

CHAPTER 6

Brookline, Massachusetts: A Small Town Seeking to Lead in a Broader EV Charging Network

Jennifer Hatch and John Helveston, PhD

6.1 Background and Overview

Brookline is a small township within the Boston Metropolitan Statistical Area (MSA). In 2016, Brookline was one of the top five towns and cities for total electric vehicle registrations in Massachusetts, behind only its neighbors Boston, Newton, Cambridge, and Lexington. The town is much smaller than those in this volume's other case studies, each of which has large populations and large total numbers of electric vehicles. But examining Brookline provides an opportunity to dive more deeply into processes, opportunities, and challenges for EV adoption in moderately sized cities.

Despite the town's campaign to prioritize electric vehicles, it still struggles to put its vehicle charging policies into motion. Brookline's privileged position within one of the most EV-forward states and municipal areas in the country illustrates the challenges to EV infrastructure adoption in the United States. At the same time, the successes of Brookline's adoption efforts provide some insight into the benefits of a regional EV infrastructure ecosystem and the creative ways in which a smaller town can build momentum around EV infrastructure and adoption.

6.2 State and Regional Enabling Environment

The policy and infrastructure of Brookline cannot be considered in a vacuum; the town both benefits from and is hindered by regional and state infrastructure, incentives, and policies. On that front, examining Brookline provides insight into the broader mechanisms of the region—especially for less-resourced, smaller towns as opposed to major hubs such as Boston.

In Massachusetts, the number of EVs grew from under 100 in 2011 to 5,610 in January 2016, with a high percentage (39%) of battery electric vehicles (2,193), or BEVs. There is a somewhat higher EV registration per capita in smaller communities, with most EVs in communities with 5,000 to 50,000 people. Also, consistent with researchers' findings worldwide, the correlation between where EVs are registered and where they publicly charge is meaningful.

The number of public EV charging stations (Level 2 electric vehicle supply equipment and direct current fast chargers) in Massachusetts grew from 33 in 2011 to 596 by July 2016 at a variety of charging venues, including retail, parking (short term and long term), workplaces, dealerships, hotels, schools, recreational facilities, and medical facilities. The vast majority of the charging venues contain Level 2 electric vehicle supply equipment (EVSE) solely or combined with Level 1 EVSE or direct-current fast chargers (Level 3). Well over half of the charging locations in Massachusetts offer free charging. For those that require payment, different pricing models are employed: hourly; by energy transferred based on kWh drawn from the EVSE; adjustable hourly and monthly; and flat fee.

Neighboring towns. The neighboring city of Boston is meeting challenges similar to those faced by Brookline and examined below. For example, the statewide zoning challenges discussed below require creative solutions particular to each town and city in the state. The city has required that five percent (5%) of parking be equipped with EVSE equipment and that new or substantially renovated parking areas and an additional 10% of spaces must be EV-ready.²³³ This rule is enforced not by statewide zoning laws but by the City of Boston's Transportation Access Plan and the Environment Department.

Incentives. In 2012, Massachusetts committed to a goal of putting 300,000 EVs on the road by 2025. Since that time, several pieces of climate change legislation and EV incentives have been put into place.

In late 2017, the Massachusetts Department of Public Utilities (DPU) laid the foundation for greater EV growth by approving a \$45 million charging station program put forth by Eversource—a utility serving 1.4 million electric customers in the state. The program is the largest of its kind approved outside of California, and it sparks the Commonwealth's zero-emissions vehicle (ZEV) initiative and climate commitments by deploying charging stations necessary to support EV adoption. This program is expected to deploy over 400 EV chargers across the state.²³⁴

²³³ *EV-Boston: Electric Vehicle Resources*, Available at: <https://www.boston.gov/departments/environment/ev-boston-electric-vehicle-resources>.

²³⁴ Kinney, J., *Eversource begins rollout of 400 electric car chargers across Massachusetts; 'range anxiety' seen as enemy to emissions progress*, Aug. 29, 2018, Available at: https://www.masslive.com/business-news/index.ssf/2018/08/eversource_rolls_out_electric_car_charge.html.

In addition to the significant expansion of EVSE installations, since June 2014 Massachusetts has spent over \$24 million on a vehicle incentive and rebate program called MOR-EV, which, to date, has prompted the purchase of over 11,000 electric vehicles. The program started as a \$2,500 rebate for the purchase of electric vehicles and has since been extended into 2019 as a rebate of \$1,500.

6.3 Brookline: A Small Boston Suburb

6.3.1 Overview

Compared to neighboring Boston, Brookline, Massachusetts, is a small town with limited resources for initiating a comprehensive EV charging plan. It has roughly 60,000 residents, one-tenth Boston's number. Brookline's population is generally wealthier than that of Boston, with median incomes and property values 50%–60% greater than those in Boston. Car ownership is slightly higher than it is in Boston, with roughly 80% of Brookline households owning one or more cars, while the same figure is 76% in Boston. Table 6.1 compares Brookline's demographics to Boston's and the state of Massachusetts.

TABLE 6.1 Comparative Profile of Brookline and Boston²³⁵

Category	Brookline	Boston	MA
Population	59,180	672,840	6,810,000
Median household income	\$102,175	\$63,621	\$75,294
Median property value	\$758,400	\$495,400	\$366,900
Average car ownership	1 car per household	1 car per household	2 car per household
Commute-drive alone	35.5%	39.4%	70.1%
Commute: public transit or walking	48%	46%	10%
Average commute time (minutes)	27.2	29	28.1
Own one or more vehicles	80.3%	77.0%	94.1%
Homeownership rate	49.2%	34.1%	62.1%
Poverty rate	12.4%	21.0%	10.4%
Median age	34	32	40
White population	71.6%	45.4%	72.4%

²³⁵ Available at: Sourdatausa.io 2016.

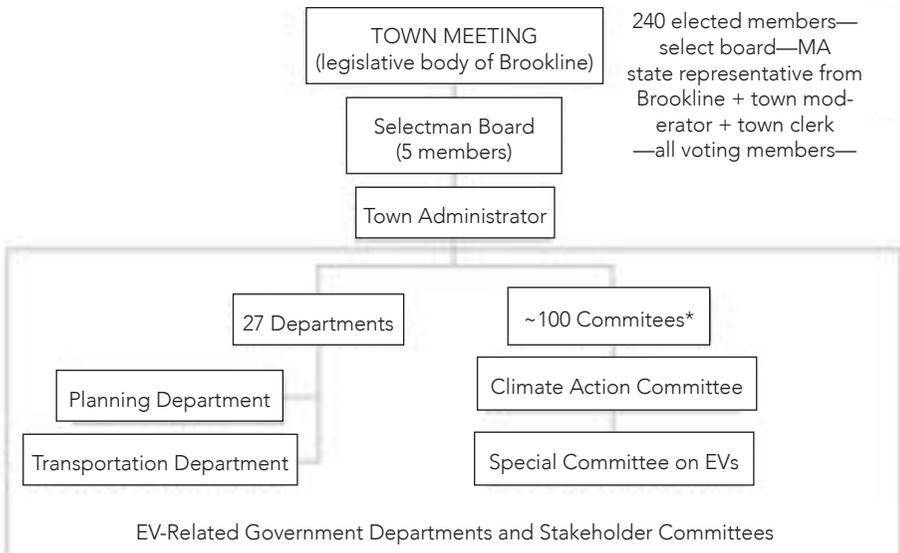
Analysis of Massachusetts’ MOR-EV incentive program indicates the most likely customers for the EV incentives program: From 2013 to 2017, households with incomes between \$100,000 and \$199,000 comprised 43% of the MOR-EV program; furthermore, 82% of MOR-EV recipients were white. Given Brookline’s high median income, it is no surprise that Brookline has among the highest absolute EV adoption numbers in Massachusetts.

Other indicators that Brookline is a promising target for EV adoption include its regionally high vehicle ownership and home ownership rates, as well as its low poverty rate. The town is characterized by well-educated citizens with relatively high incomes, two factors associated with higher EV adoption.

6.3.2 Brookline Governance and Organization

Brookline is distinct from neighboring Boston and other cities not only in its demographics, but also in its governance structure. The Township of Brookline has a well-organized local government covering typical city services. It is governed by an elected representative Town Meeting, which is the legislative body of the town, and a five-person Select Board serving as the executive branch of the township.

FIGURE 6.1 Organization of Brookline Township Governance²³⁶



* Committees are composed of staff from the Township, elected members, and stakeholders/citizens.

²³⁶ Diagram source: Editors.

Compared to other cases in this work, Brookline’s governance structure is relatively straightforward. Given the smaller population of the town and the lack of an elected executive, implementing climate action appears to be more bottom-up than the process in larger and more complex governing institutions and regions.

Bottom-up processes can have positive and negative implications for the buildout of EV infrastructure. On the one hand, it provides opportunity for citizen committees and nonprofit organizations to engage more closely and frequently with town-level government. On the other, smaller governments may have fewer resources and be less likely to attract the attention of major EV and EVSE incentive initiatives offered by state, federal, nongovernmental organizations (NGOs), philanthropies, or possibly private charging infrastructure providers, meaning that such a town must exert more effort to establish EVSE related programs.

6.3.3 Brookline Current EV Demographics

Brookline’s EV population. In the town of Brookline, 263 vehicles participated in the state EV incentive program as of October 2017. This is likely a low measure since it reflects 2017 data. A more contemporary estimate for the Brookline population of EVs is about 485 vehicles as of the beginning of 2019.²³⁷ While other cities in the Boston suburbs claim among the highest EV adoption rates in Massachusetts based on their 2016 per capita vehicle adoption, Brookline had the state’s fifth-highest absolute EV population, further solidifying the township as a leader in EV adoption.

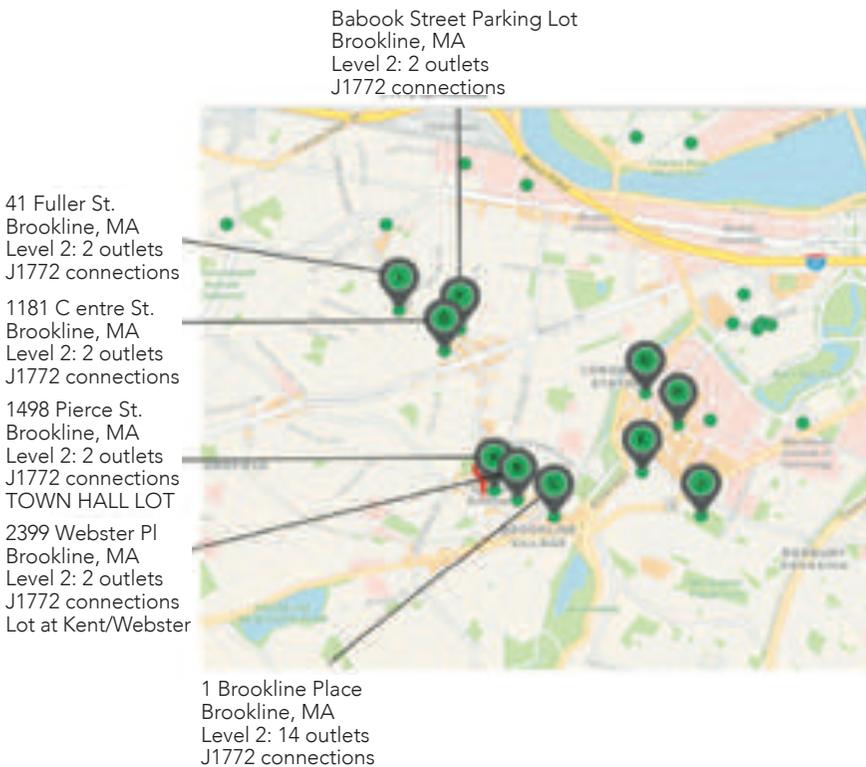
The public charging mix in Brookline is principally Level 2. Since visibility into Level 1 at-home charging is unavailable, the true ratio of chargers to vehicles is unclear. However, an estimation of 24 chargers for 430 electric vehicles is likely to be low for available charging within the township’s borders.

Surrounding accessible charging. Brookline township’s EV adoption rate benefits from its residents’ ability to take advantage of the surrounding charging infrastructure and the state incentives available to its residents. If nearby Boston-based chargers are included, access to charging stations increases. In Figure 6.2, note that in Brookline, nodes at “G,” “H,” “E,” and “J” are within about one mile of Brookline township boundaries.

²³⁷ This estimate is based on extrapolation from October 2017 data using an estimated in-state Massachusetts growth rate in EV adoption of about 87% year on year. See <https://evadoption.com/ev-market-share/ev-market-share-state/>. Also, authors have discussed present Brookline EV numbers with CSE staff in November 2017, which corroborates data used from the website included in this footnote.

Further, an estimated 506 EV charging stations are within a 30-mile radius of Brookline. This radius informs less about chargers enabling direct at-home (or nearby) charging and more about the ability of EV drivers to use their vehicles for regional trips. For instance, even for BEVs with 200- to 300-mile charge capacity, a multi-mile trip to recharge would be taken only if the vehicle’s power supply was very low. However, the broader radius of charging stations may help to address range anxiety, one of the primary barriers to electric vehicle adoption cited in EV literature. The top towns for per capita EV adoption are also all located within Boston’s suburbs—not only adding to the supportive infrastructure environment, but also to a reinforcing social environment.

FIGURE 6.2 Charging Locations in Brookline²³⁸

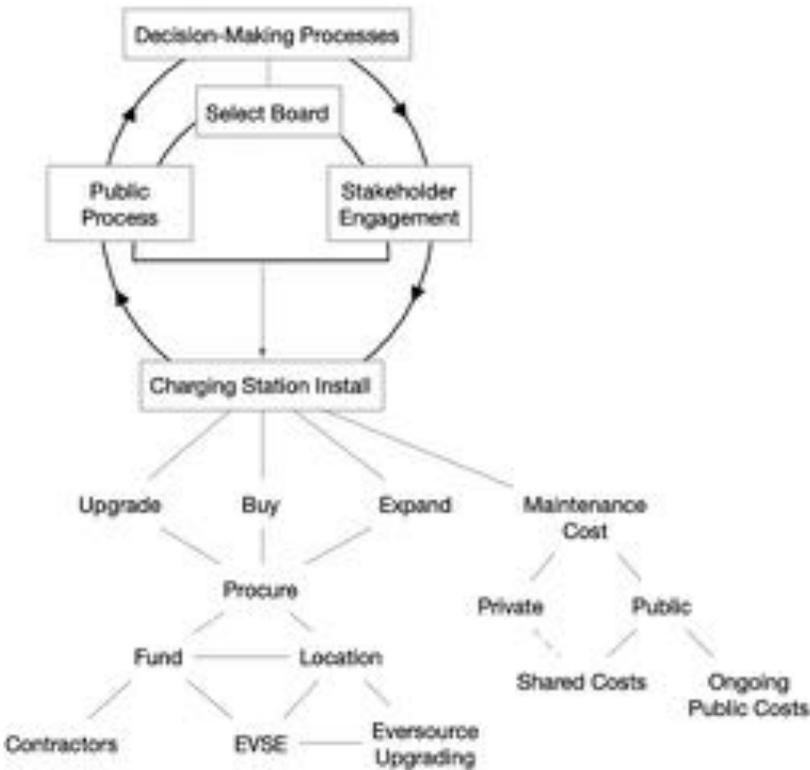


²³⁸ This is a map of the areas where EVSE charging stations operate. The map is intentionally blurred to enable more focus on the location of charging stations. Key landmarks are labeled for ease of geographic reference. The text above Figure 6.2 notes that nodes G, H, E, and J are placed at the edge of Brookline’s geographic boundaries.

6.3.4 Brookline’s EV Initiatives

Deploying EV infrastructure in Brookline is a multilayered process. Once a charging station is approved for installation, procurement cannot go forward until its specifications are mapped and included in procurement processes to select contractors. New “greenfield” charge points require different actions than upgrading or expanding existing charge points. Furthermore, township maintenance obligations must be specified and funding for ongoing maintenance must be confirmed before proceeding. When private enterprises are engaged in EV charging infrastructure, clarity regarding which entity is responsible for what maintenance obligations must be affirmed before proceeding with construction. Once these specifications are made, contractors and the EVSE must be procured, then installation can proceed following timelines specified in contracts. Figure 6.3 depicts the decision and execution that staff from the township must navigate to install EV public charging infrastructure.

FIGURE 6.3 EV Deployment Pathways in the Township of Brookline²³⁹



²³⁹ Developed by editors.

In the Brookline EV subcommittee’s exploration into opportunities and barriers to deployment, two categories of barriers came to light: legal and regulatory barriers, and financial barriers.

6.3.5 Legal and Regulatory Barriers

Aligning public and private interests is a challenge. Brookline is a town with narrow streets and a diverse mix of buildings. As noted earlier, many multifamily dwellings do not have parking spaces for tenants. Moreover, the township has had an overnight parking ban for several years, leaving car owners to park their cars in parking lots, where they pay daily or monthly fees. Some buildings have parking garages, and there are some standalone garages for private vehicles. Surface lots with leased parking spaces are ample. The challenge is for parking lot owners to reconcile the cost of EV charge point deployment with attendant revenue to cover such costs and provide a meaningful increase in parking profits.

State regulations as barriers to expanded EV infrastructure deployment. According to some town officials, many towns want to do more with EV infrastructure, but their hands are tied by state regulations. In particular, state building codes do not enable nor require EV infrastructure to be part of new building construction. This makes deploying chargers in new buildings without infringing on building code rules very difficult. The town has no authority to order private landholders to install EV charge points, leaving the town limited to inserting EVSE suggestions in developer guidelines for new developments.

Moreover, changing building codes at the state level takes time and is itself very difficult, since such changes require legislative, not administrative, action. The principal blockers to building code changes have to do with single-family homes. To require new home construction to be EV-ready increases building costs.

This also means that there can be no sweeping requirement for the installation of EVSE—the town must work with every single new development to ensure new charging infrastructure is installed. If state building codes were updated, the township could require EV charging infrastructure installations. In the absence of such changes, Brookline staff faces the complex and daunting challenge of coordinating with all affected parties to gain approvals to add charge points.

At the multifamily dwelling level, this workaround is challenging but not impossible. Brookline staff and the Select Board recommended a change to Brookline’s Transportation Access Plan (TAP) so that any major projects trigger a requirement to review transportation activity around the building location. Where possible, the township can require some chargers when housing

projects are big enough. But it is not possible to place a blanket requirement for single-family home charging infrastructure. Instead, home charging infrastructure must be required case-by-case, making single-family homes particularly complicated. One staffer said, “It’s just impossible.”

The Devil can be in the Details. Even if the EVSE have standard components, installation projects are not trivial, and execution is even slower with less standardization. But equipment problems are often the less substantial hurdles on EVSE projects. For instance, in one project, the township installed five ChargePoint chargers in multiple public spaces. Staff worked with an install vendor from a DOE-approved contractor list, and all chargers were Level 2. At two locations, electrical cabinets had to be upgraded, which required a separate grant. Brookline competed with over 200 other communities and won a “green communities” grant from the state. Thereafter, a contractor had to be hired to deal with the cabinet upgrading issues and a DOE contractor had to be hired to build the charge points. Afterward, ChargePoint did an inspection, the DOE did an inspection, and finally the five chargers were deployed. The entire process took one year, even though the equipment itself was relatively standard.

6.3.6 Financial Barriers

Funding processes are important because the township does not have funds in its budget to expand EV public charging infrastructure. Even if a private-sector entity, such as a charging station provider, invests in the infrastructure, there are public sector costs that cannot be avoided. For example, ongoing maintenance of public area spaces surrounding a privately-owned charging station accessible to the public represents an added cost to township operations. Without state help with expedited requests and approval processes, Brookline’s ability (or any town or city in Massachusetts) to expand EV infrastructure beyond incremental additions as resources permit is limited at best.

Funding issues complicate deployment in terms of funding sources, access, bidding processes, and dispersal. Funding is complicated in several ways:

- Identifying and selecting appropriate funding sources
- Competing in a bidding process
- Accepting funds and dispersing them according to schedule requirements of grants
- Accounting for funds dispersed and ensuring work products meet inspection standards

Typically, publicly funded building projects for roads and highways get federal and state money for capital costs and local entities pay for ongoing operation and maintenance. Often, these “unfunded liabilities” lead to requirements that fall outside of reasonable budgeting for towns and cities. Consequently,

either decisions are made to not undertake projects, or built facilities are neglected due to funding limitations. In one deployment case, the Township of Brookline had to buy long-term maintenance plans associated with the charging station build because the administrative staff lacked the know-how and capacity to handle maintenance. Staff said that past experiences had exposed an important problem. If a charger failed and nobody knew how to fix it, and no money was available to pay for its repair, the asset was stranded—not used and not useful. To prevent that from happening in the future, long-term maintenance plans are a workable, albeit costly, solution.

Apart from stitching together funding sources for EV charging infrastructure, the larger challenge is how decision-makers allocate funds within city budgets. Arguably, schools take precedence over building infrastructure for still-emerging vehicle-market transitions. For example, Brookline is designing two new schools with the goal that they are both net zero carbon emissions schools. This is a significant step for a small township when the planned costs are about \$200 million.

EV charging point revenue. Private enterprises providing public charging services are currently recovering costs only by charging for the parking spaces they provide. Eventually, consumers will be expected to pay for electricity services for their EVs. As the situation unfolds, the township will have the option of capturing revenue through some form of tax, or through a sharing agreement with vendors.

Building retrofits as special challenges. Retrofits can take several forms: remodeling, which does not affect the building footprint; renovations and modernizations, which can include reworking parking garages and amenities—such as surface parking lots—surrounding a building; and, finally, retrofitting multiple buildings on one or more streets. Brookline, like many cities, has experienced significant renewal and transformation, with new construction and renovation of existing structures occurring simultaneously.

Brookline township staff have tried to connect owners with the local utility (Eversource) to engage the utility in building EV infrastructure as part of the electric system upgrades retrofitting and renovation often require. Often, funding is available to support EV infrastructure construction through grants. The barrier to accessing such funds lies in having to work with all affected landowners to garner their commitment to install EV charge points, should grants be obtained.

Even if multiple landowners agree to support EV charge point installations, timing of deployment hinges on landowner schedules for renovations. Often the timing of grants being awarded and landowner schedules for construction

are misaligned, so no action is taken because landowners, for many reasons, are reluctant to—or simply cannot—alter schedules to fit grant award timelines.

Challenges in scaling EV public charging infrastructure. One proposal under consideration by the township is to place 25 chargers along Beacon Street, one of the main streets in Brookline. Such a project would cost about \$500,000, including equipment, electric system upgrading, and ongoing maintenance. One option for realizing this project would be to contract with Electrify America, which would own and operate the chargers, leasing public land from the township.

EV advisory and management functions. Brookline has taken significant steps toward climate emissions reductions and has had discussions specifically about mitigating transportation emissions since climate-change action started in the town. Two functional departments and one main advisory committee have oversight and actionable authority regarding EVs. The Planning Department is responsible for incorporating climate-related activities into town plans and the Transportation Department is responsible for all EV implementation matters.

Climate-action committee and EV subcommittee. Starting in 2000, the Board of Selectmen voted unanimously to join the “Cities for Climate Protection” program of the International Council for Local Environmental Initiatives (ICLEI). That May, the Board organized a public forum on climate change. Shortly thereafter, the first official meeting of Climate Action Brookline, a citizen’s group dedicated to emissions reductions in Brookline, took place.

Two years later, the town created a dedicated selectmen’s Climate Action Committee. The advisory group’s purview is all climate-action-related projects in the township. In its inaugural year, the committee issued its first climate action plan, which was updated in 2012. The updated plan mentions EVs several times and addresses significant behavior and mode-shift efforts toward incentivizing bicycles and regulating taxi fleets and other non-car alternatives.

In 2016, a citizen filed a citizens’ petition warrant article to request that the town require Level 1 and Level 2 charging stations. In response, an EV subcommittee was formed to examine the feasibility of such a requirement, and to explore further barriers and opportunities for EV infrastructure and incentives.

The EV subcommittee is composed of elected officials and township staff, with three independent members. One independent member is the original warrant articles petitioner, who was motivated by an interest in installing private charging services on township lands and proposed several policy changes to enable it.

The EV subcommittee worked to prepare a comprehensive study of issues related to EV deployment, including recommendations for policy and zoning

changes. Mapping deployment pathways for electric vehicles in Brookline was the first consideration.

The subcommittee report. The report included guidelines for encouraging EVSE installation, pursuit of funding sources, recommendations for building and permit planning processes, and various emphases on specific projects throughout the township. A full list of the recommendations can be seen in appendix 1.

The transportation plan. The Township of Brookline's transportation plan included providing 50 charging station ports in the public way to support an additional 300 EVs on the road. In part due to the recommendations of the subcommittee, the town has updated its transportation access plan (as of January 2018) to request that major-impact projects have charging equipment installed for at least 2% of parking spaces and that another 15% of spaces be EVSE ready.

Multifamily dwellings are not the only buildings that come under the new TAP rules. New parking garages, such as at the Brookline Village T-stop, can be required to install EV chargers. In the Brookline Village T-stop case, six new chargers were required for the project to be approved.

6.4 Current EVSE Plans

After submitting their recommendations for further work on EV charging infrastructure, the subcommittee effectively disbanded. Efforts to expand EV infrastructure are now in the hands of the township staff and Climate Action Committee. Both groups have a longer-term view of EV deployment, recognizing the need for increased EV public charging infrastructure. Brookline has the advantage of its longer-term focus, as well as its location, nestled within the larger Boston MSA. Proximity to EV charge points in the City of Boston allows the township to lean on its geographic position, should expected growth in EVs within Brookline turn out to be underestimated.

However, given the already-low EV to charger ratio in Brookline, if plans to expand EV use in Brookline are to succeed, the EV public charging infrastructure must expand significantly. While the risk that the ratio of EVs to charge points will drop is minimal (thanks to available chargers nearby in Boston), compared to in other districts with similar constraints, charging infrastructure must remain integral to the EV adoption plan.

Given the existing legal and financial barriers Brookline faces to accelerating at-home charging, in fall 2018, the town determined that fighting to require charging stations is not the best use of the town's limited funds and resources.

Instead, Maria Morelli, senior planner for Brookline, indicated that the town is focusing on influencing new commercial development.

For the fiscal year 2018–2019, the city’s transportation plans included several suggested improvements for EV charging infrastructure, but there is a notable focus on upgrading a two-mile stretch of the Beacon Street median with 50 charging ports. After suggesting all possible updates and changes given the regulatory limitations of the state, and investigating the current financial limitations of charging stations, Brookline staff came up with creative ways to incentivize EV infrastructure. Under the leadership of Senior Planner Morelli, in the last year, the town has dedicated an “investment corridor” to change perceptions of EV charging stations.

This focus was inspired by the challenges and investigations the EV subcommittee encountered over the last two years. At this point in the development of EVSE, staff realized two things: 1) EVSE is not financially self-supporting; and 2) there is not enough funding to install EVSE widely. Therefore, staff, and particularly planner Morelli, decided to reframe the promotion of EVSE in Brookline. Focusing on the Beacon Street corridor, the staff framed charging infrastructure as an amenity to local businesses, not as a money maker in and of itself. In doing so, Morelli hopes to accomplish several things:

- First, she has already begun to attract investment from utilities such as Eversource as well as local businesses
- Second, she and the local businesses in the corridor hope to attract further economic activity as EV owners wait for their vehicles to charge along the corridor
- Finally, she hopes that the momentum from the corridor will generate further enthusiasm from other business districts, which will in turn create more charging availability and incite more EV purchases

These “investment corridor” ideas are still in early stages, so their success is still undetermined. Yet Morelli is optimistic—she believes this type of corridor will have a multiplier effect that will create an environment for further investment. “Once the public gets used to it,” she says, “they will definitely ask for more.”

Brookline’s approach differs from other cities—in particular, its focus on an investment corridor demonstrates the creative thinking necessary to overcome its small-city barriers. The smaller city size and participatory governance structure are uniquely suited to concentrate resources on one specific investment zone. While larger cities may have to triage among several priorities, Brookline is in a stronger position to build consensus for specific, and effective, flagship projects. Importantly, efforts are largely the result of a dedicated group of

people who overcame legal and financial barriers to promote charging infrastructure in their town.

Clearly, Brookline is well on its way to creating a welcoming EV adoption ecosystem. Still, roughly 25,000 light duty vehicles are registered in Brookline; roughly 1.6% of those vehicles are electric. Gathering the investment and political will to push adoption from a miniscule 1.6% market share to the 80%–90% necessary to combat global climate change remains a steep uphill climb—even in one of the most forward-looking towns and states in the United States.

Brookline is remarkable for the community commitment to EVs and the bottom-up process used to frame a township EV strategy. The initiatives began with a citizen’s action committee for climate change in 2000, proceeded through citizen pressure to install further charging infrastructure, and continues with a dedicated staff working to fundraise, problem solve, and conduct significant stakeholder engagement in order to ensure that momentum builds for electric vehicles in Brookline.

Still, Brookline faces challenges on two fronts: (1) there is limited funding available to continue increasing available EV charging infrastructure, and (2) township building codes and zoning ordinances may require changing, which will lead to a collision with state-controlled policies and approval processes. So far, the town is making progress in spite of these constraints. Yet, in order for charging infrastructure to spread to other cities, even in a progressive state like Massachusetts, significant changes in law and financing need to take place.

APPENDIX TO CHAPTER 6

Subcommittee Report Recommendations

The EV subcommittee issued the following recommendations as part of their final report:

- Guidelines to encourage EVSE installation so that major projects better meet the parking needs of users and occupants
- Utilizing one of several possible alternative approaches (explained in detail in the report)
- Pursuing all available funding sources and mechanisms for public and private EV charging infrastructure
- Encouraging the Building Department and Planning Department staff to ask for EV charging infrastructure within their review of buildings plans and permits
- Pursuing an assessment of Brookline's need for additional EV charging and recommending locations, types, and funding sources for future EV charging expansion
- Advocating for adding a detailed definition of EV charging readiness to the State Building Code
- Advocating for robust funding and support for EVSE in Eversource's 17-05 rate filing
- Advocating for EV charging infrastructure funding and Zero-Emission Vehicle standards at the state legislative level
- Further analyzing the potential for EV charging at open-air parking facilities licensed by the Board of Selectmen