of the type and number of EV chargers necessary to meet the state's climate requirements.

Light-duty vehicle charging

To estimate the EV charging infrastructure in 2030 and 2035, the consultant team first estimated the number of EVs that would be registered across Massachusetts for these years, relying on state-level projections from the Massachusetts Clean Energy and Climate Plan for 2050.[2]

The consultant team then allocated the estimated number of EVs across the state at a granular spatial scale. This allowed the consultants in subsequent steps to estimate where single-family and multi-family charging will be concentrated for 2030 and 2035. To make granular estimates of EVs, the annual estimates of EVs were distributed across towns based on their respective proportion of new EV sales for 12 months spanning 2022 and 2023. For instance, if a municipality accounted for 1% of total new EV sales across 2022-2023, it was inferred to have 1% of EVs registered across Massachusetts by 2030. This

[1]See 2050 CECP and 2025/2030 CECP.

[2]Massachusetts Executive Office of Energy and Environmental Affairs. Massachusetts Clean Energy and Climate Plan for 2050. Commonwealth of Massachusetts, 2022. https://www.mass.gov/info-details/massachusetts-clean-energy-and-climate-plan-for-2050.

assumes that locations leading EV adoption now will likely continue to lead in the future. To mitigate potential overestimations, an upper threshold was applied to prevent unrealistic EV concentrations in towns with existing large market shares.

The allocation was then further refined to the grid cell level (hexagon cells that are approximately 1-km across) by adjusting the number of EVs proportionally to the share of all vehicle sales within each grid cell for 2022-2023. Notably, total new vehicle sales were utilized for this refinement, rather than exclusive EV sales, due to the limited number of EV transactions in some towns for 2022-2023, which would generate unrealistic outcomes.

Once the forecasts for the number of EV registrations were completed at the grid level, the consultant team proceeded to estimate how these EVs would be distributed between single-family and multi-family homes. These estimates utilized grid cell-level forecasts for populations of single-family and multi-family homes derived from the VE-State model of Massachusetts (developed by RSG for the Massachusetts Department of Transportation). The allocation to each home type was informed by ownership ratios indicating differing tendencies of EV ownership with respect to single-family versus multi-family homes. The observed data originated from survey responses collected by the California Vehicle Rebate Project,[3] which includes information on household characteristics and EV adoption patterns. To ensure relevance to Massachusetts, the data were adjusted using a housing-type

Table 7.1. Estimated EV chargers by category and charger type for 2030 and 2035 CECP vehicle projections[4]

Category	Charger Type	Port Count		2035 EV/Port Ratio	Source
		2030	2035		
Single-Family	Level 1	216,000	373,000	5.4	EV Pro Lite
	Level 2	582,000	945,000	2.1	EV Pro Lite
Multi-Family	Level 1	8,000	18,000	22.5	EV Pro Lite
	Level 2	18,000	45,000	8.9	EV Pro Lite
Workplace	Level 2	18,000	47,000	51.7	EV Pro Lite
Public	Level 2	40,000	92,000	26.4	Observed Ratios
	DCFC[5]	5,500	10,500	230.4	Observed and modeled ratios
MHD	Private	6,500	17,000	1.9	Modeled ratios
	Public DCFC[6]	800	2,500	13.9	Modeled ratios
Total		**794,800**	**1,550,000**		

[3]Center for Sustainable Energy. Rebate Survey Dashboard. Clean Vehicle Rebate Project, 2024. https://cleanvehiclerebate.org/en/rebate-survey-dashboard.

[4]Estimates in this table are for the total projected number of chargers needed for each category, including public and private chargers.

[5]In 2030, 45 percent of DCFCs will serve multi-family housing and 55 percent will serve long-distance travel. In 2035, 57 percent of DCFCs will serve multi-family housing and 43 percent will serve long-distance travel.

[6]The "public DCFC" included under the medium- and heavy-duty category is incremental to the "DCFC" chargers included under the public category.

normalization approach that accounts for differences in the proportion of single-family and multi-family dwelling units between California and Massachusetts, thereby better aligning the housing-related EV adoption trends with Massachusetts' built environment.

Single and multi-family charging

To determine the number of home chargers in each grid cell, the consultant team utilized the EV registration allocations at the grid cell level (discussed above) in combination with the estimated number of single and multi-family chargers that would be required to support the 2030 and 2035 fleet (see Table 7.1).

The consultant team then allocated these chargers proportionally to each grid cell based on the number of projected single-family and multi-family EV registrations in that cell. For multi-family chargers, charger assignment was based on the count of multi-family homes with off-street parking. For instance, if a grid cell was projected to contain 1% of all multi-family EV registrations with off-street parking, it would be allocated 1% of the total multi-family home chargers needed across Massachusetts.

The availability of off-street and on-street parking at multi-family homes is based on a parking availability model developed by the consultant team as part of this analysis. It was developed using land use data and municipal parking inventory data and applied to all housing units in the state

Workplace Level 2 charging

To estimate the number of Level 2 (Level 2) workplace chargers in each grid cell, the consultant team incorporated data on the number of workers projected for 2030 and 2035 from the VE-State model[7] of Massachusetts (developed by RSG for Massachusetts Department of Transportation), and data from the US Bureau's American Community Survey (ACS)[8] that indicates the proportion of workers that drive to work. The consultant team combined these two fields to estimate the number of workers that drove vehicles to work in each grid cell. The consultant team then allocated the estimated number of workplace chargers required to support the fleet (see Table 7.1 above) proportionally across grid cells based on the number of workers that drive to work in each grid cell.

Public Level 2 Charging

Deployment of Level 2 public charging stations followed a two-stage allocation process, beginning at the town level and followed by grid cell-level distribution. This approach ensured chargers were allocated based on broader indicators of need while retaining the ability to fine-tune siting at a granular level.

At the town level, allocations were informed by the expected number of registered EVs. Within towns, grid cell-level allocation was conducted using the proprietary Caret EVI Planner software. The algorithm prioritized grid cells based on:

[7] Resource Systems Group (RSG), VisionEval, 2025, accessed June 11, 2025, https://rsginc.com/visioneval-webinar/.
[8] U.S. Census Bureau. American Community Survey 5-Year Estimates. Retrieved from https://www.census.gov/programs-surveys/acs/.

- Proximity (within 2 miles) to off-street parking associated with multi-unit dwellings[9]
- Density of nearby amenities that could serve as potential site hosts[10]
- Projected 2030 traffic volume[11]
- Existing public Level 2 charger infrastructure, to avoid oversaturation[12]

This methodology distributed chargers to areas with the greatest potential demand. However, it should be noted that the consultant team did not take into account potential charging from rideshare drivers.

Public DCFC

Public DCFC deployment also followed a two-stage process, with chargers first allocated at the town level and then distributed to grid cells. This methodology addressed two distinct use cases to ensure that both neighborhood-based and corridor-based charging needs were met: residential demand from multi-family households and charging needs associated with long-distance travel.

For the multi-family household use case, town-level allocations were based on the number of multi-family housing units without access to off-street parking. Within each town, DCFCs were further distributed to grid cells using the EVI Planner software. The allocation algorithm favored grid cells that had higher numbers of off-street parking spaces associated with multi-unit dwellings within a 2-mile radius, and greater density of potential site hosts such as businesses and other amenities. The algorithm also accounts for existing DCFCs to avoid oversaturation. However, the consultants did not take into account the potential impacts of rideshare, including idling locations and driver homes.

For the long-distance travel use case, chargers were allocated across towns according to the projected share of long-distance charging demand occurring within one mile of highway or interstate exits. These town-level allocations were then refined at the grid cell level, emphasizing areas with high levels of long-distance travel activity, proximity within one mile of highway exit ramps, greater density of potential site hosts such as businesses and other amenities, and low existing coverage of DCFCs.

Charging demand for long distance travel is not simply proportional to traffic volumes or even to long-distance travel traffic volumes. Instead, it is driven by where vehicles will be when they need to charge during a long-distance trip. To identify those locations, RSG analyzed travel behavior using vehicle telemetry data, calibrated to overall traffic volumes. The analysis included all light duty travel in or through Massachusetts, using data that identified the start and end point of all trips. It includes travel between other states that passes through Massachusetts, as well as trips within, originating in, or ending in Massachusetts. RSG developed a charging model in which each vehicle departed with

[9]Areas were scored based on their proximity to locations lacking off-street parking. A two-mile Euclidean buffer was applied, and the estimates of off-street parking for any grid cell intersecting this buffer were summed.

[10]This metric captures the count of relevant amenities located within each grid cell. Amenity types included a wide range of potential destination and site-hosting locations, such as restaurants, supermarkets, gyms, and community facilities. The data were gathered from OpenStreetMap.

[11]Estimated using a combination of VisionEval forecast for 2030 and baseline traffic data from 2021. The VisionEval forecast generated forecasts of projected changes in population, employment, demographics, and housing. This was combined with annual average daily traffic (AADT) data from MassDOT and roadway data from the Highway Performance Monitoring System (HPMS) to project vehicle miles traveled (VMT) for 2030 and 2035.

[12]Derived from AFDC data, this metric used a weighted system where areas with more existing chargers were assigned fewer chargers than they would have otherwise. Charger counts were assessed within each grid cell and also within 1-mile and 4-mile radii to discourage clustering and encourage geographic dispersion.

an initial state of charge drawn from a distribution reflecting expected pre-trip charging behavior (generally starting with a relatively full battery), and the battery depletes along the trip based on typical vehicle range. Charging demand is based on the aggregated locations where these sampled vehicles would be when batteries fell below 20 percent charge. The resulting distributions of charging demand are spread more evenly along major highway corridors than traffic volumes because vehicles tend to be further from population centers when they need to charge.

While Massachusetts has made meaningful progress in building out its fast charging network along transportation corridors, the current pace of deployment will need to increase to keep up with the projected increase in demand. The deployment rate of fast chargers has been increasing for the past decade but is inadequate to meet the estimated needs for 2030 and 2035. As of the end of 2024, just over 1,000 ports serve primary and secondary transportation corridors, with most located on primary routes. Meeting the estimated need of nearly 5,000 ports by 2030 and over 9,000 by 2035 will require a continued increase in the rate of deployment. In dense urban areas such as Springfield, Worcester, Lowell, and Greater Boston, 10 to 24 DCFC ports will need to be installed per year, with Boston reaching up to 46 ports per year.

Travel modeling and forecast of multi-unit housing with off-street parking

To develop a spatial distribution of EV charging infrastructure expected across the state in 2030 and 2035, the consultant group modeled future travel patterns and developed forecasts of multi-unit housing with on-street parking.

Specifically, the consultant team used current year (2019) and future year (2050) scenario outputs from the Massachusetts statewide travel demand model, a tool maintained by the Boston Region Metropolitan Planning Organization that is used for transportation planning. The model estimates trips generated by residents in Massachusetts as well as through travel passing through the state. This model calculates future vehicle miles traveled (VMT) and total daily traffic on the road network from personal vehicles.

Town level population, household, and employment forecasts out to 2050 were obtained from the Metropolitan Area Planning Council (MAPC). Their forecasts extend to cover all of Massachusetts as well as their core planning area. These forecasts were used to develop 2030 and 2035 VMT estimates from the 2019 and 2050 statewide travel data, which informs the future location of public chargers.

The team also forecasted the quantity and location of future multi-family housing without off-street parking, an important driver of public Level 2 and DCFCs. The team used current parcel-level data on multi-family housing, data from the Census Bureau's 5-year ACS, and MAPC's population and household forecasts by town to estimate the locations of new multi-family housing in 2030 and 2035. Town parking inventory studies and survey data collected by NREL were used to establish rates of off-street parking availability at different types of multi-family housing, which were then applied to the forecasts of multi-family housing in 2030 and 2035. The analysis assumed the continuation of current rates of parking availability for new housing.

Multi-family housing charging needs will be met through a combination of both Level 2 chargers and DCFCs. Existing infrastructure and economics will play a large role in determining whether multi-family housing is met with DCFCs or Level 2 chargers. Streets that can be easily upgraded to include Level 2 on light posts or other street fixtures are better suited for higher penetration of Level 2 chargers. However, locations that have a high density of multi-family housing will likely benefit from the space-efficient and rapid DCFCs. Available parking space, proximity to housing, and capacity on the distribution system are other drivers in the selection of Level 2 chargers versus DCFCs to meet multi-family charging needs.

Medium-duty and heavy-duty vehicle charging

Chargers for medium- and heavy-duty vehicles, including buses, are categorized into two groups: public chargers for long-haul trucking (primarily made up of DCFCs) and private depot charging (primarily Level 2 chargers and a lesser amount of DCFCs). The public chargers for MHD vehicles are incremental to the public DCFC and Level 2 chargers serving light duty vehicles, as described above.

For public and long-haul charging, the consultant team forecasted medium and heavy-duty vehicle travel in 2030 and 2035 using the Massachusetts statewide travel demand model (which was also used for passenger vehicle travel modeling). This provides estimates of VMT by trucks on the road network across the state, which is used to identify routes with high demand for charging. The VMT estimates take into account long-haul trucking to, from, and traveling through Massachusetts on the highway network and local trucking within the state. From this model, priority charging locations were identified, such as truck rest stops, gas stations and other locations with truck parking close to the sections of the highway network with high amounts of truck travel. Data from MassGIS and the EPA's Underground Storage Tank database were used to develop a complete set of gas stations, rest areas, and other potential charging fueling and parking locations.

For private depot-based charging, depot and gas station locations for Massachusetts-based vehicles were found using the EPA Underground Storage Tank database, MassGIS data for rest stops and depots, and specific locations of existing charging infrastructure or depots from various data sources (MBTA, National Grid, Eversource, CALSTART/FleetAdvisor, and DOER). The geographic density of these depot and fueling locations was used as a weight to allocate medium and heavy-duty vehicles from Census Tract-level Massachusetts RMV data to smaller hex geographies. The forecasts of electric buses and trucks in the medium- and heavy-duty fleet were then used to estimate the proportion of registered vehicles that are EVs in 2030 and 2035 for each hex cell.

Estimated charger requirements for medium- and heavy-duty vehicles were used to allocate chargers to potential charging locations for both long-haul charging and depot-based charging, based on medium- and heavy-duty vehicle to charger ratios developed by the Lawrence Berkeley National Laboratory (LBNL). Charger and EV counts for already existing and planned charging infrastructure were also added to each hex cell (the data sources for existing and planned chargers included Eversource, CALSTART/Mass Fleet Advisor, and DOER).

Areas of uncertainty

Finally, it is important to acknowledge the significant uncertainty that underlies this analysis. EV adoption rates over the next five to ten years remain uncertain and will be shaped by policy developments, market conditions, and consumer behavior. CECP projections of EV adoption may not materialize by 2030 and 2035, leading to fewer chargers needed and a slightly different spatial distribution for the chargers required. In addition, interconnection delays may result in the deployment of chargers following different spatial trends than what was modeled. EV adoption rates can also be driven by factors such as the availability of state and federal incentives, technological advancements, and supply chain issues impacting cost of ownership. Higher costs may stymie EV growth as Massachusetts residents await more affordable EVs.

There is also uncertainty in EV adoption rates for single-family versus multi-family units. Adoption rates in multi-family units will partially depend on the availability of on-street parking with charger access, which is shaped by local infrastructure and zoning practices that differ by municipality.

The analysis is sensitive to the plug-in hybrid EV (PHEV) share of EVs. A higher fraction of PHEVs will reduce the need for public Level 2 and DCFCs, while lower penetration of PHEVs than was modeled will necessitate more publicly accessible chargers.

This analysis uses certain assumptions for the number of ports per EV (see Table 7.1, above). As charger sizes increase, this ratio may decrease over time, reducing the total number of chargers required but increasing the energy demand at a given location. Technological advancements in range, charging times, and battery efficiency will also place downward pressure on the number of chargers required.

To estimate future DCFC needs, the modeling relies on several assumptions, each of which introduces potential variability. Technological advancements further complicate projections. For example, this Second EVICC Assessment forecasts fewer DCFCs than the Initial EVICC Assessment. This is primarily due to a higher share of PHEVs in the short term (informed by recent trends in vehicle sales), and increased BEV battery sizes and charging speeds (more vehicles are capable of charging at higher speeds/higher kW chargers).

Higher capacity DCFCs (e.g., 350 kW) provide more power over the same amount of time as a lower capacity charger (e.g., 150 kW), increasing charging speeds. As the EV industry has evolved, the speed and capacity of DCFCs has increased; this trend is expected to continue. In the First EVICC Assessment, the Synapse consultants assumed a greater share of 150 kW DCFCs. In the current assessment, they assumed a range of charging speeds, with the average between 250 and 300 kW. Although the specific distribution of charger speeds is impossible to predict, a variety of charger speeds will be beneficial to the system. Not all vehicles are capable of charging at high-speed/high-capacity fast chargers. For instance, a vehicle may be able to plug into a 350 kW charger, but its battery may not be able to charge above 150 kW and, thus, to use the full 350 kW charger capability. Furthermore, very fast charging speeds are not always necessary; in some settings, like shopping malls where vehicles are charging for longer periods, 100 kW or 150 kW DCFCs may be sufficient. Faster chargers are particularly beneficial along transportation routes (e.g., highway rest stops) and for medium- and heavy-duty vehicles with larger batteries.

For the estimates of the requirements of medium and heavy-duty trucks, the analysis assumes that the future truck fleet will be operated in a similar way to the current almost entirely non-EV truck fleet. As EV penetration into the truck fleet increases, truck operators may change their travel patterns to accommodate charging requirements, but there is a high degree of uncertainty around this issue.

While the analysis attempts to account for these factors, they remain important sources of uncertainty that may shift infrastructure needs over time.

Modeling travel demand

The spatial distribution of EV charging infrastructure expected across the state in 2030 and 2035 relies on several data inputs. This section discusses modeling of future travel patterns based on statewide travel model outputs and forecasts of population and employment changes in the state.

Overview of the Massachusetts statewide travel demand model

The estimates of travel demand for both light vehicles and medium and heavy-duty trucks are based on outputs from the Massachusetts statewide travel demand model, a tool maintained by Central Transportation Planning Staff (CTPS) in the Boston Region Metropolitan Planning Organization (MPO) that is used for transportation planning. The consultant team obtained the version of the model called TDM23 Version 1.0,[13] which was released by the Boston MPO in June 2024.

The TDM23 was developed for the MPO's 2023 Long-Range Transportation Plan (LRTP), Destination 2050. TDM23 is also intended for use for project and policy analyses by MPO members, stakeholders, and researchers. TDM23 includes an update of the model base-and forecast-year scenarios to 2019 and 2050 respectively. These two scenarios were used by the consultant team to develop travel demand inputs.

TDM23 is a trip-based travel demand model, i.e., it estimates individual trips between traffic analysis zones by mode, purpose, and time of day, and then assigns the trips onto a transportation network and vehicle trips (in light vehicles and medium and heavy trucks) onto a highway network. Once trips are assigned, the results from the model can be used to calculate vehicle miles traveled (VMT) and total daily traffic on the road network from personal vehicles and medium and heavy-duty trucks.

The geography of TDM23 covers the entire state of Massachusetts, and areas of the surrounding states including Rhode Island and southeast New Hampshire. The model estimates trips generated by residents of and truck based in Massachusetts as well as external travel to and from the state and through travel passing through the state. Table 7.2 summarizes the structure of the travel demand steps in TDM23.

[13] TDM23: Structures and Performance (TDM Version 1.0), CTPS, Boston Region MPO, June 2024, https://ctps.org/pub/tdm23_sc/tdm23.1.0/TDM23_Structures%20and%20Performance.pdf

Table 7.2: TDM23 demand component functionality, inputs and outputs

Component	Estimates	Sensitive To
Vehicle Availability	Household vehicle availability relative to household drivers (zero, fewer than drivers, greater than or equal to drivers)	• Household size, income, workers, children • Transit access density
Work from Home	Share of commute versus work at home days	• Regionally specific inputs of work-from-home levels
Trip Generation	Resident average daily trips within region by purpose produced and attracted by zone	• Person type • Household size, income, vehicles • Household children, seniors, non-workers • Employment by category
Peak/Off-peak	Segmentation of trips into peak period (AM or PM) and off-peak (MD or NT)	• Trips by zone, purpose and market segment
Trip Distribution	Flow of trips between zones	• Trip productions and attractions by peak/off-peak • Path impedances • Mode choice utilities
Mode Choice	Mode shares and flow of trips by mode	• Trip tables by purpose, market segment, and peak/off-peak • Path roadway and transit level of service
University Travel	Generation and distribution of off-campus university student travel	• Commuter enrollment • Household population
Truck Trips	Generation, distribution, and time of day of medium, and heavy truck trips	• Employment • Path distances
Airport Ground Access	Distribution, time of day, and mode of airport traveler trips	• Airport non-transferring enplanements and deplanements
Special Generator, Externals	Non-average daily trips (airport) and nonresident/outside of region trips (through trips)	• Trips produced/attracted by zone
Time of Day	Time of Day Outbound and inbound trip time of day period	• Trip tables by purpose, market segment, peak/off-peak, and mode

Source: Table E-1, “TDM23: Structures and Performance” (Boston MPO, 2024)

Of note is that TDM23 estimates personal travel in the state for a complete enumeration of travel purposes including segments such as airport ground access, university-related travel, and external/through travel. The table shows that the estimates are sensitive to many factors including household structure and income, availability of working from home, and aspects of transportation supply such as transit level of service.

The TDM23 also separately estimates medium and heavy truck trips which are sensitive to employment forecasts and "path distances", i.e., the distance over the highway network between trip origins and destinations. Table 7.3 summarizes the structure of the transportation supply steps in TDM23.

Table 7.3: TDM23 supply component functionality, inputs and outputs

Component	Estimates	Sensitive To
Access Density	Access density category of Traffic Analysis Zone	• Population and employment density • Transit location by mode
Highway Assignment	Congested speed and volumes by roadway segment	• Trip tables by vehicle type and occupancy, market segment, and time of day • Roadway network
Tranit Assignment	Transit activity (Park-and-Ride [PnR]), boardings, alightings, transfer) by line	• Trip tables by transit access mode, market segment, and time of day segment • Transit network

Source: Table E-1, "TDM23: Structures and Performance" (Boston MPO, 2024)

For this project, the key travel metrics are taken from the highway assignment outputs. This step loads trips on to the highway network and routes them according to the travel time between origin and destination. The process takes into account congestion to produce volumes of travel on different roads that have been validated by CTPS and shown to compare reasonably well with observed traffic counts.

Model outputs for 2019 and 2050

The highway assignments results from TDM23 were processed by the consultant team to estimate travel demand by vehicle type by highway link across all of Massachusetts. The model outputs for 2019 and 2050 are summarized to show VMT by vehicle class by functional class (type of roadway, from interstates to local roads). The output from this step of the analysis is an Environmental Systems Research Institute (ESRI) GIS shapefile of the state's highway network showing light-duty, and medium- and heavy-duty truck volumes. Table 7.4 shows the base year VMT results. In total, the TDM23 estimates that there are 166 million vehicle miles traveled each day on roads in Massachusetts.

The majority of travel (158 million miles) is by light vehicles, with 7 million miles driven by trucks. Just under half of all travel (46% or 76 million miles) is on the freeway and expressway networks (including the ramps to these roads), while 37% of travel (62 million miles) is on arterials and the remaining 17% (28 million miles) is on smaller local roads.

The distribution is a little different for trucks, with a higher proportion on the freeway and expressway networks (63%, 5 million miles), and lower proportions on arterials (27%, 2 million miles) and local roads (10%, 1 million miles).

Table 7.4: Base year (2019) daily vehicle miles traveled by vehicle type and road functional class, Massachusetts

Category	Light Vehicles	Medium Trucks	Heavy Trucks	All Trucks	All Vehicles
Freeway	55,926,375	1,766,562	2,097,872	3,864,434	59,790,809
Expressway	9,538,185	298,056	198,713	496,768	10,034,954
Major Arterial	27,578,750	740,358	287,082	1,027,439	28,606,189
Minor Arterial	32,621,125	756,358	258,292	1,014,650	33,635,775
Collector	13,097,378	282,367	96,511	378,878	13,476,255
Local Road	3,543,404	87,559	34,584	122,143	3,665,547
Freeway Ramp	1,255,333	43,421	37,911	81,332	1,336,666
Expressway Ramp	4,410,975	143,252	72,191	215,443	4,626,418
Centroid	10,712,972	191,737	57,734	249,471	10,962,443
Total	**158,684,497**	**4,309,670**	**3,140,890**	**7,450,559**	**166,135,057**

Table 7.5 shows the forecast year VMT results. In total, the TDM23 estimates that there will be a very small increase to 167 million vehicle miles traveled each day in 2050. The small increase in VMT is made up of a small increase in daily light vehicle VMT, from 159 million miles to 160 million miles, and a small decrease in the daily truck VMT, from 7.5 million miles to 7.1 million miles.

Table 7.5: Forecast year (2050) daily vehicle miles traveled by vehicle type and road functional class, Massachusetts

Category	Light Vehicles	Medium Trucks	Heavy Trucks	All Trucks	All Vehicles
Freeway	56,961,003	1,698,198	2,056,028	3,754,226	60,715,228
Expressway	9,681,903	276,510	182,286	458,796	10,140,699
Major Arterial	27,449,563	689,113	255,535	944,648	28,394,212
Minor Arterial	32,407,955	715,529	240,271	955,800	33,363,755
Collector	13,085,076	268,915	90,448	359,364	13,444,440
Local Road	3,753,637	86,822	32,527	119,348	3,872,986
Freeway Ramp	1,240,636	40,296	35,777	76,073	1,316,709
Expressway Ramp	4,451,383	133,667	66,220	199,887	4,651,270
Centroid	0,774,129	180,018	52,419	232,437	11,006,566
Total	**159,805,286**	**4,089,068**	**3,011,511**	**7,100,579**	**166,905,864**

Table 7.6 shows the shares of VMT by vehicle type and scenario year. The tables confirm that truck VMT makes up between 4% and 5% of all vehicle VMT, and that the proportions are only forecast to change very marginally over the forecast horizon between 2019 and 2050.

Table 7.6: Base and forecast year percentage of vehicle miles traveled by vehicle type, Massachusetts

Scenario Year	Light Vehicles	Medium Trucks	Heavy Trucks	All Trucks	All Vehicles
Base (2019)	95.5%	2.6%	1.9%	4.5%	100.0%
Future (2050)	95.7%	2.4%	1.8%	4.3%	100.0%

Estimating 2030 and 2035 travel demand

While the TDM23 produces VMT for 2019 and 2050, the consultant team required estimates of VMT in 2030 and 2035 to be used as inputs to later steps in the analysis of EV charging infrastructure requirements.

The previous section showed that travel demand is forecast to change by only small amounts between 2019 and 2050, however, the consultant team did use population, household, and employment forecasts by town obtained from the Metropolitan Area Planning Council (MAPC) to interpolate VMT to 2030 and 2035, and in order to benchmark the reasonableness of the future estimates from the TDM23.

The MAPC forecasts extend to cover all of Massachusetts as well as their core planning area and were available in 10 year increments between 2010 and 2050. The versions of the forecasts used by the consultant team are from MAPC Model Run 139, prepared on August 11, 2023, and from Statewide Model Run 97, also prepared on August 11, 2023.

Table 7.7 shows the forecasts of household population[14] in the state between 2010 and 2050. The two spatial areas covered by the two sets of MAPC forecasts overlap slightly. The statewide forecasts, which generally cover the area outside of the MAPC region, include four towns from the MAPC region (Duxbury, Hanover, Pembroke, and Stoughton). The table shows the "Non-MAPC Communities" forecasts with those four towns removed, as well as the MAPC region forecasts and the statewide totals. The growth rates in 2030, 2040, and 2050 are calculated relative to the 2020 values.

The forecasts show a household population peaking in 2040 at just over 7 million followed by a small decrease by 2050. The overall statewide growth between 2020 and 2030 is about 3%, and this remains static in 2040 and 2050. The growth is higher in the MAPC region (which covers the Boston metropolitan area), with 4% growth by 2030 and 7% forecast by 2040. In the rest of the state, there is little to no growth predicted in this period.

[14]Household population excludes some residents of the state including military personnel and residents living in group quarters (dorms, correctional facilities, nursing homes, etc.)

Table 7.7: MAPC forecasts of household population from 2010 to 2050

Year	2010	2020	2030	2040	2050
Total Statewide Forecasts	3,344,502	3,551,218	3,591,541	3,552,416	3,464,029
MAPC Communities	73,062	77,581	76,593	74,953	71,293
Non-MAPC Communities	3,271,440	3,473,637	3,514,948	3,477,463	3,392,736
Relative to 2010 (Non-MAPC Communities)		100%	101%	100%	98%
MAPC Region	3,037,304	3,304,593	3,435,077	3,526,211	3,606,761
Relative to 2010 (MAPC Region)		100%	104%	107%	109%
Massachusetts	6,308,744	6,778,230	6,950,025	7,003,674	6,999,497
Relative to 2010 (Massachusetts)		100%	103%	103%	103%

Table 7.8 shows similar forecasts of total employment. The employment forecasts produced by MAPC have the same structure as the household population forecasts. In this case, employment is projected to grow 2% by 2030 and 3% by 2040. As with the household population forecasts, employment is forecasted to grow more in the MAPC region (3% by 2030 and 6% by 2040) than in the rest of the state where a 1% growth is forecasted in 2030 followed by a 1% decline relative to 2020 by 2040.

Table 7.8: MAPC forecasts of total employment from 2010 to 2050

Year	2010	2020	2030	2040	2050
Total Statewide Forecasts	1,344,233	1,496,830	1,501,552	1,484,617	1,467,985
MAPC Communities	27,457	26,933	24,026	23,213	22,334
Non-MAPC Communities	1,316,776	1,469,897	1,477,526	1,461,404	1,445,651
Relative to 2010 (Non-MAPC Communities)		100%	101%	99%	98%
MAPC Region	1,877,169	2,167,923	2,235,548	2,291,736	2,352,856
Relative to 2010 (MAPC Region)		100%	103%	106%	109%
Massachusetts	3,193,945	3,637,820	3,713,074	3,753,140	3,798,507
Relative to 2010 (Massachusetts)		100%	102%	103%	104%

The small changes in both household population and employment suggest that the small changes in VMT forecasted by the TDM23 are reasonable.

The final outputs from this portion of the analysis included statewide estimates of VMT by vehicle type, highway network link estimates of 2030 and 2035 VMT by vehicle type, and also household population forecasts by 2030 and 2035 that were used to grow the base year data on the location and type of households and household units. Table 7.9 shows the interpolated VMT results for the state by vehicle type for 2030 and 2035.

Table 7.9: Interpolated 2030 and 2035 daily vehicle miles traveled forecasts by vehicle type

Year	Light Vehicles	Medium Trucks	Heavy Trucks	All Trucks	All Vehicles
2019	158,684,497	4,309,670	3,140,890	7,450,559	166,135,057
2050	159,805,286	4,089,068	3,011,511	7,100,579	166,905,864
Change (2019-2050)	1,120,788	(220,602)	(129,379)	(349,981)	770,808
2030	159,350,192	4,178,643	3,064,045	7,242,687	166,592,880
2035	159,488,350	4,151,449	3,048,096	7,199,546	166,687,896

Modeling multi-family parking availability

The spatial distribution of EV charging infrastructure expected across the state in 2030 and 2035 relies on several data inputs. This section discusses forecasts of multi-unit housing locations and modeling the availability of on-street and off-street parking.

Approach

The consultant team forecasted the quantity and location of future multi-family housing with only on-street parking available as well as the quantity and location of multi-family housing with off-street parking for residents. The distinction between the two types of parking is an important driver of public Level 2 and DCFCs. Residents of multi-family housing without off-street parking will be more likely to rely on public chargers.

The consultant team used current parcel-level data on multi-family housing, data from the Census Bureau's 5-year ACS, and MAPC's population and household forecasts by town to estimate the locations of new multi-family housing in 2030 and 2035. Town parking inventory studies and survey data collected by the National Renewable Energy Laboratory (NREL) were used to establish rates of off-street parking availability at different types of multi-family housing, which were then applied to the forecasts of multi-family housing in 2030 and 2035.

Land use data

The US Census Bureau's 5-year ACS data for Massachusetts for the period ending in 2023 was the primary source of data on household locations and household dwelling types by Census Block Group. The data were extracted using the statistical programming platform, R, and the census data R package, tidycensus. The data covers 5,116 Census Block Groups, and includes data on population, households, dwelling types, number of vehicles available, household type (owned versus rented housing), average household income, and employment.

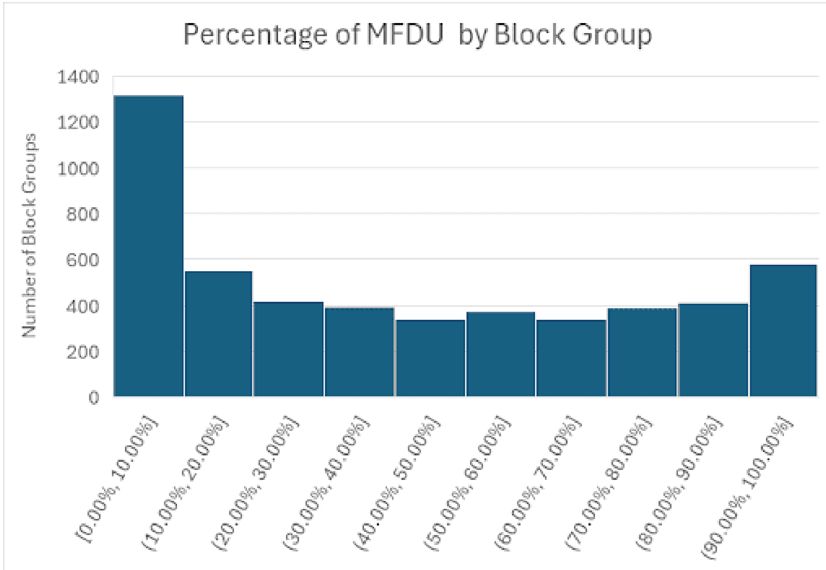
Table 7.10 summarizes the number of households by dwelling unit type according to the ACS estimates. A slight majority of households (57%) live in single family houses, compared to 42% in multi-family homes. Very few households live in mobile homes, boats, RVs or vans. Amongst the multi-family homes, almost half are 2, 3, or 4 unit buildings and just over half are large buildings, with 8% of all households in the state (accounting for about 20% of the multi-family dwellings) living in large developments of over 50 units.

Table 7.10: 5-year ACS (2019-2023) estimates of household by dwelling unit type in Massachusetts

Dwelling Unit Type	Number of Households	Percentage of Households
SFDU_detached	1,550,002	51%
SFDU_attached	175,084	6%
MFDU_2_units	283,336	9%
MFDU_3or4_units	320,710	11%
MFDU_5to9_units	172,273	6%
MFDU_10to19_units	128,312	4%
MFDU_20to49_units	134,009	4%
MFDU_50+_units	226,169	8%
Mobile_home	23,618	1%
Boat_rv_van	1,144	0%
SFDU_total	1,725,086	57%
MFDU_total	1,264,809	42%
Total	**3,014,657**	**100%**

Figure 7.1 is a histogram of the proportion of multi-family units by Census Block Group.

Figure 7.1: 5-year ACS (2019-2023) percentage of multi-family dwelling units by Block Group in Massachusetts



The most common range is the Block Group that has between 0% and 10% of its units as multi-family units. A significant number of Block Groups are over 90% multi-family units. Between those extremes, there is an even distribution in terms of the number of Block Groups in each 10% increment.

In addition to the ACS data, two other data sources were used to describe the land use in the state and other characteristics of the built environment:

- Parcel databases for each of the towns in Massachusetts, available from the Mass GIS portal.[15] These data were used to support the development of the model application including the disaggregation of the model application from Census Block Groups to the Hex geography used in later phases of the analytical process.
- The EPA's smart location database,[16] which contains Census Block Group level data for a series of variables including processed Census data, accessibility measures, and transportation supply measures such as transit service frequency. These data were collected to supplement the model estimation dataset.

Literature

The consultant team conducted a literature review to identify examples of surveys and other research that developed observed rates of parking availability by dwelling unit type. A report published by NREL, "There's No Place Like Home: Residential Parking, Electrical Access, and Implications for the Future of Electric Vehicle Charging Infrastructure"[17] contains some useful rates derived from survey work nationally.

[15]Commonwealth of Massachusetts, MassGIS—Bureau of Geographic Information, accessed June 11, 2025, https://www.mass.gov/orgs/massgis-bureau-of-geographic-information.

[16]U.S. Environmental Protection Agency (EPA), Smart Location Mapping, accessed June 11, 2025, https://www.epa.gov/smartgrowth/smart-location-mapping#SLD.

[17]Yanbo Ge, Christina Simeone, Andrew Duvall, and Eric Wood, There's No Place Like Home: Residential Parking, Electrical Access, and Implications for the Future of Electric Vehicle Charging Infrastructure (Golden, CO: National Renewable Energy Laboratory, 2021), NREL/TP-5400-81065, https://www.nrel.gov/docs/fy22osti/81065.pdf.

Figure 7.2 shows a figure from the report which summarizes the survey findings. Of note for the work on this project is the percentage of multi-family households with access to parking of different types. Smaller developments, i.e., low capacity apartments (2 to 4 unit buildings), are the least likely to have on-site (off-street) parking either in a garage or lot but do have higher rates of driveway availability. Larger developments (high-capacity apartments, 20+ unit buildings) tend to have available off-street parking garages or lots and the proportion of households that make use of on-street parking is smaller (about 40% compared to around 60% in low-capacity apartments.)

Figure 7.2: Percent of households with charging or potential charging access by household and parking type[18]

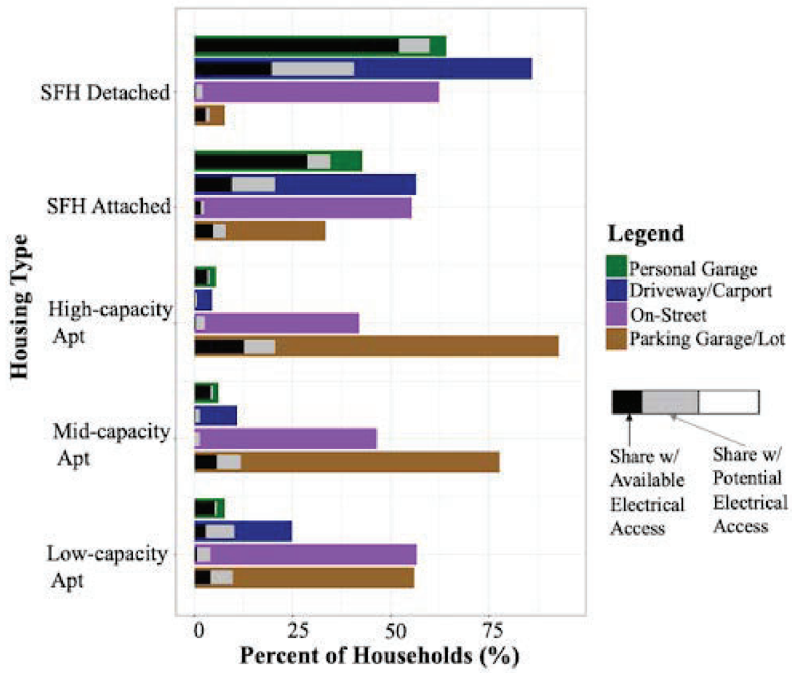


Figure 7. Existing and potential electrical access by residence type and parking option

Note: SFH stands for single-family home.

Parking inventory data

Several towns and planning agencies in Massachusetts have inventories of on-street parking as well as other types of parking available to residents and visitors. These data were processed and analyzed to augment the land use data and provide training data for the models of parking availability. The sources obtained and reviewed by the consultant team included:

- Somerville: On-street parking inventory by Somerville neighborhood[19]
- Andover: Andover public parking map and study (2016), includes on-street parking inventories and locations[20]

[18]Yanbo Ge, Christina Simeone, Andrew Duvall, and Eric Wood, There's No Place Like Home: Residential Parking, Electrical Access, and Implications for the Future of Electric Vehicle Charging Infrastructure (Golden, CO: National Renewable Energy Laboratory, 2021), Figure 7, NREL/TP-5400-81065, https://www.nrel.gov/docs/fy22osti/81065.pdf.

[19]City of Somerville, Parking Study Engagement Platform, accessed June 11, 2025, https://voice.somervillema.gov/parking-study.

[20] City of Andover, Downtown Andover Parking Study, accessed June 11, 2025, https://andoverma.gov/DocumentCenter/View/181/Downtown-Andover-Parking-Study-PDF?bidId=.

- Brookline: Brookline metered parking inventory, from a quick Google maps comparison it appears their metered parking is all on-street parking[21]
- Barnstable: all on-street spaces[22]
- MAPC Perfect Fit Parking: Overnight parking inventory[23]

Model development

The consultant team created an estimation dataset for 140 Census Block Groups from the ACS data, smart location database, and parking inventory data, and tested a series of regression models to develop models that predicted with reasonable accuracy the number of on-street and off-street parking spaces available to residents of multi-family dwellings in the Census Block Group. The final models are shown below in Table 7.11 and Table 7.12.

Table 7.11. Regression model of on-street parking

Coefficients:	Estimate	Std. Error	t value	PR(>|t|)	Significance code
(Intercept)	1.464	0.431	3.396	0.001	***
OwnedVehicles	-0.002	0.001	-2.877	0.005	**
D3BPO4_mea	0.023	0.009	2.454	0.015	*
HH_Density	-0.114	0.024	-4.761	0.000	***
D4C_mean	-0.028	0.008	-3.454	0.001	***
PopDensity	0.056	0.014	3.922	0.000	***
EmpDensity	-0.206	0.127	-1.629	0.106	

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 1.362 on 133 degrees of freedom
Multiple R-squared: 0.2479, Adjusted R-squared: 0.214
F-statistic: 7.308 on 6 and 133 DF, p-value: 9.176e-07

Where:

- OwnedVehicles is the number of vehicles in units that are owner occupied
- D3BP04 is the density of pedestrian oriented four legged intersections
- HH_Density is the density of households
- D4C_mean is the average frequency of transit services accessible to households
- PopDensity is the population density
- EmpDensity is the employment density

[21]Metropolitan Area Planning Council (MAPC), Metro Boston Perfect Fit Parking Dashboard, accessed June 11, 2025, https://experience.arcgis.com/experience/0a4e9fb71c0a4cdca76edcb2eff21a09/.

[22]Town of Barnstable Planning & Development Department, Appendix B: Existing Conditions Report, accessed June 11, 2025, https://www.town.barnstable.ma.us/Departments/planninganddevelopment/Projects/Appendix-B--Existing-Conditions.pdf.

[23]Metropolitan Area Planning Council, Perfect Fit Parking, accessed June 11, 2025, https://perfectfitparking.mapc.org/.

Table 7.12: Regression model of off-street parking

Coefficients:	Estimate	Std. Error	t value	PR(>|t|)	Significance code
(Intercept)	2.946	0.583	5.052	0.000	***
D3A_mean	-0.082	0.017	-4.956	0.000	***
RentalVehicles	0.002	0.001	4.319	0.000	***
HH_Density	-0.022	0.010	-2.256	0.026	*
IncomePerCapita	-0.00001	0.000	-2.592	0.011	*
OwnedVehicles	-0.001	0.001	-1.874	0.063	.
D3BPO4_mea	0.012	0.007	1.688	0.094	.

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 1.03 on 133 degrees of freedom
Multiple R-squared: 0.2866, Adjusted R-squared: 0.2544
F-statistic: 8.906 on 6 and 133 DF, p-value: 3.599e-08

Where:

- D3A_mean is the total road network density
- RentalVehicles is the number of vehicles in units that are renter occupied
- HH_Density is the density of households
- IncomePerCapita is the average income per person
- OwnedVehicles is the number of vehicles in units that are owner occupied
- D3BP04 is the density of pedestrian oriented four legged intersections

The model estimation results indicate that use of on-street parking by multi-family dwelling units is more likely (positive coefficient) in areas with higher density pedestrian friendly street patterns (for example in urban grid type street networks), is slightly lower (negative coefficient) in areas with good transit service and where fewer owner occupiers have vehicles, and is lower in areas with higher employment density (for example mixed use neighborhoods where competition for on-street parking may be higher).

The model estimation results indicate that use of off-street parking by multi-family dwelling units is more likely (positive coefficient) as the number of vehicles owned by renting households increases. Conversely, it is slightly lower (negative coefficient) in areas with higher total road network density (and therefore is more likely in units in more suburban locations), in areas with higher household density, and in higher income areas.

Model application

The model application developed by the consultant team applied the two models described above to all Census Block Groups in the state in 2030 and 2035.

The first step in this process was to estimate the number of multi-family dwelling units by Census Block Group. This was achieved by factoring the ACS estimates of households by dwelling unit type by Census Block Group to the future year estimates of total households derived from the MAPC household forecasts (described earlier in this Appendix).

Since forecasts by dwelling unit type are not available, the consultant team assumed that the housing mix in each Block Group would remain the same in the future. Given the relatively small changes in the number of housing units, this simplifying assumption is likely to be reasonable.
Table 7.13 shows the resulting breakdown of single family and multi-family units in the current year, 2030, and 2035. The total number of units increases modestly, and the share of multi-family units increases slightly (as expected given the slightly higher growth rates in more urban areas of the state).

Table 7.13: Number and percentage of units by type, current year, 2030, and 2035

Year	SFDU	MFDU	Total
Units in 2023	1,675,232	1,253,371	2,928,603
Units in 2030	1,733,408	1,314,737	3,048,145
Units in 2035	1,742,624	1,336,960	3,079,584
Percent in 2023	57.2%	42.8%	100.0%
Percent in 2030	56.9%	43.1%	100.0%
Percent in 2035	56.6%	43.4%	100.0%

The consultant team did not attempt to model changes in some of the explanatory variables that were found to be significant in the models, such as transit level of service, vehicle ownership, and road network characteristics. These were assumed to be unchanged from the current year to 2030 and 2035. Given the relatively small changes in the number of households and amount of employment, any changes in these other variables are likely to be small.

Once the models have been applied for each Block Group, the results are then disaggregated to the hex zone system that later analytical steps use, creating an output database of numbers of dwelling units by year and type and number of parking spaces available to multi-family dwelling units by year and type (on and off-street) by hex zone.

Model results

Table 7.14 shows a summary of the parking availability results from applying the model in 2030 and 2035. The share of parking spaces used by residents of multi-family dwellings, both on and off-street, remains fairly static over time as expected given the application assumptions and the relatively small changes in the number and distribution of housing units over time.

The mapped results shown in Chapter 4 show that off-street parking at multi-family dwellings is more common in non-Boston urban areas and lower density parts of the Boston Region. However, many multi-family buildings even in the densest parts of Boston do have some off-street parking.

The estimates of on-street parking spaces used by residents of multi-family households in 2030 and 2035 are much more focused in the densest (and often older) parts of urban areas, particularly the Boston Region.

Table 7.14: Number and Percentage of Units by Type, Current Year, 2030, and 2035

Year	Off Street	On Street	Total
Units in 2023	1,422,085	926,932	2,349,017
Units in 2030	1,474,655	968,358	2,443,013
Units in 2035	1,487,755	981,969	2,469,724
Percent in 2023	60.5%	39.5%	100.0%
Percent in 2030	60.4%	39.6%	100.0%
Percent in 2035	60.2%	39.8%	100.0%

Estimating demand (MW)

Chapter 4 and this Appendix describe the process of estimating the spatial distribution of EV charging ports in 2030 and 2035 that are necessary to meet the state's climate goals. The next step in the analysis was estimating demand (MW) from the number of charging ports in 2030 and 2035, a precursor to estimating the associated distribution grid impact. Specifically, the Synapse consultant team converted the geospatial distribution of charger ports to a geospatial distribution of demand during peak periods.

To develop a full picture, the Synapse consultant team estimated EV charger demand for four scenarios, each with different degrees of managed charging. The four scenarios are:

1. Unmanaged charging
2. Evenly spread charging (flat charging)
3. Currently offered managed charging programs (status quo)
4. High-enrollment advanced managed charging (technical potential)

For details on each scenario, see Chapter 5.

To determine electricity demand during peak periods from EV chargers, analysts need to understand charging behavior and use over a 24-hour period on a summer weekday (i.e., on days when the electricity system currently peaks and is expected to peak in 2030 and 2035). This generally involves developing and using 24-hour load curves, specific to different charger types and managed charging scenarios.

The Synapse consultant team estimated the load curves for each of the five types of chargers included in the EV Charger Deployment analysis for light-duty vehicles: residential Level 1 and Level 2 chargers, work Level 2 chargers, and publicly available Level 2 and DCFCs. The team also estimated load curves for public and private chargers that support medium and heavy-duty vehicles. Public chargers are primarily DCFCs located along transportation routes, while private charging include slower fast chargers, as well as Level 1 and 2 chargers located at truck and bus depots. Additional information on how each load curve was developed is provided in the following section.

Once 24-hour load curves were developed, the consultant team could determine the demand coincident with peak periods (e.g., 3pm to 7pm). As discussed in Chapter 4 and earlier in this Appendix, the Synapse consultant team first estimated counts for each EV charger type at the hex level (approximately 1 km in diameter) in 2030 and 2035. For each hex, the consultant team then multiplied the count of each EV charger type by the demand for that charger type at times that are coincident with the grid load peaks. This process was repeated for each of the four managed charging scenarios and for both 2030 and 2035.

The system-wide demand during peak periods by charger type for light-duty and medium- and heavy-duty vehicle chargers are shown in Tables 7.15 and 7.16, respectively. The load curves used to calculate peak demand estimates assume that not all chargers are being used at the same time over the course of the day. They consider coincidence factors specific to each charging scenario.

Table 7.15. System-wide peak demand, in MW, for light-duty vehicle chargers

Year	Scenario	Home Level 1	Home Level 2	Work Level 2	Public Level 2	Public DCFC
2030	Scenario 1	109	936	116	216	176
2030	Scenario 2	78	472	116	206	148
2030	Scenario 3	112	829	116	216	176
2030	Scenario 4	5	47	6	11	160
2035	Scenario 1	190	1,855	303	491	337
2035	Scenario 2	137	934	302	469	283
2035	Scenario 3	196	1,642	303	491	337
2035	Scenario 4	9	93	15	25	305

Table 7.16. System-wide peak demand, in MW, for public and private medium- and heavy-duty vehicle chargers

Year	Scenario	Private chargers (mostly Level 2)	Public chargers (mostly DCFC)
2030	Scenario 1	58	25
2030	Scenario 2	48	25
2030	Scenario 3	48	25
2030	Scenario 4	2	22
2035	Scenario 1	150	53
2035	Scenario 2	123	53
2035	Scenario 3	123	53
2035	Scenario 4	6	48

Load curves for light-duty vehicle chargers

Scenarios 1 & 2

The consultants used load curves for light-duty vehicle chargers for the "unmanaged charging scenario" (scenario 1) and the "flat charging" scenario (scenario 2) from NREL's EVI-Pro Lite.[24] The model uses detailed data from personal vehicle travel patterns, electric vehicle attributes, and charging station characteristics to develop state-wide aggregate weekend and weekday 24-hour load curves by charger type. The Synapse consulting team then converted the state-wide aggregate load curves to be a per-charger 24-hour load curve.

The team used the assumptions provided in Table 7.17 to generate EVI-Pro Lite load curves. In EVI-Pro Lite, the home charging strategy assumption was set to Immediate – as fast as possible for the unmanaged scenario (scenario 1) and Immediate – as slow as possible (even spread) for the "flat charging" scenario (scenario 2).

[24] National Renewable Energy Laboratory. 2018. EVI-Pro Lite: Electric Vehicle Infrastructure Projection Tool. Available at: https://afdc.energy.gov/evi-x-toolbox#/evi-pro-ports.

Table 7.17. EVI Pro-Lite assumptions

Assumption	2035 Value	Assumption Support
Number of light-duty EVs	2.4 million	Projections from CECP[25]
Average daily miles traveled per vehicle	35 miles	EVI Pro Lite default assumption
Average ambient temperature	86F	Assuming charging during summer peak hours
Plug-in vehicles that are all-electric	75%	Estimated based on recent vehicle sales trends[26]
Plug-in vehicles that are sedans	38%	EVI Pro Lite default assumption
Mix of workplace charging	20% Level 1, 80% Level 2	Workplace chargers assumed to be primarily level 2.
Access to home charging	75%	Reflects estimates of current access to home chargers.[27]
Preference for home charging	80%	Most similar percentage to access to home charging (of available EVI Pro-Lite options)

Scenario 3

Residential charger load curves for the status quo scenario (scenario 3) come from National Grid's off-peak charging rebate program.[28] Currently, roughly 15 percent of EV owners participate in this program in National Grid's service territory.[29] The consultant team applied these program-specific load curves and participation rates to all residential Level 1 and Level 2 chargers across the state in 2030 and 2035. No other charger types are managed in this scenario.

Scenario 4

The consultant team developed load curves from the technical potential scenario (scenario 4). The consultants assumed that 95 percent of all home, workplace, and public Level 2 charging would participate in rigorous managed charging programs on any given day, where all participating charging occurs during off-peak periods. This is meant to demonstrate the highest possible load reductions that could exist from managed charging and would likely involve a mix of active and passive management programs and technologies. The consultants also assume there would be no secondary peaks associated with managed EV charging (as a result of active and full management of EV loads). In this scenario, 95 percent of public DCFCs are assumed to participate in a management program on any given day that reduces peak demand by 10 percent (maintaining "fast" charging and a positive customer experience for these charger types).[30]

[25] Mass.gov, 2024. Massachusetts Workbook of Energy Modeling Results. Available at https://www.mass.gov/info-details/massachusetts-clean-energy-and-climate-plan-for-2050.

[26] Massachusetts Department of Transportation, Massachusetts Vehicle Census – Municipal Aggregation, 2025, accessed June 11, 2025, https://geodot-homepage-massdot.hub.arcgis.com/pages/massvehiclecensus.

[27] International Council on Clean Transportation, Home Charging Access and the Implications for Charging Infrastructure Costs in the United States, 2023, accessed June 11, 2025, https://theicct.org/wp-content/uploads/2023/03/home-charging-infrastructure-costs-mar23.pdf.

[28] DNV, Final Report: Massachusetts Phase III EV Program Year 1 Evaluation Report, for National Grid, May 7, 2024, Docket 24-64, Phase II and III Exhibit NG-MMJG-1, 104.

[29] National Grid, MA EV Phase II and III Program Year 1 Annual Report, May 15, 2024, Docket 24-64, Phase II and III Exhibit NG-MMJG-1, 29.

[30] 10 percent is a rough estimate as peak demand reductions for DCFCs is expected to be small.

Scenario 4 is not practically possible; however, it serves to illustrate the importance of managed charging and the types of locations where managed changing is most likely to help avoid grid upgrades.

Load curves for medium and heavy-duty vehicle chargers

The distribution of medium and heavy-duty electric vehicle chargers is described in Chapter 5 and in above sections of this Appendix. The consultant team used load curves for medium and heavy-duty chargers from LBNL's HEVI-Load tool,[31] provided to EEA as part of DOE's state technical assistance program. LBNL provided load curves for both private (or depot-based charging) and public charging (DCFCs primarily located along transportation routes). The private chargers included 50kW and 150kW chargers and Level 1 and 2 chargers. Public chargers included DCFCs that are 250kW, 350kW, 500kW, 1000kW, and 1500kW speeds. For the scenarios 1, 2, and 3, Synapse calculated average load curves for the two charger categories (private and public chargers), weighted by the number of chargers in each category (also provided by LBNL). Scenario 1 load curves are based on the LBNL average hourly unmanaged loads. Scenarios 2 and 3 are calculated from the LBNL managed average hourly loads. The load curves used to calculate peak demand estimates assume that not all chargers are being used at the same time over the course of the day. They consider coincidence factors specific to each charging scenario.

Public medium and heavy-duty vehicle chargers are typically less flexible than residential and workplace light-duty vehicle charging, due to fleet operational and long-distance travel needs.[32] For scenario 4, the consultant team assumed that for public chargers, 10 percent of the load during peak hours (5 to 10 PM) could be redistributed evenly to off-peak hours. Private chargers, typically located at fleet depots, have a higher potential for managed charging. The consultant assumed that 95 percent of private medium and heavy-duty chargers participate in a program that distributes all charging to off-peak hours.

Allocating peak demand to feeders on the distribution grid

The consultant team conducted geospatial analysis to assess how the EV load will impact the electric distribution system in 2030 and 2035. To assign the EV load from each hex cell to the electric distribution feeders, the consultant team overlaid geospatial data on locations of National Grid's, Eversource's, and Unitil's distribution system feeders onto the map of load estimates for each hex cells across the entire state.

The consultant team determined the portion of each hex cell load to allocate to each feeder based on how much of each feeder overlapped with the hex cell's area. If only one feeder intersects a hex cell, the entirety of the EV load in that hex cell is assumed to be served by that feeder. If multiple feeders intersect a hex cell, the EV load in that hex cell is allocated to the feeders based on the distance each

[31] LBNL. Medium and Heavy-Duty Electric Vehicle Infrastructure – Load Operations and Deployment (HEVI-LOAD). Available at: https://transportation.lbl.gov/hevi-load.

[32] Pricing signals have the potential to lead to more flexible management of medium and heavy-duty chargers in the future. For this analysis, it was assumed these loads have minimal flexibility.

feeder covers in the hex cell. For example, if two feeders intersect a hex cell, and the length of one feeder within that hex cell is 1 kilometer, and the length of other is only 0.5 kilometers inside the hex cell, then two-thirds of the EV load is allocated to the first feeder, and the remainder to the second feeder. If there are no feeders that intersect a hex cell, the EV load of that hex cell is assigned to the nearest feeder. However, if there is not a feeder within two kilometers (the diameter of two hex cells), the EV load in that hex cell is not assigned to a feeder, because that hex cell is likely in the service area of another utility (e.g., a municipal light plant). Finally, since single feeders often span multiple hex cells, the EV load from each hex cell along the feeder was summed to estimate the total load across the feeder from all hex cells.

This length-based methodology is oversimplified. In reality, demand from EV chargers on individual feeders will depend on the precise point locations of the EV chargers at a street level. However, since EV charger counts are only calculated at the granularity of the kilometer-wide hex cell, a more granular analysis of EV charger locations and their associated feeder was not possible.

Determining potential grid upgrades necessary to support future EV chargers

Analysis of distribution feeders

The EVICC technical consultant team was able to obtain two key pieces of data for the feeders in National Grid,Eversource, and Unitil service areas: 2022 peak load (demand) and 2022 feeder rating. The feeder rating describes the upper limit on how much electricity can be carried on that feeder. A summary of the utility feeder data is summarized in Table 7.18.

Peak load data is the absolute maximum demand (kW) experienced by the feeder across the entire year, rather than coincident demand (i.e., load on the feeder during the system peak period). Historically, peak periods in Massachusetts occur during hot summer afternoons and early evenings, when home air conditioners and appliances are in highest use.[33] Neither National Grid , Unitil, nor Eversource specified when peaks on each feeder occur. The consultant team assumed that most feeders would be peaking during summer afternoons in this analysis, in line with typical peak periods. As forecasted by the utilities, the team also assumed that peak periods would shift later in the day by 2035, primarily due to incremental distributed solar.[34]

[33] Beyond the mid-2030s, Massachusetts is expected to become a winter peaking system. Further analysis and data would be required to analyze coincident EV loads with these different peaks. The shift to winter peaking may occur sooner in some locations on the grid.

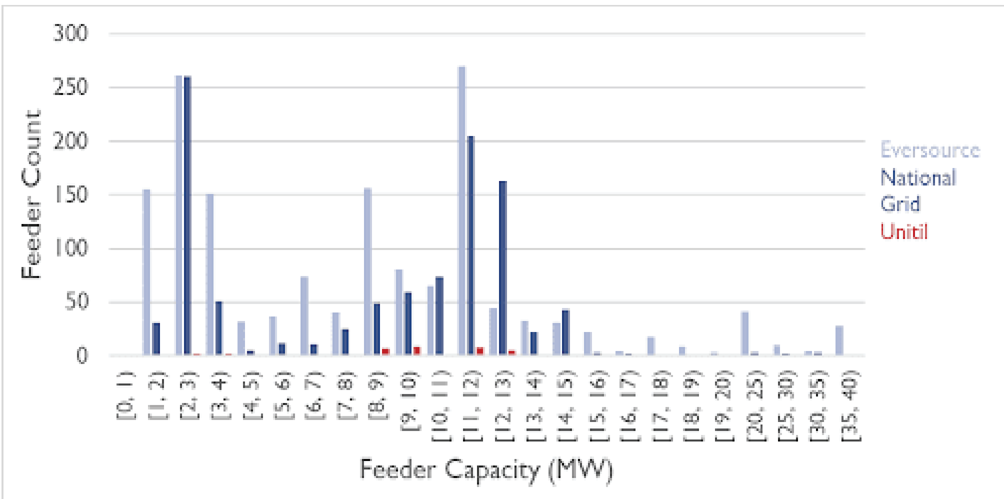
[34] National Grid, Future Grid Plan, Massachusetts Electric Company and Nantucket Electric Company 2023 to 2050 Electric Peak (MW) Forecast, p. 10, and Appendix E: Load Shapes for Typical Day Types, p. 75, accessed June 11, 2025, https://www.mass.gov/doc/gmacesmp-draftnational-grid/download?_gl=1%2Adfgptb%2A_ga%2ANzUwNDI5MDE3LjE2NTA5ODEyMjQ.%2A_ga_SW2TVH2WBY%2AMTY5MzkyMDE2OS4zNi4xLjE2OTM5MjM1OTcuMC4wLjA.

Table 7.18 Summary of utility feeder data

Data Category	Eversource	National Grid	Unitil	Total
Total distribution feeders	2,006	1,045	38	3,089
Feeders with load and capacity data	1,555	1,024	38	2,614
Already overloaded feeders in 2022 (excluded)	157	174	0	331

The size of feeders varies substantially across the state (Figure 7.3). About 20 percent of all feeders fall into the 2-3 MW size range while roughly 18 percent feeders are in the 11-12 MW size range.

Figure 7.3 Distribution of feeders in Massachusetts



For this analysis, feeders that carry peak loads equal to or greater than 80 percent of their nameplate capacity are considered overloaded (as per industry standards).[35] Utilities often reserve the top 20 percent margin as a safety buffer for unexpectedly high load events or emergencies, such as a nearby feeder going offline.[36] Given the high-values observed in many scenarios, feeders operating between 80% and 100% of their rated capacity may warrant further study by the utility to assess whether intervention is necessary. In particular, special attention should be paid to new building loads and other non-EV loads. Feeders with ratios greater than 100 percent are already overloaded at peak times, and likely need prompt attention from utilities. Approximately 326, or 13 percent, of National Grid,Eversource, and Unitilfeeders in Massachusetts were found to be already overloaded (≥80 percent) in 2022. Five feeders were found to have capacity fractions equal to or greater than 110 percent (severely overloaded).[37] Table 7.19 shows the load level experienced by feeders in utility service territories according to 2022 data.

[35] Electric Power Research Institute (EPRI), EVs2Scale2030 Grid Primer: An Initial Look at the Impacts of Electric Vehicle Deployment on the Nation's Grid, 2023, accessed June 11, 2025, https://www.epri.com/research/products/000000003002028010.

[36] Eversource Energy, Distribution System Planning Guide, 2020, accessed June 11, 2025, https://www.mass.gov/doc/eversource-distribution-planning-guide/download.

[37] This may be due to data discrepancies, or these feeders may have taken on high loads during emergency events or outages of nearby feeders. These feeders are likely already on utility's radar for near-term studies.

Table 7.19 Count of feeders experiencing overloading in 2022*

Current Loading % (2022)		National Grid	Eversource	Total
≥	<			
80%	90%	120	89	209
90%	100%	42	52	94
100%	110%	9	13	22
110%	120%	3	0	3
120%		0	3	3
	Total feeder count	174	157	331
	% of feeders in MA	7%	6%	13%

**Note: No Unitil feeders in 2022 are considered already overloaded.*

Analysis of substations

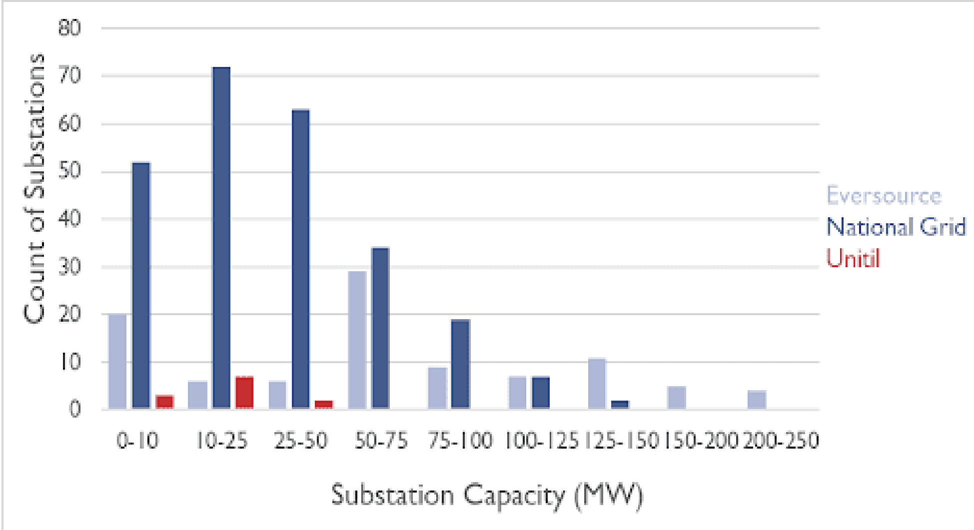
The Synapse consulting team also assessed overloading on the 346 substation areas in Eversource's, National Grid's, and Unitil's service territories. Substation capacity is determined by the size and configuration of substation equipment, including transformers and circuit breakers. Similar to feeder capacities, substation capacity is a dynamic rating that can depend on temperature and other factors. For this analysis, the consultant team assumed a threshold for overloading of 100 percent.

National Grid and Eversource did not provide the Synapse consulting team with substation peak loads. Instead, the team used the sum of the peak loads of all the connecting feeders as a proxy. Larger substations serving urban areas may have eight or more connecting feeders. This approach is likely to overestimate peak load slightly, as there are likely feeders peaking at different times on peak days.

The consulting team did not have substation capacity data for National Grid's service territory; again, as a proxy, the team added up the capacity ratings of all connecting feeders. The consulting team did have bulk substation ratings for most of Eversource's service territory; for substations that were missing substation capacity, the team estimated it using the same approach taken for National Grid substation ratings. Unitil provided substation transformer peak loads and normal ratings, which were used for this analysis.

Like feeders, the capacity of substations differs substantially across the state and between utility service territories, as shown in Figure 7.4.

Figure 7.4 Sizes of substations in Massachusetts



Roughly 20, or 4 percent, of substations have 2022 peak loads greater than or equal to 100 percent of their 2022 capacities (Table 7.20). All overloaded substations are in Eversource's service area. Substation overloading is more imprecise than feeder loading, since substation peak loads are calculated by summing up non-coincident 2022 existing peak loads and feeder capacities. Substations may also have a higher threshold for being considered overloaded than the consultants assumed in this study.

Table 7.20. Current substation overloading

Current Loading % (2022)		Eversource (count)
≥	<	
100%	110%	4
110%	120%	6
120%	130%	2
130%		8
	Sum	20
	% of substations in MA	4%

Caveats

Evaluating overloaded feeders has several key assumptions and system simplifications. The assessment of feeder headroom is based on 2022 peak load and feeder capacity data; it does not include forecasts of future peaks, nor does it take into account upcoming improvements to the distribution grid. The purpose of this analysis was to determine the relative likelihood of EV loads causing the need to upgrade grid assets, not to determine specific loads, specific grid assets to upgrade, or what upgrade may be warranted. Specifically, the analysis does not include future building electrification and behind-the-meter solar, which will change peak loads across most distribution feeders.

The analysis also assumes that Massachusetts continues to have a summer peaking system in 2035. Analysis of future winter peaking would require projected winter peak loads on feeders and substations, resulting from increased building electrification. EDCs would need to provide current winter peaks and forecasted system peaks on a feeder-level. The analysis would require new wintertime EV charger load curves, taking into account that colder temperatures diminish EV range. Different charging behavior and reduced range would impact locational charging needs. A winter peaking analysis should also consider future building electrification and coincidence with winter peaks. Managed charging programs would need to be reconsidered. EV charging during the hottest periods of the day (midday) should be incentivized, in contrast to charging during summer periods. A winter grid impact analysis could be useful in the next EVICC assessment.

Appendix 8. EV Charging Grid Planning Processes

This Appendix provides an overview of the information related to electric vehicle (EV) charging included by Massachusetts' investor-owned utilities, Eversource, National Grid, and Unitil (also known as electric distribution companies or EDCs), in their Electric Sector Modernization Plans and the grid impact analysis and EDC planning process required under Section 103 of An Act Promoting a Clean Energy Grid, Advancing Equity and Protecting Ratepayers (2024 Climate Act).

Electric Sector Modernization Plans (ESMPs)

The 2022 Act Driving Clean Energy and Offshore Wind (2022 Climate Act) directed the EDCs to develop ESMPs every five years. These comprehensive grid planning documents describe the current state of the distribution grid, the utilities' current and proposed investments in the electric grid, projections of future electric grid reliability needs, a forecast of the Commonwealth's future electricity needs, and strategies to support Distributed Energy Resources (DERs) including solar, energy storage, EVs, and electric heat pumps. To inform their EV load forecasts, the EDCs relied on the EV adoption benchmarks included in the Massachusetts Clean Energy and Climate Plans[1] (CECP) and the Commonwealth's adoption of Advanced Clean Cars II (ACC II) and Advanced Clean Trucks (ACT).[2]

The first ESMPs were approved by the Massachusetts Department of Public Utilities (DPU) as strategic plans in August 2024, following robust stakeholder engagement and review. The Massachusetts Department of Energy Resources (DOER), the Attorney General's Office (AGO), and other stakeholders advocated for the inclusion of EV load management assumptions in the ESMP forecasts, citing its importance in advancing EV adoption and reducing ratepayer costs. Future ESMP proceedings will include additional opportunities for stakeholder engagement.

In its Order on the EDCs' ESMPs, the DPU encouraged Eversource and Unitil to file managed charging program proposals for the DPU's review in the near term. Eversource and Unitil filed managed charging program proposals with the DPU in December 2024 (See D.P.U. 24-195 and D.P.U. 24-197). If the DPU approves the electric distribution companies' managed charging program proposals, EVICC anticipates that these utilities will adjust their future ESMP forecasts and demand assessments to account for the impacts of their managed charging programs on expected load growth and provide relevant load management updates in their biannual ESMP reports to the DPU (See Chapter 3 and Appendix 3 for more information on the EDCs' December 2024 filings).

[1]See 2050 CECP and 2025/2030 CECP.

[2]See Chapter 2 for more on ACC II and ACT.

Section 103 of the 2024 Climate Act

Section 103 of the 2024 Climate Act established a new grid planning process to accommodate the growth of EV charging. Section 103 directs EVICC to include a ten-year EV charging demand forecast and an analysis of the associated distribution grid impacts in its biannual assessments to the General Court, including identification of areas that may require distribution system upgrades to accommodate future EV charging demand. EVICC's ten-year charging forecast can be found in Chapter 4 and the associated analysis of grid impacts can be found in Chapter 5. The analytical methodology for both the ten-year forecast and the grid impact analysis are included in Appendix 7.

Section 103 also requires EVICC to work with state agencies, stakeholders, and the EDCs following the publication of the Assessment to identify fast charging and fleet charging hubs across Massachusetts. EVICC plans to utilize pre-existing analysis from the EDCs[3] and this Assessment as a starting point to identify the following hubs: (1) fast charging hubs along major corridors and secondary transportation corridors; (2) charging hubs at public parking lots in dense residential areas, with a focus on EJ populations and transit parking lots; (3) fast charging and Level 2 charging hubs at medium- and heavy-duty fleet depots; and (4) charging hubs that serve two or more of these use cases. The results of this analysis will be shared at a future EVICC public meeting.

Last, Section 103 requires the EDCs to identify the distribution system upgrades necessary to meet a ten year EV charging demand forecast, in coordination with EVICC, and to file a plan for the necessary grid upgrades with the DPU within a year of the Assessment (i.e., on or before August 11, 2026, and every two years thereafter). EVICC will provide the EDCs with a list of electric distribution feeders and substations to evaluate for potential infrastructure upgrades, or other solutions, to accommodate transportation electrification in 2030 and 2035 based on the analysis conducted for this Assessment.[4] The list will include feeders with a load-to-capacity ratio at or above 80 percent in 2030 and substations with a load-to-capacity ratio at or above 100 percent in 2035 using the Bloomberg New Energy Finance (BNEF) EV adoption forecast discussed in Chapter 4, applied to Massachusetts.[5] The analysis used to identify feeders and substations for further evaluation also assumes that the current managed charging participation rates persist as EV adoption increases. This approach will ensure that the most likely grid constraints are evaluated first, while mitigating the risk of overbuilding, which could result in EDC customers paying for new grid infrastructure before they are needed.

EVICC will work with the EDCs and appropriate state agencies (e.g., Department of Energy Resources, Attorney General's Office, Department of Transportation, MBTA, etc.) on this subsequent grid impact analysis, ensuring that other demands on the electric distribution system, including building electrification, economic and housing development, and distributed generation deployment, are

[3]See, e.g., National Grid, Overview: Electric Highways Study, EVICC Public Meeting, June 29, 2023, https://www.mass.gov/doc/june-29-2023-evicc-meeting-national-grid-presentation/download; See also, e.g.,National Grid, Northeast Freight Corridors Charging Plan: Planning the Future of Medium- and Heavy-Duty Infrastructure, EVICC Public Meeting, December 4, 2024, 32–43, https://www.mass.gov/doc/evicc-meeting-deck-december-4-2024/download.

[4]This analysis will be updated, as necessary, based on the charging hubs identified through the processes discussed in the prior paragraph.

[5]See Chapter 5 for more information regarding the 80 percent and 100 percent load-to-capacity ratios for feeders and substations, respectively.

included in the EDCs' analysis of each feeder and substation.

EVICC will request that the EDCs include the following in their analysis:

- Whether an upgrade is required on each feeder and substation identified by EVICC in 2030 or 2035:
- If so, why and if not, why not;
- If so, information on planned upgrade(s) that would help mitigate the constraint, including, but not limited to:
    - The public planning document or public filing in a DPU proceeding where the upgrade is included (e.g., rate case, ESMP, etc.);
    - Information on the planned upgrade if it is not included in a public planning document or a filing in a DPU proceeding;
    - The expected completion date of the planned upgrade and whether the timing aligns with the timing of the constraint identified in the EVICC analysis; and,
    - If the timing is not anticipated to align with the timing identified in the EVICC analysis, whether and how the EDCs plan to reprioritize upgrades to meet the timing identified by EVICC.
- If an upgrade or upgrades that would help mitigate the constraint are not already planned or being planned or if such upgrade(s) will not fully mitigate the constraint, information on the upgrade(s) needed to fully mitigate the identified constraint, including, but not limited to:
    - Analysis of the type of upgrade needed (e.g., reconductoring the feeder from X kVA to Y kVA);
    - The expected timeline to complete the upgrade(s); and,
    - Information to support the identified upgrade(s) as the least cost option.
- For each feeder and substation, the EDCs will identify key deviations between the EDCs' analysis of future EV charging and grid capacity needs and the analysis that EVICC developed for this Assessment.

EVICC will also request that the EDCs identify any other feeders and substations not included in the list provided by EVICC that are likely to require an upgrade(s) by 2030 and 2035, respectively, as a result of future EV charging demand and related information on the upgrade(s) needed to mitigate the identified constraint.

The EDCs will present the outcome of their analysis, protecting confidential and sensitive information, as necessary, at a future EVICC public meeting.

The processes and next steps related to Section 103 are likely to evolve over the next year as EVICC, the EDCs, and relevant state agencies further develop and implement these processes for the first time. EVICC will collaborate with the EDCs and relevant state agencies to ensure the thoughtful design and implementation of these processes such that they result in productive outcomes over the next year and are well situated to be integrated with other electric distribution system planning efforts in the future.