



CITY OF CAMBRIDGE

Zero Emissions

Transportation Plan

2025



ARUP



Project Staff

Susanne Rasmussen, Director of Environment and Transportation

Stephanie Groll, Mobility Strategy Manager

Marlees West Owayda, Community Engagement Manager

Department Heads

Melissa Peters, Assistant City Manager for Community Development

Brooke McKenna, Commissioner of Transportation

Julie Wormser, Chief Climate Officer

Executive Office

Yi-An Huang, City Manager

Owen O'Riordan, Former Deputy City Manager

Kathy Watkins, Deputy City Manager

City Council

E. Denise Simmons, Mayor

Mark C. McGovern, Vice Mayor

Burhan Azeem

Patricia M. Nolan

Sumbul Siddiqui

Jivan Sobrinho-Wheeler

Paul F. Toner

Ayesha M. Wilson

Catherine Zusy

camb.ma/zetplan

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Executive Summary

Why Zero Emissions Transportation Plan, and Why Now?¹

The climate crisis is already impacting Cambridge through extreme heat, poor air quality, and more frequent weather emergencies. The City has committed to net zero greenhouse gas (GHG) emissions by 2050. Net Zero² refers to the balance between the amount of greenhouse gas that's produced and the amount that's removed from the atmosphere. Transportation is a major source of greenhouse gas emissions, with 94% of city emissions coming from private on-road vehicles³. The Zero Emissions Transportation Plan (ZETP) aims to eliminate these emissions while creating a more accessible and equitable transportation system. Achieving this goal requires urgent action and an understanding of past planning inequities that shape how residents experience and adapt to changes.

How We Made the Plan

The Zero Emissions Transportation Plan was developed through an inclusive process to bring in a wide range of voices, especially those who are underheard, underserved, and historically excluded. The goal was to build trust, strengthen relationships, and support ongoing engagement efforts.

We worked with an advisory group, City committees, and the broader community to develop and refine potential actions. This included input from more than 50 public events, focus groups, and meetings, which helped shape how potential actions were refined and which ideas were adapted or removed from consideration.

Four key goals guided the Zero Emissions Transportation Plan:

1. Remove climate pollution from transportation
2. Make moving around Cambridge more accessible, safe, and enjoyable
3. Improve economic opportunity and address historic injustices
4. Create a stronger and more connected community

City staff also worked with consultants to estimate transportation emissions in Cambridge and model the impact of potential actions. This baseline was used to determine how many emissions need to be reduced by 2050 and to evaluate how proposed actions would contribute to those reductions.

What We Learned From Community Members

- People are open to changing how they travel but need support.
- People want to feel heard and see action.
- Higher costs for owning or parking a car can feel unfair and inherently inequitable.
- Better communication about changes is needed.
- Seniors and people with disabilities

need reliable, convenient and dignified transportation alternatives.

- Electric vehicles (EVs) are only part of the solution.
- Different solutions work for different needs, so a range of options is important.

What is in the Plan?

The Plan describes and recommends actions in six categories:

- 1. Community engagement:** Engaging people equitably to improve their transportation experience
- 2. Buses and shuttles:** Improving bus and shuttle service
- 3. Bike, walk, and micromobility:** Making it accessible, safe, and enjoyable for people to walk, bike, and take a scooter
- 4. Reducing car trips:** Giving people more travel choices to reduce the need to drive
- 5. Reducing car ownership:** Making it easier to not own a car
- 6. Electric vehicles:** Encouraging a shift to electric vehicles

The City has prioritized near-term actions based on impact, feasibility, cost, and community input.

These include:

- Helping residents access transportation options and discounts
- Improving bus speed and reliability on key routes
- Expanding access to biking and Bluebikes
- Increasing public EV and micromobility charging

What Comes Next?

Cambridge's next step is the development of a Cambridge Access and Mobility Plan, a citywide transportation planning process launching in 2026. It will build on the ZETP's foundation and further integrate land use, safety, accessibility, and sustainability to create a transportation system that meets the needs of Cambridge residents now and in the future.



Introduction

Transportation is the Last Piece of Our Climate Strategy to Address Greenhouse Gas Emissions

Climate change impacts are already creating critical challenges for individuals and communities, and for governments' responses in Cambridge and beyond. These impacts will become more severe if emissions are not reduced. For example, some major impacts in Massachusetts include:

- Extreme heat / worse air quality (leading to learning loss, more childhood asthma, death)
- Worse weather emergencies (from floods, dangerous storms, rise in sea-level)
- More economic struggles (increased demand for public services, like emergency response, food assistance, health insurance)

To address Cambridge's contribution to climate change, the City Council has committed to an ambitious climate agenda, including the use of 100% renewable energy by 2035 and achieving net zero emissions by 2050. Net zero⁶ refers to the balance between the amount of greenhouse gas that's produced and the amount that's removed from the atmosphere. The City of Cambridge estimated how many emissions we have in Cambridge, most recently in 2019⁷, and there are plans to address these emissions through the Net Zero Action Plan for buildings and the Zero Waste Master Plan. However, transportation accounts for an important share of the city's greenhouse gas (GHG) emissions and the Zero Emissions Transportation Plan (ZETP) is the last piece of the City's strategy to achieve net zero emissions by 2050.



Why Did We Make the Zero Emissions Transportation Plan?

The intent of the Zero Emissions Transportation Plan is not only to eliminate transportation-related emissions in Cambridge, but also to create a more accessible and equitable transportation system that makes traveling around the city work better for all residents.

The history of how transportation and planning have worked in the City is important to consider as we work towards these outcomes. Housing discrimination in Cambridge created inequities that were deepened by subsequent planning decisions over generations⁸, resulting in uneven economic and social advantages across communities. Disparities in the distribution of public resources have also created an uneven landscape for implementing change. As a result of these inequities, the transition to “zero emissions” (meaning no climate pollution will come from transportation) will be easier for some residents than others. Addressing this is essential as Cambridge works toward realizing a zero emission transportation system that serves everyone in Cambridge.

Given this context, four key goals guided the Zero Emissions Transportation Plan:

1. Remove climate pollution from transportation
2. Make moving around Cambridge more accessible, safe, and enjoyable
3. Improve economic opportunity and address historic injustices
4. Create a stronger and more connected community

The first two are longstanding goals the City has worked to achieve over the past 35 years. The second two are also City goals, but are now considered together with transportation actions in this plan. This Plan documents the City’s commitment both to remove climate pollution from transportation in Cambridge and to create a better, more equitable transportation system for everyone in the city. The Plan will inform citywide transportation policies.

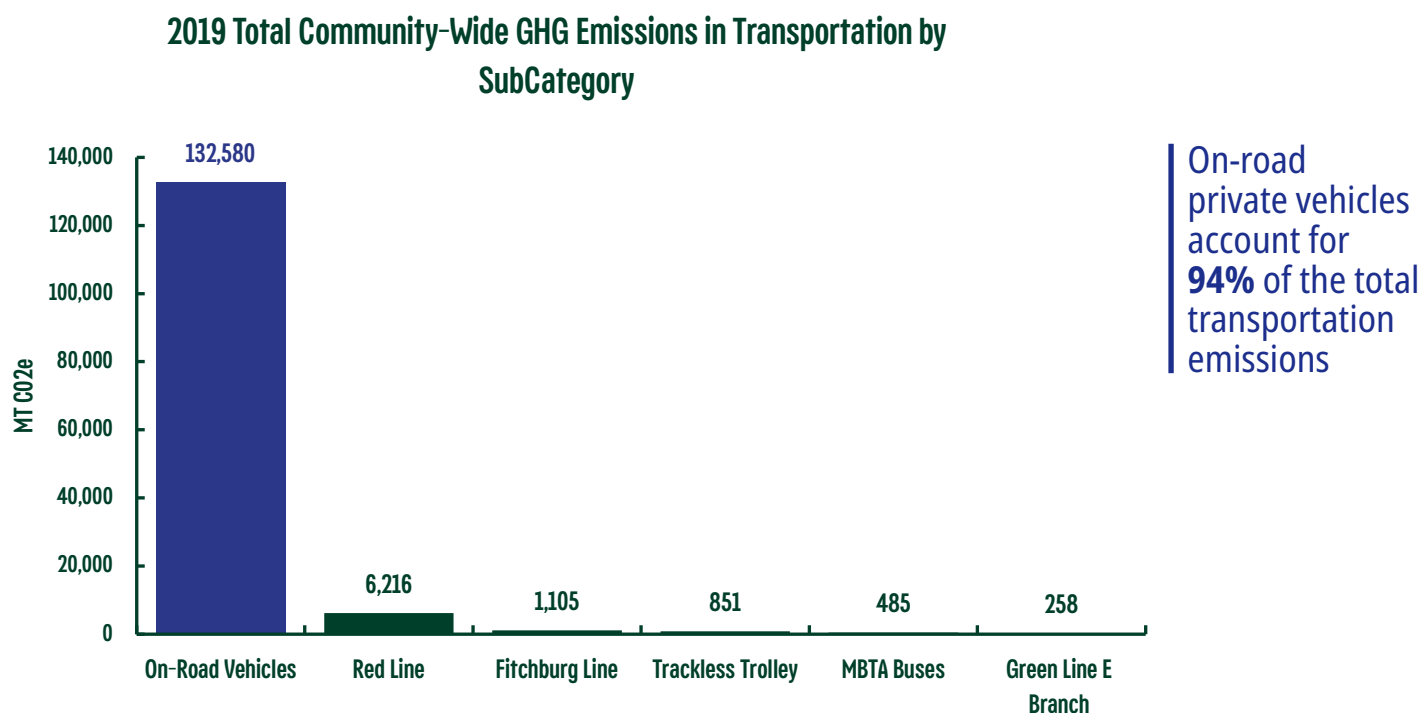
How Do We Eliminate Transportation Emissions?

Transportation Emissions in Cambridge

Most of Cambridge's transportation emissions come from on-road private vehicles. As illustrated in Figure 1⁹, these vehicles account for 94% of total transportation emissions. They are principally garaged in Cambridge and include personal and commercial cars and trucks, and Cambridge Municipal fleet vehicles. Since 2019, trackless trolleys¹⁰ have been replaced with hybrid diesel-electric buses and in 2026 they will be replaced by 100% electric buses.

Due to the way greenhouse gas emissions are measured, this Plan focuses on on-road emissions only and does not address other sources of emissions such as air travel by residents and businesses or consumer habits that generate deliveries in Cambridge. This Plan seeks to address emissions within the city, but many trips through Cambridge include travel in other cities, which the City cannot control (though it can have some influence, especially with regional coordination).

Figure 1



Walking and biking are not presented on the graph, as they do not emit GHG. In addition, emissions of delivery vehicles are not counted in this estimate, unless the vehicle is principally garaged in Cambridge.

Because most of Cambridge's transportation emissions come from on-road vehicles, the Plan recommendations primarily focus on shifting away from private vehicle use and reducing emissions from private vehicles that are still on the road.

The [Massachusetts Vehicle Census](#) shows that the percentage of commercial vehicles out of total vehicles registered in Cambridge has declined slightly in recent years: from 4% in 2020, to 3% in each year of 2021 through 2025. Therefore, about 5,303 metric tons of CO₂ are emitted by commercial vehicles that are principally garaged in Cambridge¹¹.

Table 1¹² also shows electric vehicles have increased from 1% to 4% of all passenger vehicles, a fourfold increase from 2020 to 2025. The table shows a difference between the number of Registry of Motor Vehicles (RMV) and number of resident parking permits because not all vehicle owners obtain residential parking permits. This is likely the group of residents that have off-street parking available and do not need a Resident Parking Permit to park on-street.



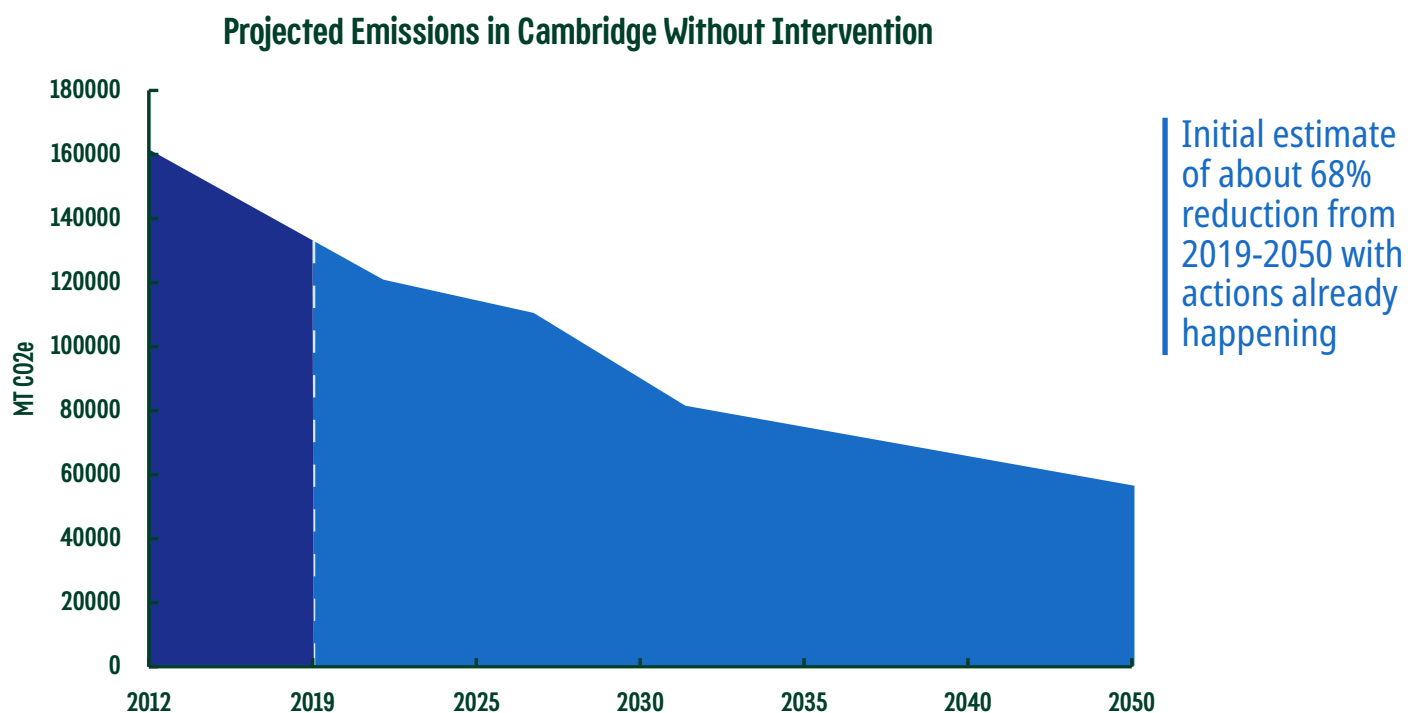
Reducing Greenhouse Gas (GHG) Emissions From Transportation Can be Challenging

While working to eliminate transportation emissions, the City is also committed to improving people's transportation options and making it easier for them to move around. To bring these goals together, this plan allows everyone to contribute in some way and improves people's options, rather than just making it harder for people to drive. Getting to zero emissions for transportation will need a significant shift in people's transportation behaviors. Not every option works for every person, so the plan needs to have a variety of ways to shift behaviors to bring down emissions. Additionally, in cases where the changes create difficult adjustments or burdens, the Plan seeks to reduce the harm or discomfort of that shift.

Ongoing and Projected Transportation GHG Reductions

Transportation emissions are expected to decrease significantly in the coming years and decades due to changes in technology and policies already underway. This will be the result of federal changes (ex. fuel-efficiency regulations)¹³, state policies and plans (e.g. MBTA improvements, roadway tolls, electric vehicles goals and policies, etc.) and market forces (ex. decreasing prices for EVs, electric bikes, etc.). Additionally, there are plans already in place in Cambridge that will help reduce emissions, such as more mixed-use areas and development near public transportation, construction of bike lanes and improved bus infrastructure, etc. All these changes already under way are estimated to reduce emissions by 68% by 2050 compared to 2019 levels. This reduction is described further in Appendix 4. That leaves a remaining gap of approximately 32% of emissions that we still need to eliminate.

Figure 2



Electrification

Transition from fossil fuel vehicles to electric vehicles means even for trips that are likely to remain in a vehicle, such as those not yet served by transit, GHG emissions can be avoided. Electrification is a useful tactic alongside mode shift and land use changes. While the latter two are imperative for lasting change, they also tend to evolve gradually due to complex connections among policies, regulations, politics, funding, and other issues. Electrification, which is shaped by policy but also by market forces, can evolve more quickly.

This shift is shown in historical data about EV purchasing, which is used to project the future share of EVs. Upfront, the shift to EVs is expected to increase under existing State policies and incentives, thereby significantly contributing to GHG reductions¹⁴.

State Initiatives

The state sets policies and incentive programs to promote compact communities, which make it easier to build a life around public transportation and shift to using electric vehicles.

Electric Vehicle Adoption

Drivers can benefit from existing state rebates and grants, including Massachusetts Offers Rebates for Electric Vehicles (MOR-EV), Massachusetts Electric Vehicle Incentive Program (MassEVIP), and DRIVE for New Vehicles. These programs make electric vehicles more affordable, with provisions aimed at making it easier for low-income residents to buy an EV. Additionally, Massachusetts is advancing grid decarbonization and improvements to combustion engine fuel efficiency standards to make gas cars more efficient. These changes help reduce the lifecycle GHG emissions for transportation.

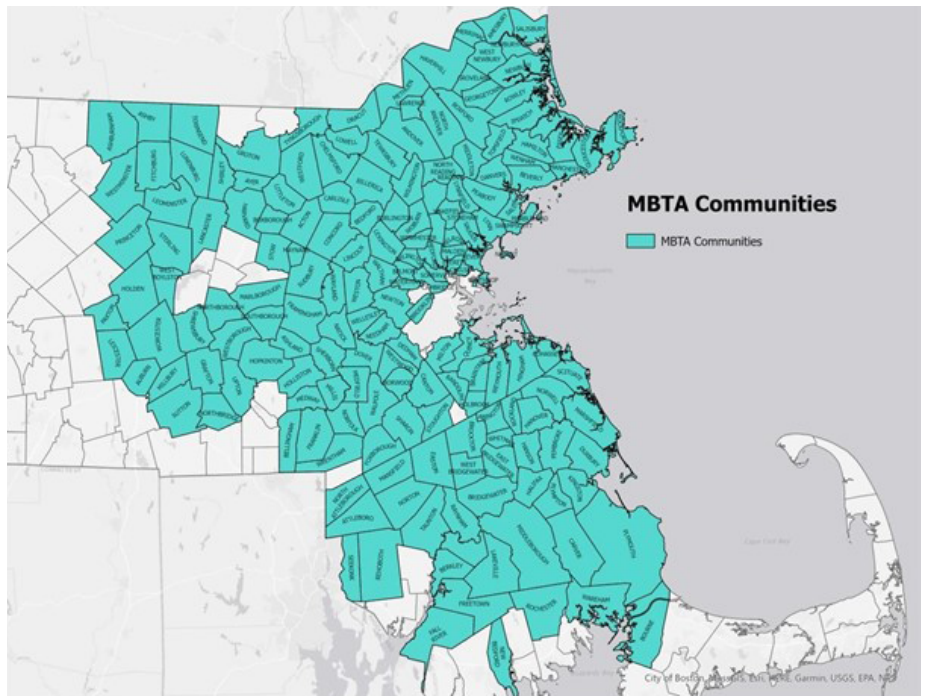
These state programs were consistent with those at the federal level until 2025. The future of federal support for EVs is uncertain and the City will continue to monitor federal programs.

Land Use Policy

Massachusetts has instituted policies to increase transit-oriented development in communities that have access to public transportation. In 2021, the legislature passed a law, the MBTA Communities Act, requiring communities that are near public transportation stations to have at least one zoning district of reasonable size in which multi-family housing is permitted as of right, located not more than half a mile from a commuter rail station, subway station, ferry terminal, or bus station, and has no age restrictions and suitable for families with children. These changes encourage growth near public transportation, which can help ensure more trips (including to employment centers like Cambridge) will happen on public transportation instead of by car.

Local Initiatives

The City of Cambridge is making planning and transportation changes to make the places people need to go closer to their homes and workplaces. It is also building more infrastructure and services to make it easier and safer to bike, walk, and use micromobility, as well as connect to public transportation options. Envision Cambridge is a comprehensive plan that set goals for 2030. Completed actions include reducing parking requirements, increasing separation between bike and cars, and improving engagement with seniors and people with disabilities on mobility projects. The Community Development Department (CDD) has led several efforts, such as a zoning amendment that allows multifamily housing as-of-right citywide up to six stories or more depending on the district.



Cambridge Vehicle Ownership Trends

Now we'll look at vehicle ownership trends. People who don't own cars tend to get around more by walking, biking, and taking public transportation, even if they also sometimes take a ride-hail vehicle. Lower vehicle ownership also makes it possible to use the city space that would be used for parking for other things that people need and want.

As shown in Figures 3¹⁵ and 4¹⁶, analysis of Cambridge resident trends since 1990 shows a decrease in cars per household. While American Community Survey data indicates a slight increase in the total number of cars owned in Cambridge, the average number of cars per household has declined because the number of households has increased at a faster rate than the number of cars. We also see that the number of households with zero vehicles has increased 6 percentage points between 1990 to 2023. More than a third of households now have no cars in Cambridge.

Figure 3

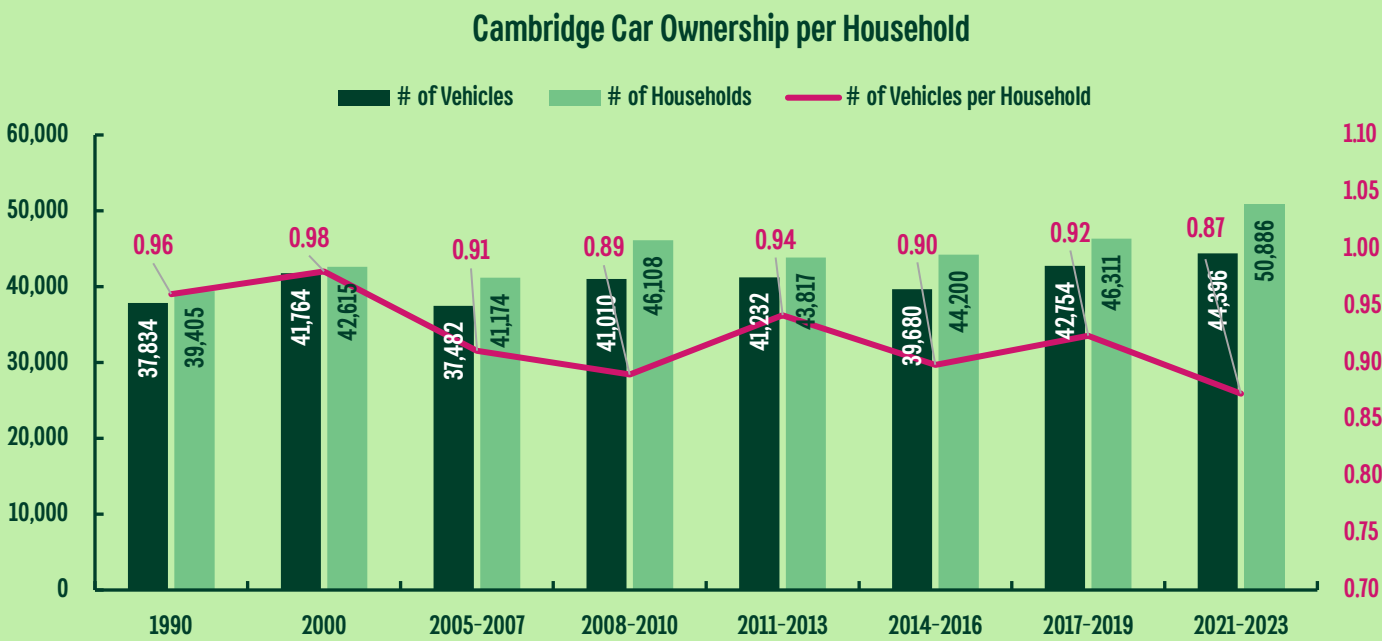


Figure 4

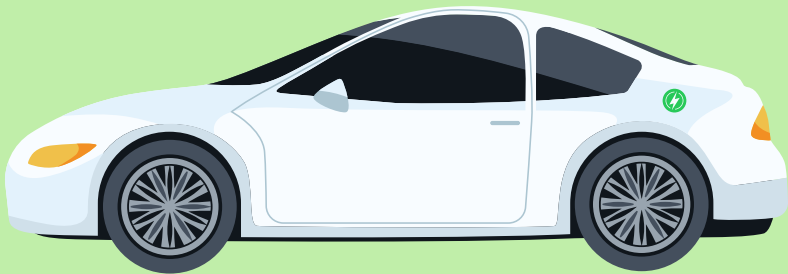
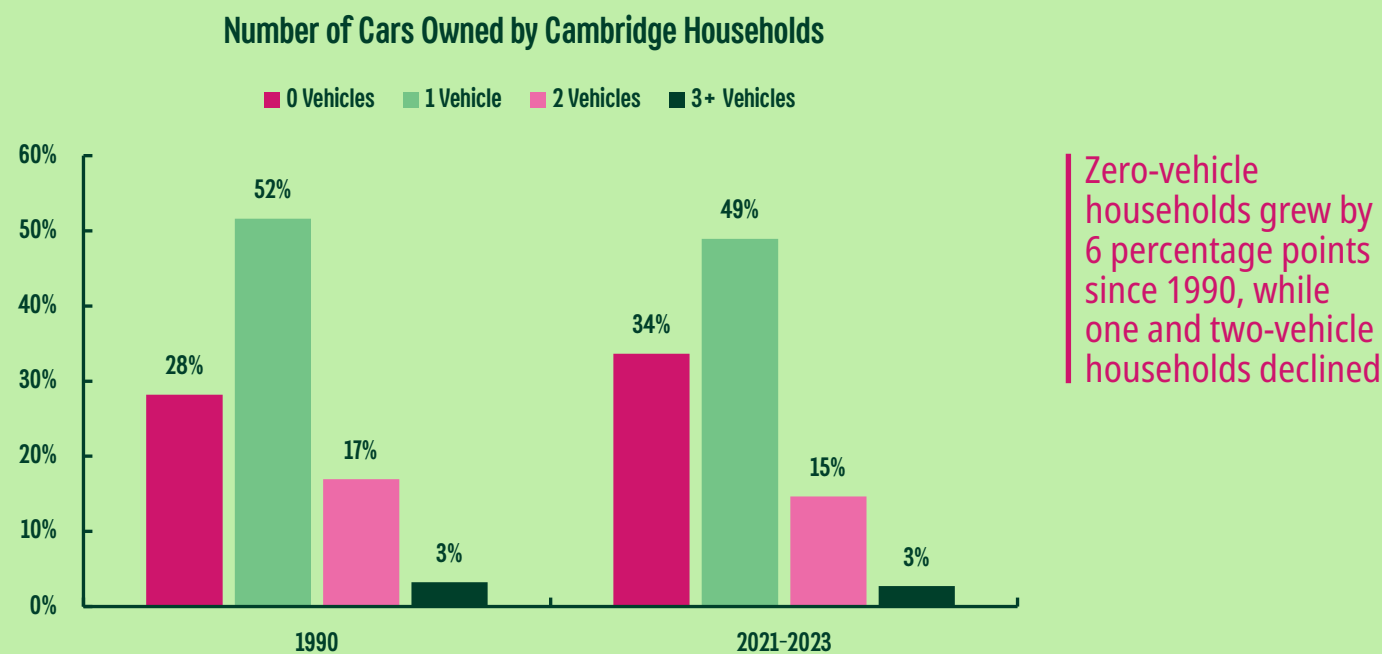


Table 1

Year	# Households ACS	# Resident Parking Permits	# RPPs per Household	RMV Date	All Vehicles (RMV)	EVs	% EVs	# Veh/HH (RMV)
2018	46,383	37,026	0.80	-	-	-	-	-
2019	47,374	38,745	0.82	-	-	-	-	-
2020	-	37,357	-	1/1/2020	42,058	416	1%	-
2021	52,487	35,326	0.67	1/1/2021	41,757	565	1.4%	0.8
2022	50,861	37,180	0.73	1/1/2022	42,516	774	1.8%	0.84
2023	49,310	39,246	0.8	1/1/2023	42,266	1,028	2.4%	0.86
2024	51,275	37,237	0.73	1/1/2024	41,668	1,441	3.5%	0.81
2025	-	-	-	1/1/2025	41,823	1,841	4.4%	-

Table 1 illustrates car ownership trends over the past seven years. While the total number of registered vehicles (about 42,000 vehicles) and resident parking permits (RPPs) (about 37,000 vehicles) has remained relatively even, they have generally decreased over time on a per-household basis due to growth in the number of households in Cambridge that own fewer vehicles¹⁷.



How Did We Develop the Zero Emissions Transportation Plan?

Technical Approach

City staff worked with technical consultants to develop a starting estimate of how many greenhouse gas emissions come from transportation in Cambridge. This baseline was used to measure how possible actions could reduce emissions.

Working with an Advisory Group and drawing on input from the wider community, City staff developed a long list of potential actions. Over the course of the planning effort, frequent community input guided how this list was refined and which ideas were included, adapted, or removed from consideration.

Three main sources from leading organizations guided our technical framework:

- **Greenlining Institute's Mobility Equity Framework** was used to help develop the goals for the plan and considerations for how to evaluate potential actions.
- **California Air Pollution Control Officers Association's (CAPCOA) Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity.** This handbook provides methods for quantifying GHG emission reductions from a list of measures primarily focused on project-level actions. The Handbook also includes methods for assessing potential co-benefits of different climate vulnerability reduction measures, as well as measures that can be implemented to improve health and equity.
- **Argonne National Laboratory's Alternative Fuel Lifecycle Environmental and Economic Transportation (AFLEET) Tool:** The spreadsheet provides detailed energy, emission, and cost data for alternative fuel and advanced vehicles (AFVs), including light-duty, heavy-duty, and off-road AFVs. This spreadsheet was used to estimate the GHG emission reduction potential of increased accessibility and usage of electric vehicle charging.

A detailed explanation of the technical approach and the assumptions underlying the model is included in Appendix 4.

The Planning Process

A key goal of the ZETP process was to develop and test new ways of engaging in planning with Cambridge community members. This included a new approach to inclusive engagement, putting the focus on getting community input starting from the very beginning to guide the development of a plan, rather than creating options or a draft plan and then asking for community reactions. The process aimed to include many voices, especially those who have been underheard, underserved, and historically excluded in the past.

We identified an additional 3 priorities: build deep and lasting City-community relationships, foster community trust in City planning, and facilitate ongoing engagement.

Following Engagement Best Practices

We followed best practices for an equitable and effective process. An equitable process should:

1. Be guided by community voices
2. Be transparent
3. Prioritize underserved, underheard, and historically excluded groups of people
4. Reduce harm
5. Build long-term relationships
6. Be accessible

Advisory Group

The process centered on the formation of an advisory group composed of community organizations that serve or represent Cambridge residents, particularly those who may have been left out of planning efforts in the past. These members contributed their lived experience and important perspectives on behalf of their communities.

Advisory Group (AG) members met for 18 months to share their experiences and relay community feedback about their mobility needs. The AG raised issues that affect equity in transportation, as well as other challenges that impact people in their communities. To support the AG process and make AG members' influence as meaningful as possible, significant time was spent over multiple meetings sharing information with the members about land use and transportation planning. Topics included transportation planning tools, opportunities, evolution in Cambridge, historical shortcomings, the role of community advocacy, accomplishments, etc. Increasing members' familiarity and fluency in these topics supported a deeper, more technical ongoing discussion in the Plan development. In addition to the Community Development Department Transportation and Environmental Planning staff managing the project, the AG was supported by facilitation and technical consultants.

The process also emphasized building relationships among the AG and between AG members and City staff. Time was spent in each meeting connecting socially over food, and most of the meetings were spent in dialogue with brief substantive presentations to share information and frame issues for AG deliberation. AG members were encouraged to partner in developing

meeting agendas, ask questions, and suggest topics about which they would like to learn more in future meetings.

AG members contributed valuable insight and experience to the process, though their “day jobs” were not focused on transportation issues. Recognizing that they offered their time to this process amidst other work and community commitments, the City secured a grant through the Urban Sustainability Directors Network (USDN) to provide stipends to compensate AG members for their time. This support also made it possible for members from community-based organizations not typically focused on transportation issues, but whose constituencies are significantly impacted by transportation issues, to defray the cost of their staff participating in the process. Also recognizing that members’ other commitments may at times conflict with AG meeting times, the project team offered the option for one-on-one catch-up calls with members who had to miss a meeting. This helped make the commitment to the ongoing process more manageable and accessible for busy members with multiple commitments and kept them up to date as the meetings built on each other.

Zero Emissions Transportation Plan Advisory Group Members

James Pierre | *Adius Arts Initiative, Founder*

Lonnell Wells | *Cambridge Bike Giveback, Founder*

Farris Blount | *Cambridge Black Pastor's Alliance, Junior Pastor*

Rachel Tanenhaus | *Cambridge Commission for Persons with Disabilities, ADA Coordinator/Executive Director*

Omriqui Thomas | *Cambridge Public School Student*

Ali Sorrels | *Cambridge Women's Center, Co-Director, Operations & Administration*

Yao Wu | *Chinese American Association of Cambridge, Member*

Ben Engle | *Food For Free, Chief Operations Officer*

Nora Sears | *De Novo Center for Justice and Healing, Volunteer and Training Coordinator (replaced Elizabeth Brusie, Assistant Legal Director)*

Ibrahim Omar | *Islamic Society of Boston Cambridge*

Karim Razazz | *Islamic Society of Boston Cambridge*

Guerlancia Laurent | *Margaret Fuller Neighborhood House, Community Liaison and Adult Enrichment Coordinator*

Angela Vierling-Classen | *North Cambridge resident*



Community Engagement Activities

In addition to the Advisory Group process, City staff connected with many community members at more than 50 events (See Appendix 1). Staff shared information about the ZETP process and hear ideas and concerns about transportation in the city that informed the Plan. Key engagement activities included:

Community Meetings

The project team held two waves of in-person and virtual community meetings:

1. The first wave occurred midway through the development of the Plan (March 2024). The purpose of this first wave was to share information about the Plan and its goals, discuss the categories of actions and issues being considered in the Plan, and get ideas and feedback about the broad categories and

potential actions within them.

2. The second wave occurred at a later Draft Plan stage (November 2024). The purpose of this second wave was to share updated information about the Plan and its goals, and share the draft actions being considered to include in the Plan. Community feedback lead to refinement of the draft actions.

Community Engagement Team at the Community Development Department (CET@CDD)

CET@CDD was an invaluable partner in the ZETP engagement efforts. CET@CDD provided feedback directly at many points in the development of the Plan. The Team also conducted outreach to share invitations (along with the availability of interpretation) to community meetings with members of their communities. Additionally, they recruited

participants from their communities and co-hosted two focus groups.

Small-group meetings hosted by Advisory Group members

Some AG members hosted informal meetings with their communities/organizations to gather additional, feedback during the development of the Plan.

Focus groups

In addition to the CET focus group, the project staff hosted several other focus groups with particular interest groups such as neighborhood associations and transportation/sustainability advocates to gather additional targeted feedback.

Committee meetings

Project staff met with several City advisory committees to discuss the Plan and get feedback at various points in the process.

Joining community events

Project staff attended numerous events throughout the city to share information about the Plan and gather feedback. This engagement, typically informal through tabling and activities at fairs, cookouts, community-based organization events, etc., helped broaden the reach of engagement, bringing information and opportunities to provide input to community members who otherwise may not have learned about or provided feedback on the Plan.

City Council hearing

Project staff and Advisory Group members presented draft strategies for the Zero Emissions Transportation Plan at a hearing of the City Council's Health & Environment Committee¹⁸. The hearing discussion helped inform this report.

Emails, online feedback form, and individual conversations

Community members shared thoughts and feedback on draft actions with project staff throughout the planning process.

Community input from all these engagement activities was collected and brought to the AG to discuss and integrate into the Plan.

This process ensured that the Plan reflected community ideas, feedback, and concerns, and that the AG's guidance was grounded in a broad range of community voices.



What We Learned from the Community to Guide the Plan

Over the course of the process with the Advisory Group and the broader community, we heard a number of critical recurring themes. This feedback guided the development of all actions in the Plan.

People want to make a change, but they need support to do so.

Community members were supportive of potential changes and improvements to Cambridge's transportation systems and willing to adopt new transportation behaviors. People would love to be less reliant on cars if other options were available. However, they emphasized that they need better transportation options to address practical barriers they face to choosing options that reduce climate pollution.

Key Themes from Community Feedback

People want to know that the City hears their mobility concerns and is doing something to address them. The responses need to be co-led by the community.

The City should engage in partnerships with the many communities in Cambridge by supporting community-led projects.

In cases where change is hard, it needs to acknowledge those challenges and work with the community to figure out how the harm or the discomfort of change can be managed.

Focus on making alternatives to driving easier.

- There are some real reasons that it can be hard to live without using a car.
- People are making the best transportation choices they can, given the options available.
- Actions should be focused on improving the choices available to people, rather than making it harder for them to use their car.
- Public transportation needs to be better, more reliable, more frequent schedules, and it needs to feel safe and be clean.
- Biking and walking need to be safer and more accessible.

Cars increase people's independence. The benefits people experience include:

- Not waiting for a bus that makes them late.
- Being able to a job that is far from home, or to multiple jobs in one day.
- Going on a weekend trip outside the city.
- Getting kids to after-school activities.
- Being more protected from violence when in a car.

At the same time, cars are also causing people to lose independence. The disadvantages people experience include:

- Not leaving the house after getting home from work because they don't want to lose a parking spot.
- Planning around kids' lives because they have to be available to drive them places.
- Not being able to receive visitors at home because they can't find parking.
- Health is especially impacted by particulates caused by vehicle traffic that worsen air quality.
- Traffic congestion makes every trip take much longer.

Pricing actions (such as making it more expensive to own or park a car) feel punitive and inequitable.

- A small increase in these costs will weigh most heavily on people with less money and be easily absorbed by people with more money. They will not significantly change behavior in either case.
- Means-testing (such as requiring people to prove their low-income status) creates onerous obstacles to receiving support and incentives. Time-intensive administrative tasks required to demonstrate eligibility demand more time and effort from people already facing systemic barriers who may benefit most from those incentives.

The City needs to do a better job communicating about the changes that are coming.

- Acknowledge the challenges that could come with transitioning to new kinds of transportation.
- Clearly explain the problems that these Plan actions will solve and how these connect to the concerns people expressed.

Seniors and people with disabilities, in particular, need a reliable, convenient, and dignified way to get around. The Plan needs to take seriously the need to improve these people's mobility options and disrupt the pattern of their needs being left out, as has occurred historically in other planning efforts and contexts.

Electric vehicles (EVs) and charging needs to be more affordable and accessible. This needs to include education and outreach to help make it easier for people to feel comfortable using an EV.

Also, EVs are only part of the solution.

EVs can eliminate transportation-related emissions, but still create traffic and safety concerns. They also have other negative effects from the intensity of resources required to build and operate them and impact on indigenous communities around the world.

Housing needs to be more affordable to allow people to live closer to where they need to go. People need easy, close access to the places they regularly go to make it possible to walk, bike, or take public transportation.

Those who are responsible for creating more emissions and who have more resources now as a result, should have more responsibility for reducing them. Individuals and large institutions who have profited from the system as it has functioned should take on more responsibility for reducing emissions than marginalized people who live with at least as many burdens.

Not all actions have to be for all people. All communities and different types of people should be able to see themselves in the Plan. There must be many transportation options, so everyone can see ways to contribute to emissions reduction and have opportunities to improve their mobility.

To be successful in eliminating GHG emissions, we need to:

1. Support a broad culture of sustainable mobility that reflects and invites participation from the whole Cambridge community.
2. Infuse social connection into our transportation network to make travel a part of what enriches people's lives.
3. Ensure the transition is as comfortable as possible.



Recommendations

How Did We Decide on These Recommendations?

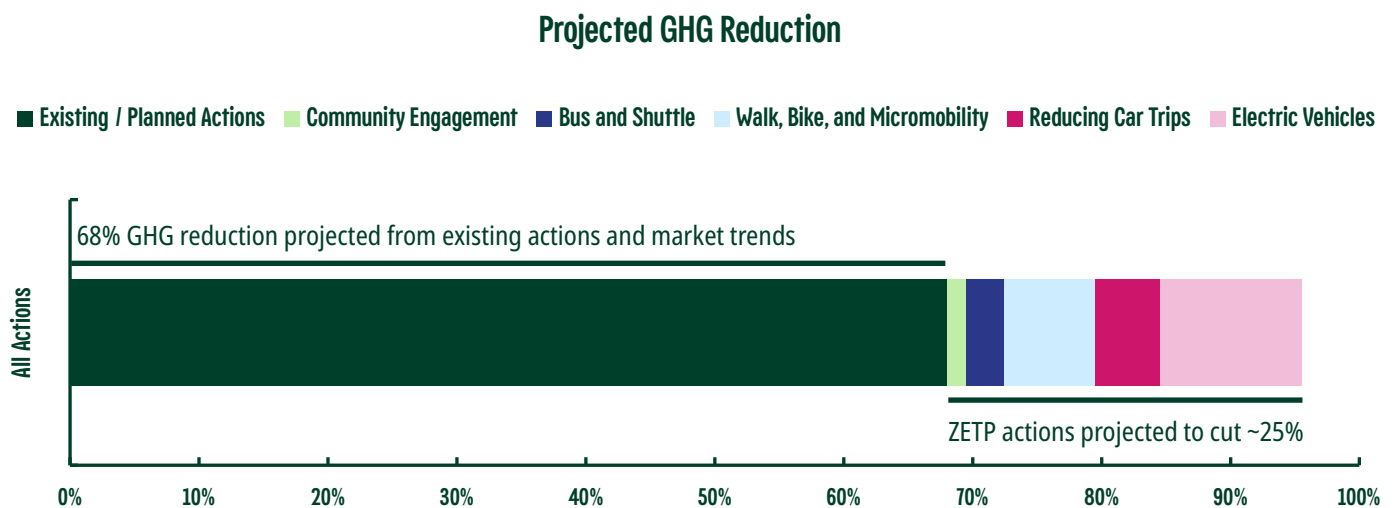
Throughout this process, we evaluated how each of the following recommendations would advance our core goals:

- Remove climate pollution from transportation
- Make moving around Cambridge more accessible, safe, and enjoyable
- Improve economic opportunity and address historic injustices
- Create a stronger and more connected community

To guide our approach, we used national best practices for quantifying transportation emissions to develop a baseline and then calculate the emissions reduction potential of actions. We prioritized solutions that would deliver the greatest impact with the most equitable outcomes. While some recommendations do not have a direct impact on emissions, they will improve the quality of people's transportation experience and will help make some of the more challenging parts of transitioning to zero emissions transportation more feasible and appealing. Finally, we focused on developing a plan that addressed factors that the City can control, or at least directly influence.

The plan contains actions that encourage a shift in behavior. If we take all these actions, we expect to eliminate about 25% of the remaining GHG emissions based on the 2019 GHG Emissions Inventory. As noted on figure 5¹⁹, some changes already underway are expected to reduce emissions by 68%. This leaves an estimated 7% of emissions left to eliminate, which we will monitor as we get updated models of emissions and address with future updates.

Figure 5



Strategies to Get to Zero Emissions by 2050

The following tables contain six categories of recommended actions:

- 1. Community Engagement:** Engaging people equitably to improve their transportation experience.
- 2. Buses and Shuttles:** Improving bus and shuttle service
- 3. Bike, Walk, and Micromobility:** Making it accessible, safe, and enjoyable for people to walk, bike, and take a scooter
- 4. Reducing Car Trips:** Giving people more travel choices to reduce the need to drive
- 5. Reducing Car Ownership:** Making it easier to not own a car
- 6. Electric Vehicles:** Encouraging a shift to electric vehicles

Community Engagement (CE)

Community engagement actions are about partnering with Cambridge residents to improve people's mobility options and collaboratively transition to new transportation systems and behaviors. The goal of this category is to make transportation more affordable, inclusive, and responsive to community needs by increasing awareness, engagement, and building support for community-led initiatives.

Why do we have Community Engagement as its own category?

- We need an inclusive process to hear directly from communities about how to improve sustainable mobility options and then communicate changes.
- We need to strengthen relationships and build trust.
- We need to partner with community groups and build shared ownership in this transition.

Category	Recommended Actions	What Could This Look Like?
CE-1	Provide a high degree of City support to help resident navigate transportation changes, and access transportation options and discounts.	Examples • Offer one-on-one support, using the Cambridge Economic Opportunity Committee's model, to help residents enroll in income-eligible programs and navigate opportunities (remotely, by phone, or in community spaces). • Add clear bicycle route signage, like San Francisco's "Wiggle" signs that direct cyclists to various points of interest via safe infrastructure. • Expand the Safe Routes to School program for Cambridge youth through the school system. For example, incorporate transit training into the existing 2nd and 6th grade walking and bicycling training. • Develop a one-stop-shop strategy to help residents enroll in discounted transit, Bluebikes, and other non-transportation programs, such as food and fuel assistance. • Explore creation of a seamless on line system for eligibility screening and enrollment in discounted programs. • Provide accessible transportation information and workshops, with additional efforts to reach underheard, underserved, and historically excluded people. Considerations • Ensure outreach about resources, events, and opportunities to engage is shared in multiple languages through diverse channels, including Harvard Crimson, CCTV, Cambridge Day to reach broad audiences such as youth and college students.

Category	Recommended Actions	What Could This Look Like?
CE-2	Encourage community-led initiatives that improve awareness of low-carbon transportation options and support a culture of sustainable mobility across many different communities.	Examples • Provide dedicated funding and staff resources for relationship-building, such as an expanded Community Engagement Team or activities proposed by community groups. • Identify Neighborhood mobility “community connectors” within communities to connect residents to resources, opportunities, and trainings. • Hold neighborhood conversations to address and solve mobility issues. • Collaborate with youth ambassadors to host events and ensure seniors and people with disabilities can participate safely. • Partner with community members to create an all-mode etiquette and education program. • Engage Transit, Bike, Pedestrian, and Climate committees, and Youth Council to support community relationship-building efforts.
CE-3	Conduct a transportation security index survey.	Effects of this action • Information collected on how residents' lives are shaped by their transportation needs and options will provide a better understanding of: • How safe, easy, reliable, and comfortable people's transportation experiences are • Potential disparities in transportation experiences across different groups, such as racial or income disparities • Ongoing progress in reducing transportation disparities over time. Considerations • Use a wide range of tools to gather input and make participation accessible to all.

Buses and Shuttles (BAS)

The buses and shuttles actions aim to improve public transportation by improving the frequency and reliability of buses, upgrading on-demand shuttle services for seniors and people with disabilities, and expanding community knowledge and access to existing bus and shuttle services. These strategies collectively seek to make bus and shuttle transportation more efficient, accessible, and responsive to the range of community transportation needs.

Category	Recommended Actions	What Could This Look Like?
BAS-1	Enable better bus frequency and reliability by installing bus priority projects on (signal priority, queue jumps, or bus lanes).	Examples • Combine new bus lanes with pedestrian safety measures in the same construction phase to maximize benefits. • Spearhead regional efforts to develop funding and design solutions to bus priority projects and support the MBTA's Bus Network Redesign priorities. • Advocate for extended bus service hours on key routes serving essential workers, hospitals, and universities. Effects of this action: • Queue jump lanes and new signals at certain intersections to help buses move ahead of traffic and operate more reliably. • Fewer travel lanes and/or less parking for private cars on some streets to provide more street space for vehicles transporting more passengers. • More dedicated bus-only lanes to support three times as many buses per hour on key Cambridge routes, with MBTA requiring bus lanes for municipalities to qualify for improved service. • Decreased street congestion over time, with peak-hour traffic remaining until more people shift from driving to taking the bus. • More comfortable bus stops {e.g., with shelters, real-time bus information, and larger areas for wheelchair users}.

Category	Recommended Actions	What Could This Look Like?
BAS-2	Improve on-demand shuttle service for people with disabilities and seniors.	Examples • Enhance service in the following ways: • Offer specialized vehicles to accommodate a range of disabilities, ensuring comfort and safety for all passengers. • Hire and train compassionate drivers who understand the unique needs of the disability community and provide assistance as needed. • Provide coverage to and from key locations in Cambridge and surrounding areas, facilitating access to medical appointments, employment, social events, and more. • Use real-time booking technology (call center and app). • Investigate regional collaboration opportunities to expand Door2Door shuttle service hours and eligibility by trip-purpose and income. Effects of this action • Accessible, reliable transportation that allows seniors and individuals with disabilities, to travel with dignity, maintain their independence and actively participate in their communities.

Category	Recommended Actions	What Could This Look Like?
BAS-3	Expand knowledge of, access to, and comfort with public transit options, including existing publicly accessible shuttles, especially for youth.	Examples • Include shuttle availability in transportation information and incorporate with public transit shuttles in transit-planning efforts. • Include education about how to use the public transit system in middle existing publicly school curriculum. • Explore options to expand Charlie Card subsidies for more students. Effects of this action • Availability of transit data in a format that ensures shuttles are included in transit and trip-planning apps (GTFS). Considerations • Work with private and institutional shuttle providers to ensure public access to their services.

Walk, Bike and Micromobility (WBM)²⁰

The walk, bike, and micromobility actions seek to make walking, biking, and scootering practical, accessible, and appealing travel options. By developing comprehensive infrastructure, support systems, and community programs, these actions further the convenience, accessibility and safety of these options for residents of all ages and abilities. City staff have participated in state-level planning for a changing micromobility landscape. They are working to clarify safety rules and expand options for micromobility, which can help reduce single-occupancy vehicle travel, especially for short trips, as well as provide more mobility options for seniors and people with disabilities.

Category	Recommended Actions	What Could This Look Like?
WBM-1	Improve and maintain walking infrastructure.	Examples • Provide equitable maintenance and attention to sidewalks in low-income and historically burdened neighborhoods. • Keep sidewalks remain smooth and easy to walk and roll on, free of snow, leaves, and other obstructions, and marked with clear directions to accessible routes. • Continue to fund and implement DPW's Five-Year Plan for Sidewalk and Street Reconstruction and the Miscellaneous Sidewalk Program. Effects of this action • New infrastructure for comfortable walking in hot weather, including water fountains, shade, and public benches beyond bus stops, located according to shade data identifying the hottest streets. • Raised crosswalks, improved visibility at intersections, and flashing beacons at high-traffic locations to make walking to other modes easier and safer.

Category	Recommended Actions	What Could This Look Like?
WBM-2	Improve bicycle infrastructure, including building the Citywide Bicycle Network Vision.	Effects of this action • A network of safe, comfortable streets for people of all ages and abilities to use, providing access to all destinations in the city. • Reduction of some car lanes and/or street parking to create safe biking space. Decreased street congestion over time, with peak-hour traffic remaining until more people shift from driving to biking. • Less reliance on private cars and buses for school and activity-related trips as more families bike with their children and more youth bike independently. Considerations • Work with CCPD to integrate safer crossing of bike lanes for people with disabilities. • Increase access to charging and storage for e-bikes and e-scooters. • Clarify rules and regulations for e-scooters and other small e-devices. • Establish clear procedures for handling and tracking pedestrian and cyclist crashes, as well as bike theft to inform future policy.

Category	Recommended Actions	What Could This Look Like?
WBM-3	Improve access to bikes through support for community groups and improvements to the Bluebikes system.	Examples • Support community organizations in providing access to bikes, bike repair, and riding education. • Coordinate with the MBTA to improve bike storage at stations. • Establish a regional, centralized governance structure for Bluebikes to improve community system performance. • Develop a strategy to expand Bluebikes stations so most Cambridge residents and workers are within a 3-minute walk (about 170 Bluebikes stations), with ongoing evaluation of future needs. • Add more electric bikes to the Bluebikes system and explore integration of accessibility options. Effects of this action • Convenient, affordable access to bikes and cargo bikes, combined with education in riding, repair, and safety, delivered through the City's education efforts and community-led culture-building activities. • Easier alternatives to driving, with e-bikes for longer trips and high-quality connections to buses and trains. • Slight parking reductions if curbs are extended for new stations. • Education efforts will be a part of an all-mode etiquette and education program in action CE-2.

Reducing Car Trips (RCT)

Reducing Car Trip actions reduce resident dependence on car travel through creating more integrated transportation systems and leveraging technology, policy, and regional cooperation. While reducing car trips is an important strategy to address transportation emissions, it is important to recognize that individual travel choices are complex and influenced by various factors, such as personal identity, life experiences, and specific trip circumstances. When discussing reducing car dependency during community engagement events, the community raised concerns over punitive measures that make residents feel penalized or shamed for owning a car or forced into uncomfortable behavior shifts. Advisory Group members shared these concerns. Therefore, the actions developed in this category focus on improving support and options for other transportation modes.

Category	Recommended Actions	What Could This Look Like?
RCT-1	Expand employer and property owner responsibility for supporting sustainable transportation.	Examples • Develop a strategy for community engagement about transportation options that align with legally regulated processes. • Require more properties, including residential and commercial properties with supporting 20 or more parking spaces, to limit driving trips. • Increase the number of properties offering employees cash incentives to take public transit or bike instead of using parking, starting with larger properties and later including smaller ones. Effects of this action • Increased access to discounted T passes and other non-car mobility incentives for people who live or work in Cambridge. • Greater reliance on buses, trains, carpools, bikes, and walking. • Reduced traffic congestion, improved safety for vulnerable road users and less competition for parking. • Potential costs increases for business owners, if property owners pass on expenses. Considerations • Recognize that some people will continue to drive due to the nature of their work (e.g., cleaning crews) or disability needs. • Share the program's results and celebrate the successes of participants.
RCT-2	Research possible approaches to use technology to improve Cambridge residents' experience of getting around, with financial support for residents with low incomes.	Examples: • Offer sponsored access to a trip-planning app so people can plan trips across all modes more easily. • Provide monthly financial support in a mobility wallet for low-income residents to cover transportation expenses, such as transit fares, Bluebikes membership, bicycle purchase and maintenance, EV carshare membership, etc.

Category	Recommended Actions	What Could This Look Like?
RCT-3	Participate in State and regional discussions about congestion and other emission pricing in Greater Boston	Examples • Coordinate with neighboring municipalities to discuss regional congestion- or emission-pricing, in partnership with the State. • Investigate opportunities for participating in State discussions, determine representatives to participate, and establish the City's position. Effects of this action • Significant reduction in traffic and air pollution, with potential improvements in traffic safety and increased funding for transportation. Considerations • Ensure Cambridge's input in these conversations reflects community needs and desires and uses an equitable approach. For example: • Drivers could pay a fee to enter the urban area, with gas-powered cars paying more than electric and hybrid cars, and with discounts for low-income individuals. • Conduct a study on the emissions reduction potential of road pricing, • Discuss, if applicable, whether the State should adopt vehicle miles traveled as a new metric for assessing the impact of new development.
RCT-4	Create better connections between transportation modes.	Examples: • Establish uniform standards at key intersections and squares. • Explore options for seamless fare transfers between MBTA and Bluebikes .

Category	Recommended Actions	What Could This Look Like?
RCT-5	Further expand collaboration with neighboring municipalities and universities on regional projects and key advocacy issues.	Examples • Address transportation emissions with neighboring municipalities as part of a regional system, through the Massachusetts Mayors' Association and other staff level efforts. Effects of this action • Increased coordination between neighboring municipalities and universities, resulting in: • Unified advocacy to state officials on regional policies and major projects (e.g., emerging technology issues like micromobility) • Joint applications for grants and other funding opportunities • Expanded connections to multi-use paths and better bus and commuter rail service • Less traffic on Cambridge streets when fewer people commute alone in cars • Reduced air pollution • Increased traffic safety • Fewer pass-through car trips in Cambridge

Reducing Car Ownership (RCO)

Reducing Car Ownership actions encourage car-free transportation by providing incentives and support for residents who forgo car ownership. The goal is to reduce car dependency, traffic, and parking demands and make it easier for residents to rely on walking, biking, and public transportation. Feedback from the community and the Advisory Group emphasized that the City should carefully design any such programs to avoid unintended consequences and ensure equitable access to incentives, especially for lower-income individuals and people who already live without a personal vehicle. Reducing car ownership is a critical path to get to zero emissions. Most of the impactful strategies are indirect, like making other modes work better, but this Plan acknowledges the importance of this shift with its own category since it is a key piece of the puzzle for achieving our sustainable transportation goals.

Category	Recommended Actions	What Could This Look Like?
RCO-1	Explore meaningful ways to acknowledge residents who have no registered vehicles, including eligibility for households that reduce their number of cars.	Examples - Identify and address the barriers that prevent car-lite residents from going fully car-free. Effects of this action - Reduced car ownership leading to more walking, biking, and transit use, along with less parking competition and car traffic in Cambridge. Considerations - Include families that go from 2+ cars to only 1 car . - Avoid providing additional benefits to people already financially able to own a car. - Extend this program to homeowners, renters, college students, and unhoused individuals in Cambridge.

Electric Vehicles (EV)

Electric Vehicle actions reduce barriers to EV adoption by expanding accessible charging stations, considering electric pricing models, requiring EV-readiness in new developments, and providing supportive resources for Cambridge residents. Some community members emphasized that although EVs are a critical alternative to gas-powered vehicles, reducing reliance on cars in general is still an important goal for the city, considering all the other impacts of cars (e.g. use of space for driving and parking, traffic, safety, air quality and noise, etc.)

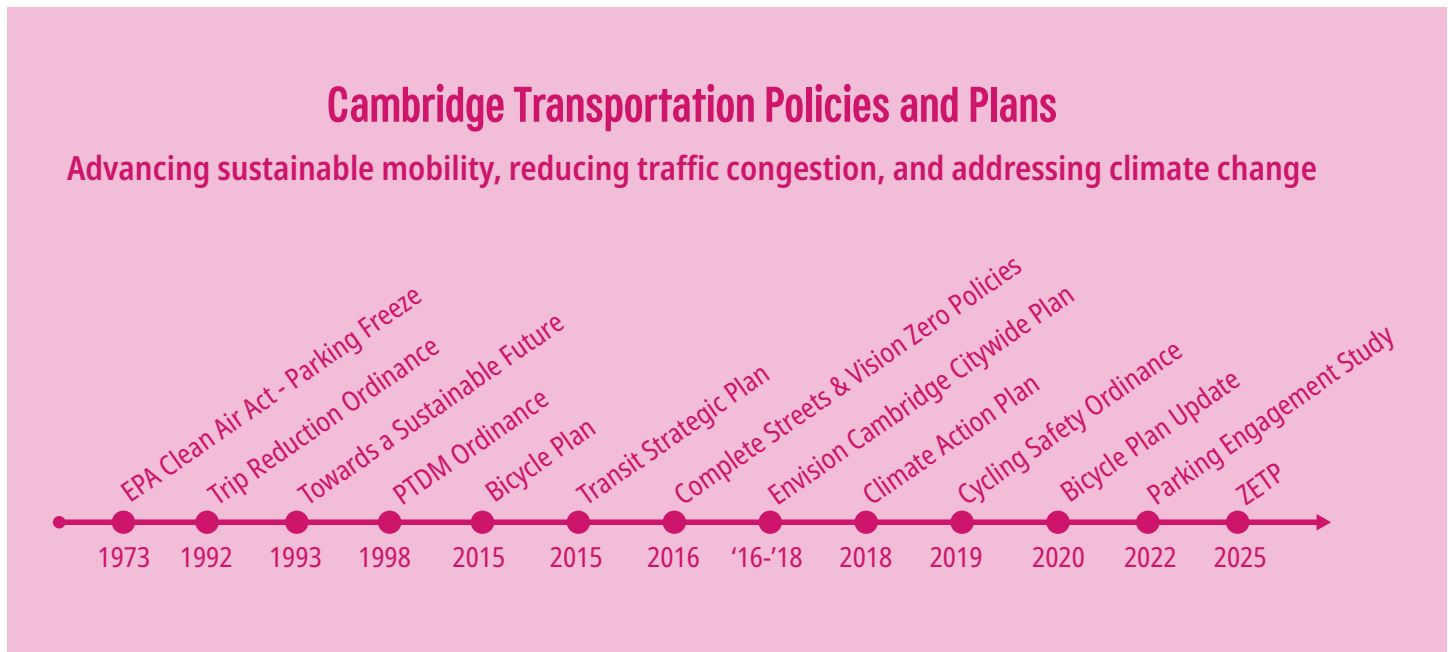
Category	Recommended Actions	What Could This Look Like?
EV-1	Increase availability of publicly accessible charging and fast charging electric vehicle (EV) and mobility devices (ex. e-bikes and e-scooters).	Examples • Develop a strategy to increase public charging on private property, such as at large retail locations or gas stations. Effects of this action • Expanded public access to electric vehicle charging through publicly owned, privately owned, curbside, and off-street options, with solar EV charging where possible. • 100 publicly owned chargers by 2027, and 475 publicly-accessible Level 2 chargers and 25 DC fast chargers by 2050 in Cambridge. • Designation of certain parking spaces for EV chargers. • Continued use of sidewalk space for EV chargers (where sidewalks are 6 feet or wider). Considerations • Ensure EV chargers are usable for people with mobility limitations, without restricting accessible parking to EV only. • Develop a strategy to provide public charging stations in commercial areas for e-bikes, e-scooters, and other e-micromobility devices. • Weigh City policies and practices for granting residential parking spaces against the need to expand a publicly accessible EV charging network.

Category	Recommended Actions	What Could This Look Like?
EV-2	Work with affordable housing sites to add EV charging for site residents.	Effects of this action • Installation of four ADA-accessible Level 2 chargers at twenty locations (80 additional charging spots). • Increased charging access for residents at affordable housing locations. • Easier charging access for visitors to CHA residents with electric vehicles, e-bikes, or e-scooters. Consideration • Ensure that installing EV chargers does not increase the cost of housing. • Pair with an EV carshare program to provide access to an EV without requiring ownership.
EV-3	Require new developments to install EV charging (Level 2 or DC fast charging) to serve 25% of total number of parking spaces and make the remaining 75% of spaces EV-ready.	Examples • Align Cambridge's zoning requirements with Boston's EV Readiness Policy for new developments (installing wiring for EV chargers in all future parking spaces). • Require developers to provide sufficient electrical panel and transformer capacity to support future installation of chargers for all parking spaces. Effects of this action • More buildings equipped with EV-charging and readiness for an all-electric vehicle future.

Category	Recommended Actions	What Could This Look Like?
EV-4	Advocate that Eversource provide discounted EV charging rates at off-peak times.	Examples • Explore a pilot off-peak rate incentive for multi-family buildings to ensure access for renters and condo owners. • Include micromobility charging in off-peak rate structures, where possible. Effects of this action • Lower-cost charging options to make EV ownership more feasible for low-income residents. Consideration • Collaborate with Electrify Cambridge and Climate Committee on this work.
EV-5	Provide high degree of support to help residents access existing state and federal incentives and rebates for buying EV's and learn more about using and charging EVs.	Examples • Offer EV 101 workshops providing information on total cost of ownership, and other sustainable mobility options. • Work with partners such as the Green Energy Consumers Alliance, Electrify Cambridge, and the Climate Committee to advance this work and educate people about EVs. Effects of this action • Improved access to and awareness of incentives that reduce the cost of buying a new electric vehicle. • Faster transition from gas vehicles to electric vehicles for Cambridge residents.

Current Policies and Plans

Current policies and plans are under way to move the City closer to its climate and transportation goals. The ZETP actions are not trying to change existing planning efforts. Instead, they are meant to complement these policies and make the transition easier for people.



In addition, there are numerous existing City programs whose goal is to make it easier, safer, more accessible, and more affordable for people to walk, bike, take transit, and shift to driving electric vehicles.

Examples include:

- Bluebikes regional public bikeshare system
- Safe Routes to School program
- Bicycle education workshops for youth and seniors
- Transportation outreach and Information about sustainable transportation for City employees and community members
- Bicycle Committee, Transit Advisory Committee, Pedestrian Committee
- Bicycle access program
- Bike parking program
- Bus stop amenities program
- Traffic Calming Program

- School Wellness Policy
- Five Year Plan for Sidewalk & Street Reconstruction
- Private development infrastructure improvements and mitigation
- Public electric vehicle charging station program

State policies include:

- MassDOT Project Development and Design Guide
- MassDOT Healthy Transportation Policy Directive
- MassDOT Transportation Planning Greenhouse Gas Reduction
- MassDOT Beyond Mobility 2050 Transportation Plan



How Will We Measure our Progress Towards Zero Emissions?

To help us reach our goal of zero climate pollution from transportation by 2050, this Plan includes targets to track our progress. These are “SMART” goals, meaning they are:

- **Specific:** Clear about what Cambridge wants to achieve.
- **Measurable:** Has an objective way to measure and evaluate success.
- **Achievable:** Is ambitious but attainable with the resources available.
- **Relevant:** The goal meaningfully contributes to larger City objectives.
- **Time-bound:** There are time-frames and checkpoints (2030, 2040, 2050).

These goals will help the City track whether the Plan actions are successful, so we can change our approach if it’s not working. We chose these SMART goals because they measure progress on the Plan’s high-level priorities, the City’s overall goal to cut all transportation climate emissions, and the City’s goal to reduce driving alone in Cambridge.

We used a 2019 baseline to match our last greenhouse gas inventory. In cases where the baseline was a different year, we noted it below.

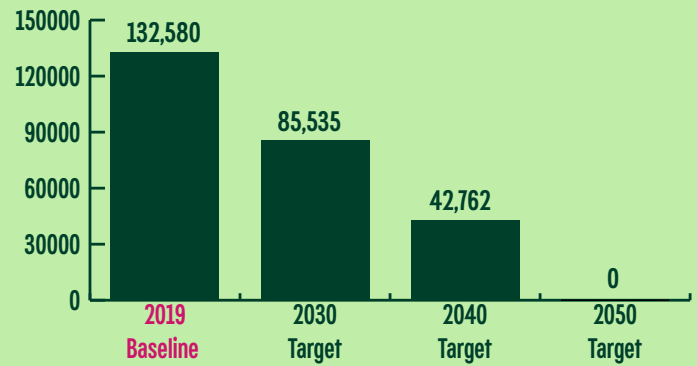
These targets follow a straight path from 2019 to 2050. We have reason to expect progress towards these targets will not be linear, but we don’t have better ways to estimate. In 5 years, we will review the targets and adjust as necessary.

SMART Goal 1

Reduce transportation emissions (MTCO₂)²¹.

Desired Outcome

Transportation no longer causes any climate pollution.

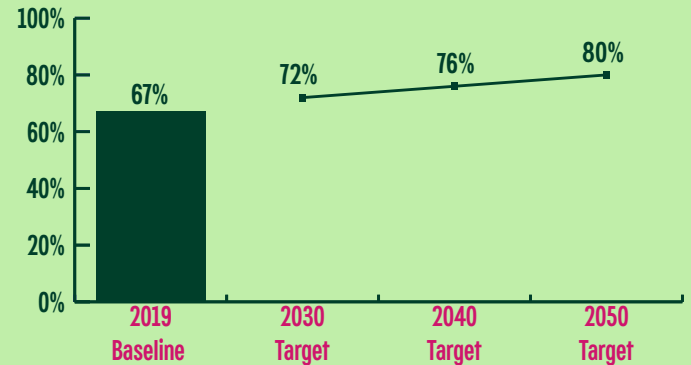


SMART Goal 2

Increase percent of all trips that start or end in Cambridge that are public transit, walking, biking, or carpool²².

Desired Outcome

More people choose walking, biking, and taking transit because it is a more accessible, safe, and enjoyable way to get around.

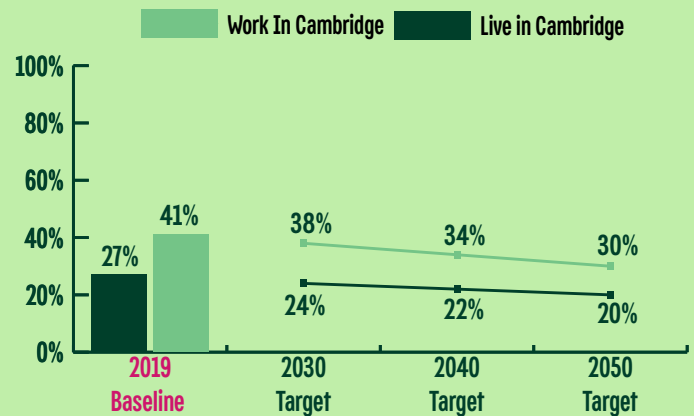


SMART Goal 3

Reduce percent of people who drive alone to work for Cambridge residents and workers²³.

Desired Outcome

Fewer people drive alone to work.

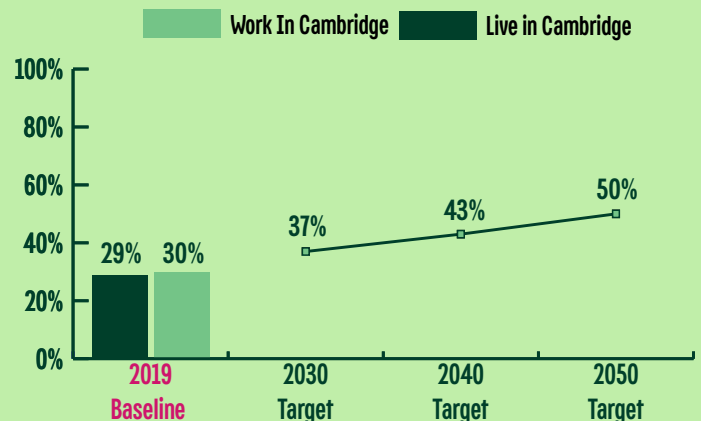


SMART Goal 4a

Increase the % of people who commute by public transit to work for Cambridge residents and workers²⁴.

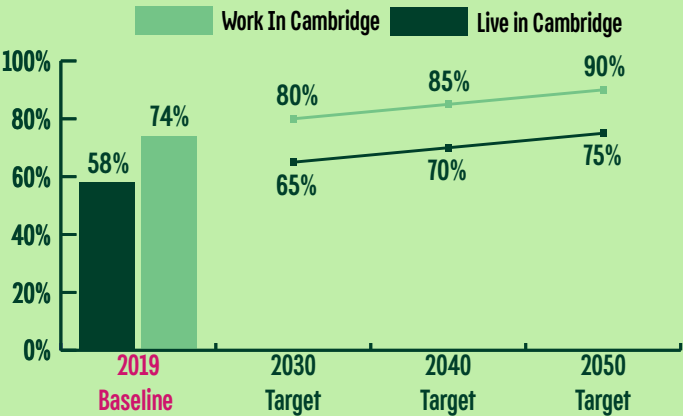
Desired Outcome

More people take public transit because they have better access to high-quality transit options.



SMART Goal 4b

Increase the % of people who are within 0.5 miles walking distance to an MBTA rapid transit station or a 0.25-mile walking distance to a high-frequency bus route stop²⁵.



SMART Goal 5a

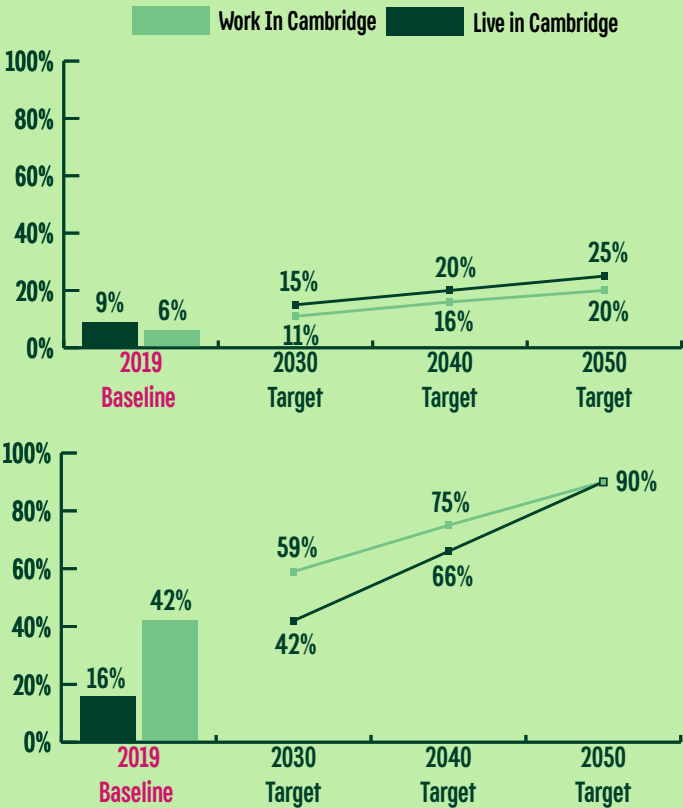
Increase the % of people who commute by bike to work for Cambridge residents and workers²⁶.

SMART Goal 5b

Increase the % of people who are within 0.125 miles walking distance to a Bluebikes bikeshare dock and 0.25 miles distance to an off-road pathway or separated bike lane²⁷.

Desired Outcome

People ride bikes more because it's easier and safer.

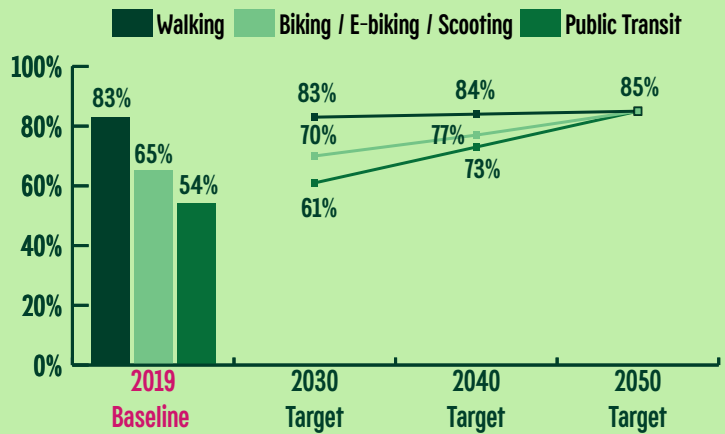


SMART Goal 6

Increase percent of residents in Annual Citywide survey who say that walking, biking/e-biking/scooting, or public transit is an excellent or good option for getting around³¹.

Desired Outcome

More residents think that walking, biking/e-biking/scooting, or public transit is an excellent or good option for getting around Cambridge.

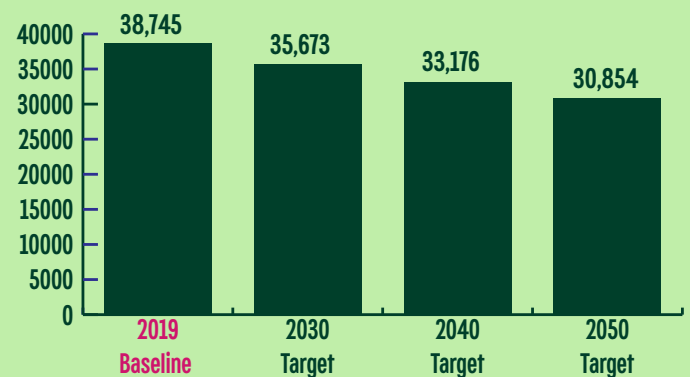


SMART Goal 7

Reduce the number of resident parking permits issued²⁸.

Desired Outcome

People living in Cambridge have fewer cars.



SMART Goal 8

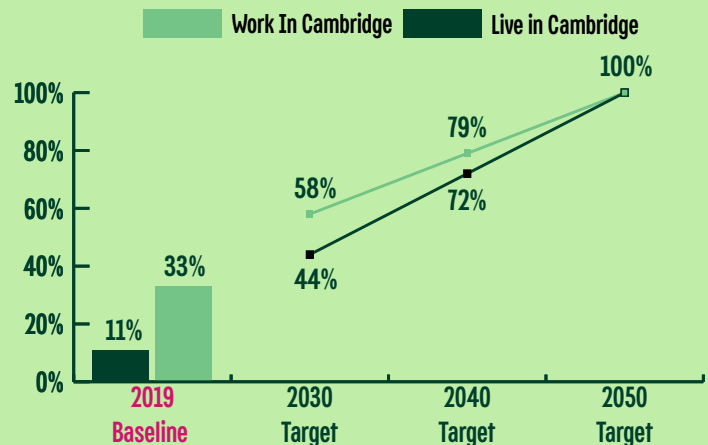
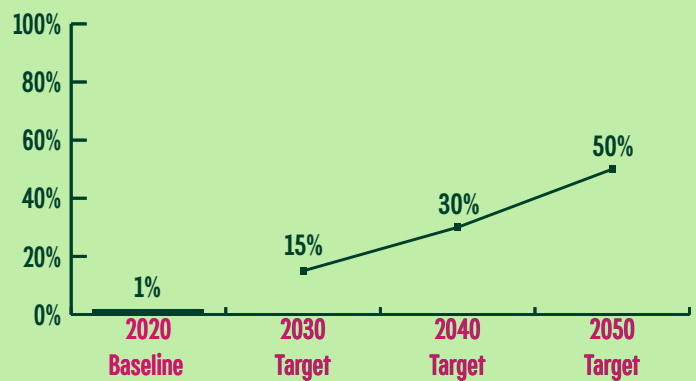
Increase % of registered vehicles in Cambridge that are electric²⁹.

SMART Goal 8b

Increase % of people within 0.25 miles of an EV charger³⁰.

Desired Outcome

More people switch from gas to electric cars.



How Will This Plan Move the City Into the Future?

This document lays the foundation for Cambridge to transition to a zero emissions transportation system by 2050. It provides actionable strategies to support increased mobility options, shift travel behavior, electrify transportation modes, and integrate land use planning with mobility goals.

We realize this plan will not be easy or straightforward. Many of these actions require new policies and infrastructure, which will require investment and ongoing maintenance. Given the complexity and interconnectedness of our transportation system and collective choices to affect each other and the public realm, we know these actions will also rely on changes in choices, habits, and behaviors of everyone traveling around the city. As these actions are implemented, some could lead to street changes that make it faster to take a bus or more comfortable to ride a bike, while at the same time creating shorter-term traffic congestion. Adjustment to new systems and habits can be challenging in the short term. In the longer term, these changes will result in reduced transportation emissions, mode shift, increased safety, and improvement in the transportation experience generally in the city. These changes can also bring other benefits such as improved air quality, reduced traffic noise, increased access to and use of public space, including sidewalks and streets, and greater opportunities to build community. It will be important to ensure that these additional benefits are equitably distributed across the city.



Near-Term Priorities

To make the Zero Emission Transportation Plan a reality, the City has prioritized actions for near-term implementation and define project milestones. This prioritization process used criteria based on the City's goals, guidance from the Advisory Group, community feedback, and implementation constraints. Actions were prioritized using the following criteria:

- Greater impact on plan goals
- Easier to implement/within City control
- Requested often in community engagement
- Complements other actions already happening in Cambridge
- Lower cost

- **Improve community engagement - CE-1:** Provide a high degree of City support to help residents navigate transportation changes, and access transportation options and discounts
- **Improve bus service - BAS-1:** Enable better bus frequency and reliability by installing bus priority projects on important routes (signal priority, queue jumps, or bus lanes).
- **Improve bike mobility - WBM-3:** Improve access to bikes through support for community groups and improvements to the Bluebikes system
- **Expand electric vehicles - EV-1:** Increase availability of publicly accessible charging and fast charging for electric vehicles (EV) and micromobility devices (ex. e-bikes and e-scooters)

Using these criteria, the following actions are prioritized for near-term (i.e. one- to two-year) implementation:

This plan and the set of actions it contains will become a guiding framework for implementation in the short-, medium-, and long-term. This was a holistic process that focused on relationship building to set us up to be successful and build consensus around a set of actions that a broad range of community members would support. Making the plan a reality will require ongoing attention and investment by the City and stakeholders; adaptation when transportation tools, technologies, and opportunities change; prioritization, recognizing that not everything can be implemented at once; and continued listening, dialogue, and responsiveness to community members as needs and challenges shift over time.

Lessons Learned and Considerations for Future Processes

Process Lessons

One of the explicit goals of this Plan was to test new engagement processes and develop new tools for community-driven planning. Below are some reflections about this process:

Advisory Group

Compensation: Advisory Group members expressed that the compensation offered to them in recognition of their contribution to the process was meaningful for their participation, either individually or for their organizations to be able to allocate their time to the process.

Relationship-building: Taking time at the beginning of the process to make connections and build an environment where there was trust and openness to share ideas was critical to the success of the group.

Membership: The Advisory Group was intentionally composed of community members who were not transportation experts, but who brought lived experience and perspectives from their wide variety of communities. With time spent upfront sharing information about transportation planning and tools, we were successful in having a meaningful, specific and at times, technical discussion to guide the Plan.

Time commitment:

- It was important to set clear expectations about the amount of time members would need to spend on the process. Most members did not have time to review materials in between meetings, so meetings needed to be planned to review content and discuss.
- As the process was extended, some members' availability, jobs, and/or life circumstances changed, making it harder or not possible for them to continue to participate. Two-thirds of Advisory Group members participated in the entire planning process.

Community Engagement

Engage earlier: Initially, most of the effort for the Plan was focused on work with the Advisory Group. This was intended to allow the staff to follow the Advisory Group's priorities for how we developed the plan and how we engaged with the broader community. Though the first public engagement efforts occurred early enough in the process that questions were still very open-ended and the Plan was in its early stages, community members expressed that they would

have liked to have been engaged still earlier, even if there were no specific proposals yet to which they could react.

Discussing community feedback with the Advisory Group: Bringing feedback heard in community engagement to the Advisory Group for discussion and integration into the Plan was an effective way to make sure all feedback was considered thoughtfully.

Participating with an open mind: One of the reasons the Advisory Group worked so well was because they participated in training with open minds. Educating residents by providing fact-based analyses about economic, health, and climate effects of a future with and without GHG emissions is critical.

Plan for accessibility needs to increase participation, especially from underserved, underheard, and historically excluded groups of people: Additional lead time, budget, and meeting design considerations need to be accounted for to make the process as accessible as possible. Our success in making these accessibility improvements also relied on collaboration with key partners in the City, including the Language Justice Division and the Community Engagement Team @ CDD:

- CART (communication access real-time translation) services at virtual and in person meetings
- Revisions of materials to ensure plain language
- Translation of outreach and key materials
- Interpretation services

Allow lots of time and space for one-on-one conversations: Tabling at community events allowed lots of individual conversations that could focus on what was important to community members to share. At public meetings, holding an open-house portion of the meeting with multiple staff available at different stations helped maximize the opportunity for deeper conversations.

Technical Lessons

Projecting how emissions will be reduced by the actions in this Plan is a complex task. These changes interact with each other and with many other influences, including market conditions, social and cultural dynamics, and politics. Longer-term projections, particularly, could change significantly in the coming years as technologies and other factors shift. Because the projected emissions reductions are estimates, they should not be relied on as exact calculations but should be treated as indicators of magnitude and inform decision making for the things the City can influence.

As GHG emissions accounting methods expand in the future, we'll be able to address air travel by residents and businesses, and consumer habits that generate deliveries.

The Cambridge context makes estimating GHG emissions easier in some ways and harder in others. Cambridge benefits from having a lot of data coverage. Local, regional, and federal sources provide information on vehicle inventories, socioeconomic topics, travel patterns,

and other useful information. However, Cambridge is unlike many of the communities that have been the basis of research and case studies. Cambridge has a smaller area, a smaller population, and higher density than many of the case studies. The city also has a higher share of work trips by transit than many examples used in research. Therefore, many of the assumptions and inputs used in emissions reduction estimates need to be adjusted or scaled based on professional judgment for the Cambridge context.



Conclusion

This plan takes a comprehensive approach to eliminating transportation emissions and improving people's mobility options. The actions range in cost, difficulty (technically, politically, etc.), and timeline to implement. An actionable implementation plan that identifies what is most important and feasible to do first is needed to build on this document. With limitations to funding and staff time, prioritization should focus on delivering the most benefit towards all the Plan's goals as soon as possible. At the same time, ongoing advocacy and engagement from the community will be needed to keep longer-term actions a priority.

There are also hurdles that need to be addressed to implement some of these actions. Regional alignment on transportation priorities and effective regional collaboration will be critical. In some cases, state action or legal changes will need to be addressed to support Cambridge's action (e.g. safety issues requiring state action for cars and trucks, sources of funds for subsidies, etc.)

Finally, the big shifts in transportation this Plan calls for will require coordination across City departments and with other planning efforts related to sustainability, land use, public safety, and equity.

What's Next: Cambridge Access and Mobility Plan

A critical next step in our climate and transportation planning is taking an integrated citywide approach to mobility planning. Beginning in 2025, the Department of Transportation (DOT) will create an all-mode Cambridge Access and Mobility Plan (CAMP).

Instead of creating or updating a separate bike plan, transit plan, and pedestrian plan, this will be a citywide transportation plan for traveling to, from, and within Cambridge by walking, bicycling, taking transit, riding micromobility, and driving. The CAMP will consider constraints and trade-offs as we continue improving the ways we engage with and listen to community members.

The CAMP will conclude with a proposed five-year work plan for the Department of Transportation. Following the model of the Five-Year Plan for Sidewalk and Street Reconstruction, the DOT Work Plan will publicly and clearly communicate proposed next steps for mobility in Cambridge.

Acknowledgments

We would like to recognize and appreciate our Advisory Group members, whose wisdom, feedback, and reflections guided our entire process.

We are grateful to all community members who shared their experiences and insights during this process. Their feedback, suggestions, and critiques shaped the Zero Emission Transportation Plan and ensured it reflected a range of perspectives, ideas, and needs.

We extend our gratitude to our community partners who hosted presentations and discussions about the ZETP plan at their events, contributing significantly to the plan's development and community engagement goals.

We appreciate being able to participate as an Urban Sustainability Directors Network Nexus city. This process helped us, build long-term relationships with community partners, provide climate & transportation training for Advisory Group members, and provide professional development for CET Outreach workers.

We would like to acknowledge the following staff members for their assistance and expertise in preparing the Zero Emission Transportation Plan:

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Abebe Kelemework

Ahmad Khamis

Jody McDonough

Ryan McKinnon

Ahmad Khamis

Jody McDonough

Ryan McKinnon

Nikhil Nadkarni

Catiana Jean Pierre

Brad Pillen

Melissa Quest-Mercadante

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Nick Schmidt

Cara Seiderman

Meghan Shaw

Annie Shawn

Scott Walker

Roshni Wadhwani

Latoya Weaver

Mason Wells

José Wendel

Commission for Persons with Disabilities

Rachel Tanenhaus, Executive Director

Kate Thurman

Department of Public Works

John Nardone, Commissioner

Jerry Friedman

Irina Sidorenko

Jim Wilcox

Department of Transportation (*formally Traffic, Parking, and Transportation Department*)

Elise Harmon-Freeman

Jackie McLaughlin

Chaimaa Medhat

Stephen Meuse

Adam Shulman

Andreas Wolfe

Language Justice Division

Crystal Rosa

Public Safety

Christine Elow, Police Commissioner

Kara Blue

Appendices

Appendix 1: Community Engagement Events

The process for developing the Plan involved extensive community outreach. In addition to the following events, City staff engaged in many 1-1 conversations with community members and coordinated with staff from various City departments, including Community Development; Department of Transportation (formally Traffic, Parking, and Transportation); Public Works; Police; and the Commission for Persons with Disabilities.

- 17 Advisory Group meetings
- 2 Joint Transportation Committee meetings (Pedestrian, Bicycle, and Transit Advisory Committees)
- 2 Spring 2024 Community Meetings – virtual and in-person
- 3 Climate Committee meetings
- 2 CET@CDD focus groups
- Islamic Society of Boston youth focus group
- Community Learning Center Conferencing
- Cambridge Commission for Persons with Disabilities Board meeting
- River Festival
- Cambridge Economic Opportunity Commission Staff Focus Group
- Fresh Pond Apartments Summer Party
- HRI Neighbor2Neighbor Cookout
- Alewife Transportation Management Association Meeting
- Central Square Advisory Committee
- Cambridge Youth Programs Activity
- Cambridge Housing Authority Coffee Chat
- BIPOC Business Advisory Group meeting
- Science Festival “In the Neighborhood” Lecture
- Science Festival Carnival
- Arts in the Park
- Neighborhood Association Focus Group
- Advocate Focus Group
- 2 Fall 2024 Community Meetings – virtual and in-person
- Harvard Square Advisory Committee
- City Council Health & Environment Committee Hearing

Appendix 2: Multilingual Executive Summary

English



Scan the QR code to read the **Executive Summary**. It highlights the key goals and actions in the Zero Emissions Transportation Plan, including efforts to reduce emissions, improve transportation options, and support equity in Cambridge.

Amharic



የሰነዱን ዋና ማጠቃለያ ለማንበብ የቀረበውን የኪው.አር.ኮድ ስኬት ያድርጉ። ማጠቃለያው የልቀት መጠንን ለመቀነስ፣ የትራንስፖርት አማራጮችን ለማሻሻል እና በ**Cambridge** ውስጥ ፍትሐዊነትን ለማረጋገጥ የሚደረጉ ጥረቶችን ጨምሮ፣ በ**Zero Emissions Transportation Plan** (ኬሮ የጋዝ ልቀት ትራንስፖርት ዕቅድ) ውስጥ የተቀመጡ ዋና ዋና ግቦችን እና ተግባራትን ያብራራል።

Chinese



扫描 QR 码阅读执行摘要。该摘要着重阐述了 Zero Emissions Transportation Plan (《零排放交通计划》) 中的关键目标与行动, 包括 Cambridge 为减少排放、改善出行选择及支持公平所付出的努力。

Haitian Creole



Eskane kòd QR la pou li **Rezime Jeneral** la. Li prezante moman enpòtan ki gen rapò ak objektif ak aksyon kle yo nan Zero Emissions Transportation Plan (Plan Transpò Zewo Emisyon) an, tankou efò pou redwi emisyon, amelyore opsyon transpò yo, epi sipòte ekite nan Cambridge.

Bangla



এক্সিকিউটিভ সামারি পড়তে QR কোডটি স্ক্যান করুন। এটি Zero Emissions Transportation Plan (শূন্য নির্গমন পরিবহন পরিকল্পনা) মূল লক্ষ্য ও পদক্ষেপগুলো তুলে ধরে, যার মধ্যে Cambridge-এ নির্গমন হ্রাস, পরিবহন ব্যবস্থার উন্নতি ও সমতা নিশ্চিত করার প্রচেষ্টা অন্তর্ভুক্ত রয়েছে।

Arabic



امسح رمز الاستجابة السريعة (QR) لقراءة الملخص التنفيذي. يُسلط هذا الملخص الضوء على الأهداف والإجراءات الرئيسية في «Zero Emissions Transportation Plan» (خطة النقل بانبعاثات صفرية)، بما يشمل الجهود المبذولة للحد من الانبعاثات، وتحسين خيارات النقل، وتعزيز العدالة في Cambridge.

Spanish



Escanee el código QR para leer el **resumen ejecutivo**. En él se presentan los aspectos destacados de los objetivos y medidas clave del Zero Emissions Transportation Plan (Plan de Transporte de Cero Emisiones), incluidos los esfuerzos para reducir las emisiones, mejorar las opciones de transporte y promover la equidad en Cambridge.

Portuguese



Escaneie o código QR para ler o **Sumário Executivo**. Ele apresenta breves resumos das principais metas e ações do Zero Emissions Transportation Plan (Plano de Transporte com Emissões Zero), incluindo os esforços para reduzir as emissões, melhorar as opções de transporte e promover a equidade em Cambridge.

Appendix 3: Endnotes

- 1 The Cambridge “Zero Emissions Transportation Plan” was originally called the “Net Zero Transportation Plan” while it was in development. Staff changed the name after community members asked for a clearer term than “Net Zero.”
- 2 For more information on what it means to be “net zero,” visit <https://www.nationalgrid.com/stories/energy-explained/what-is-net-zero>.
- 3 See page 27 of the 2019 Cambridge Community GHG Inventory: https://www.cambridgema.gov/-/media/Files/CDD/Climate/ghginventory/2019cambridgecommunitywideghginventory_summaryreport.pdf
- 4 For more information on what it means to be “net zero,” visit <https://www.nationalgrid.com/stories/energy-explained/what-is-net-zero>.
- 5 See page 27 of the 2019 Cambridge Community GHG Inventory: https://www.cambridgema.gov/-/media/Files/CDD/Climate/ghginventory/2019cambridgecommunitywideghginventory_summaryreport.pdf
- 6 For more information on what it means to be “net zero,” visit <https://www.nationalgrid.com/stories/energy-explained/whatis-net-zero>.
- 7 A 2024 update to the community inventory of greenhouse gas emissions will be available at the end of 2026.
- 8 For example, redlining was a racist practice of denying loans and discouraging investment in majority black and immigrant neighborhoods throughout the United States. Highway expansion in the mid 1900’s resulted in the destruction and displacement of many dense, thriving, black and immigrant neighborhoods—often the ones that had been redlined. The proposed inner belt highway lines up exactly with the map of redlining in Cambridge but was stopped by community members who worked together to fight it. However, a truck route still goes through the Coast, exposing neighbors to more noise and pollution than areas without a designated truck route.
- 9 Data Source: 2019 Cambridge Greenhouse Gas Inventory: <https://www.cambridgema.gov/CDD/climateandenergy/greenhousegasemissions/communityemissions>
- 10 Trackless trolleys are electric buses powered by overhead wires.
- 11 Community members wondered how many emissions are generated by commercial vehicles during the engagement for this Plan.
- 12 **Data Source:** Households (HH) = American Community Survey, Resident Parking Permits (RPP) = City of Cambridge Department of Transportation, # Registered Vehicles = Registry of Motor Vehicles (RMV), # Electric Vehicles (EVs) = Massachusetts Municipal Vehicle Census.
- 13 This analysis was conducted in the previous Federal administration, and emissions are subject to change as Federal policies and program changes.

14 The future share of EVs is the number of electric vehicles in use, divided by the number of all vehicles in use, regardless of their fuel type. Data about the EV stock in the United States is sourced from the IEA Global EV Outlook 2024, which provides historical data from 2010 to 2020, and projections for 2025, 2030, and 2040 under two scenarios: the Stated Policies Scenario (SPS) and the Sustainable Development Scenario (SDS). The SPS reflects the impact of existing policies and announced targets, while the SDS is aligned with the Paris Agreement goals and net zero emissions by 2050. The stock share of EVs is expected to increase significantly in both scenarios, reaching more than half of the total car stock by 2040 in the SDS, and by 2050 in the SPS. This study references the more conservative SPS scenario.

15 **Data Source:** US Census and American Community Survey 3-year averages

16 **Data Source:** US Census and American Community Survey 3-year averages

17 The City recently created a new limit on the number of vehicles that individuals are allowed to get a residential parking permit for—that limit is now four permits.

18 The Plan was called the Net Zero Transportation Plan at the time of the hearing.

19 **Data Source:** Arup consultant analysis. Full analysis described in Appendix 4.

20 Community members have asked for clearer rules and guidance for micromobility devices like scooters. The Massachusetts Department of Transportation is developing recommendations to clarify rules for e-bikes and e-scooters, and the City aims to incorporate those and address any other aspects that can be advanced locally.

21 **Data source:** GHG community inventory (personal, commercial, and City fleet vehicles principally garaged in Cambridge: odometer x mpg; + transit).

22 **Data source:** Replica, using fall Thursday data. Replica uses big data from multiple sources to estimate how people are traveling to, from, and through Cambridge. Read about this product here: <https://www.replicahq.com/>.

23 **Data source:** US Census Bureau's American Community Survey 1-year data, <https://www.census.gov/programs-surveys/acs.html>

24 **Data source:** US Census Bureau's American Community Survey 1-year data, <https://www.census.gov/programs-surveys/acs.html>

25 **Data source:** Envision indicator tracking. Cambridge CDD, Cambridge GIS; Population from 2010 and 2020 Census, plus Annual Housing Starts data from CDD; Number of workers from Census LEHD Origin-Destination Employment Statistics (LODES)

26 **Data source:** US Census Bureau's American Community Survey 1-year data, <https://www.census.gov/programs-surveys/acs.html>

27 **Data source:** Envision indicator tracking. Population from 2010 and 2020 Census, plus Annual Housing Starts data from CDD; Number of workers from Census LEHD Origin-Destination Employment Statistics (LODES).

28 **Data source:** Cambridge Resident Parking Permit Program

29 **Data source:** MassVehicleCensus by MADOT: <https://geodot-homepage-massdot.hub.arcgis.com/pages/massvehiclecensus#mvcdashboard>

30 **Data source:** NREL Alternative Fueling Station data: <https://developer.nrel.gov/docs/transportation/alt-fuel-stations-v1/all/#fuel-station-record-fields>

31 **Data source:** Annual Citywide survey: <https://developer.nlr.gov/docs/transportation/alt-fuel-stations-v1/>

Appendix 4: Modeling Methodology and Assumptions



Memorandum

To	Stephanie Groll, City of Cambridge
Date	March 13 th , 2025
Copies	Amelia Casey, Arup
Reference number	281746-00
From	Joe Kaylor
File reference	
Subject	City of Cambridge Net Zero Transportation Plan Greenhouse Gas (GHG) Emission Reduction Model - Technical Documentation

Introduction

The purpose of this technical memo is to document previous modeling work that informed baseline assumptions related to the greenhouse gas (GHG) reduction potential of existing state and local policies, describe the methodology and layout of the GHG reduction model that was developed for the Net Zero Transportation Plan (NZTP) effort, and document the detailed assumptions and data sources that were used to inform strategy reduction estimates.

To address Cambridge's contribution to climate change, the City Council has committed to an ambitious climate agenda, including the use of 100% renewable energy by 2035 and achieving net zero emissions by 2050. The City of Cambridge estimated how many emissions we have in Cambridge, most recently in 2019, and there are plans to address emissions from buildings and waste. These goals are being advanced through a broad strategy that includes the Net Zero Action Plan for buildings and the Net Zero Waste Plan. However, transportation accounts for a significant share of the city's GHG emissions and the NZTP is the last piece of the City's climate strategy.

The following memo is outlined as follows:

- GHG Analysis Outputs + Further Studies for Consideration
 - *Providing the GHG reduction output and additional studies to further support the NZTP*
- Previous Modeling Work
 - *Documenting key assumptions and data inputs from the 2017 DNV-GL Technical Memorandum*
- Spreadsheet Framework
 - *Documenting the analysis methodology and spreadsheet format*
- GHG Emission Reduction Strategies and Assumptions
 - *Documenting the description, assumptions, calculations, and reduction potential for each of the proposed GHG strategy*

Key Findings and Assumptions:

- **Boundary Definition and Accounting Methodology:** The 2012 baseline, 2050 forecasts, and 2019 inventory were developed utilizing the “resident activity” method for GHG estimation. This includes all resident activities and for businesses that garage their vehicles in Cambridge, which includes some but not all employment generated transportation emissions. The boundary used for the baseline and forecast was the City of Cambridge administrative boundary.
- **Fuel Efficiency:** The fuel efficiency assumptions used in the baseline and forecast methodology was 18.8 MPG for gasoline vehicles in 2012 and 39.0 MPG for gasoline vehicles in 2050.
- **EV Market Penetration:** The EV market penetration, as represented in the percent of VMT that is electrified, was assumed to be .02% in 2012, increasing to 8.76% by 2050.
- **State and Local Policy Actions:** The following state and local policy actions have, in total, a 68% reduction potential by 2050.
 - **Fuel Efficiency Improvements:** 45%
 - **Increased EV Market:** 3%
 - **VMT and Vehicle Ownership Reductions:** 13%
 - **Land Use Densification and Zoning:** 5%
 - **Other forecast assumption adjustments:** 2%
- **MAPC Strong Region Forecast:** This analysis assumed 0.84 vehicles per household would be the equivalent of reaching the 15% reduction in vehicle ownership per household below 1990 levels. NZTP VMT and Vehicle Ownership Reduction was adjusted to avoid double counting with other VMT reduction measures.
- **NZTP Reduction Potential:** This analysis found that, with the addition of new strategies for reducing greenhouse gas emissions, the City of Cambridge can achieve an additional reduction in on-road transportation emissions of 27% (as shown in Figure 1 below), or a total reduction potential of 95%.

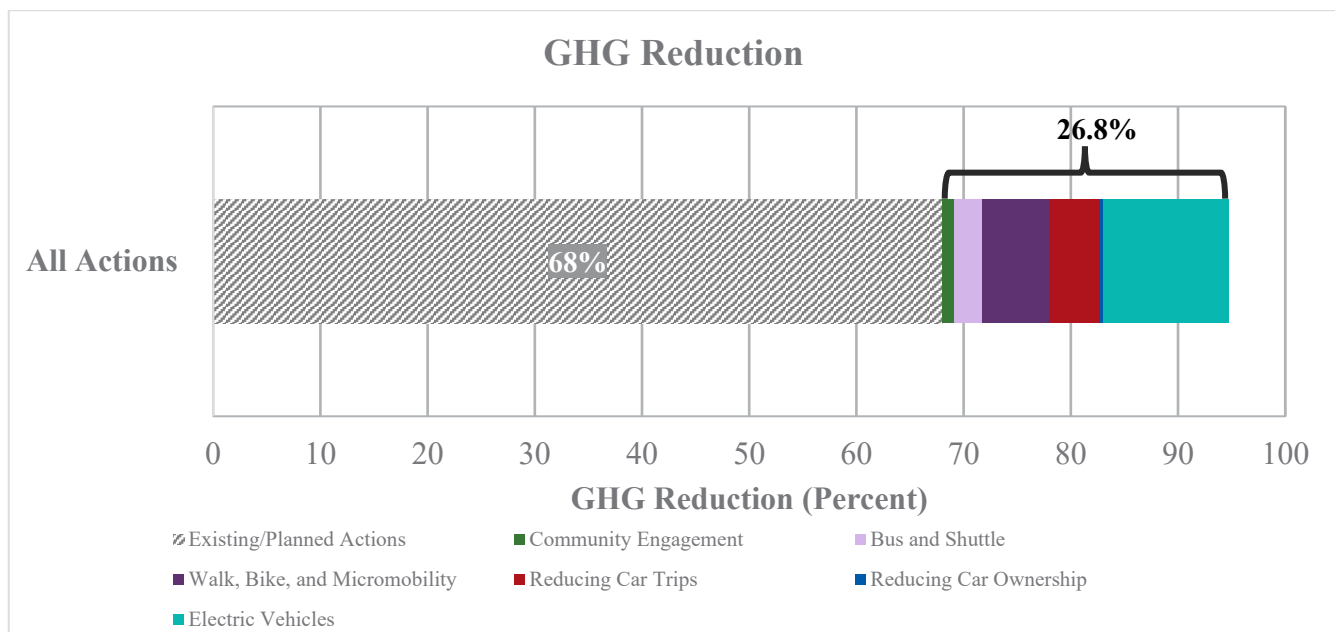


Figure 1 GHG Reduction Analysis Outputs (by Action)

Further studies should consider:

- **Updated fuel efficiency assumptions.** Assumptions used in the 2017 emissions forecasts developed by DNV GL are now outdated. Market trends and more progressive state transportation policy has increased the fuel efficiency anticipated for the passenger vehicle fleet by 2050.
- **Updated electric vehicle (EV) market penetration assumptions.** Since 2017, there has been a notable acceleration in the adoption of electric vehicles in the passenger vehicle fleet. Future study should align with more recent forecasts for EV market potential in 2050.
- **Updated land use assumptions.** Recent Cambridge zoning reform and affordable housing policies would further reduce vehicle miles traveled (VMT) and GHG emissions from transportation. Future study should explore the effectiveness of these policies in further reducing GHG emissions from transportation.
- **Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC).** Future emissions inventories and climate action planning should consider utilizing the geographical approach to estimating transportation emissions. Recent advancements in big data products, like Replica, can be leveraged to more accurately estimate the GHG emissions for all on-road travel occurring within the City of Cambridge's boundary.
- **Model updates.** For a more in-depth analysis of the reduction potential of strategies with GPC defined geographical approach transportation emission forecasts, model methodology should be updated to estimate the absolute reduction potential of GHG emission reduction strategies in metric tons of carbon dioxide equivalent (MT CO₂e) rather than indexing by the percent reduction potential as used in this model.

Previous Modeling Work

In 2017, DNV-GL developed a 2012 baseline community-wide GHG inventory and forecasts for 2030, 2040, and 2050. The summary of this previous modeling work was sourced from DNV GL's Technical Memorandum on "Community-wide GHG Inventory and Forecasting Methodologies" updated in 2017. The forecast years were chosen to align with the City's Net Zero Action Plan and Climate Protection Action Committee's (CPAC) Roadmap for the City's role in the global response to climate change. The community-wide GHG inventory utilized the Cambridge administrative boundary as its geographic boundary, although this does not exclude emissions related to city activities that occur outside the city limits like electricity generation. Transportation emissions were modeled using the GPC "resident activity" method which is a measurement of the transport activities of city residents. Data was sourced for businesses that garage their vehicle in the city, meaning that some employment activity is also captured in the baseline and forecast assumptions.

2012 Baseline On-Road Transportation

In accordance with Section 7.3 of the GPC, the resident activity method was used to quantify on-road transportation emissions in Cambridge. This method quantifies emissions from transportation activity undertaken by city residents and businesses that garage their vehicle in the city. Emissions factors for the 2012 baseline were sourced from TCR and electricity emission factors were sourced from ISO New England, as summarized in Table 1.

Table 1 2012 Baseline Inventory Emission Factors (Source DNV GL 2017)

Fuel Type	Emission Factor	Emission Factor Units	Source
Gasoline	.01032	MT CO ₂ e/gallon	TCR
Diesel	.01033	MT CO ₂ /gallon	TCR
Electricity	.000353802	MT CO ₂ /kWh	ISO New England

2050 BAU Forecasting Methodology

A “Business as Usual” (BAU) forecast was developed to estimate how GHG emissions would grow in Cambridge in the absence of policies aimed at reducing GHG emissions. To estimate BAU growth in emissions, “the compound annual growth rate in select demographics were used as proxies for the growth rate in corresponding inventory subsectors. For example, population, jobs, and household forecasts from MAPC’s Boston Region Long Range Transportation Plan Projections (BRLRTPP) were used to project Cambridge community-scale emissions by subsector. Table 2 shows these growth rates used in DNV-GL’s analysis and Table 3 shows the baseline inventory and BAU 2050 forecast by sector. BAU emissions for 2050 were forecasted to be 188,798 MT CO₂e.

Table 2 DNV GL Emissions Forecast Annual Growth Rates Used to Project Emissions by Subsector (Source DNV GL 2017)

Sector	Subsector	Annual Growth Rate Proxy Used	Annual BAU Growth Rate		
			2012-2030	2012-2040	2012-2050
Stationary Energy	Residential Buildings	Population	0.62%	0.55%	0.55%
	Commercial & Institutional Buildings and Facilities	Jobs	0.52%	0.52%	0.47%
	Manufacturing Industries and Construction	Population & Jobs	0.57%	0.51%	0.51%
	Energy Industries*	Installed Capacity	1.99%	1.27%	0.94%
Transportation	On-road	Households	0.59%	0.54%	0.54%
	Rail	Households	0.59%	0.54%	0.54%
Waste	Solid Waste Disposal	Population & Jobs	0.57%	0.51%	0.51%
	Incineration and Open Burning	Population & Jobs	0.57%	0.51%	0.51%
	Wastewater Treatment and Discharge	Population & Jobs	0.57%	0.51%	0.51%
All Subsectors Weighted Average Growth Rate			0.77%	0.61%	0.56%

Table 3 2012 Baseline Inventory and "Business as Usual" Emissions Forecast by Subject (Source DNV GL 2017)

		2012	2030	2040	2050			
Sector	Subsector	(MTCO ₂ e)	Annual growth rate: 2012-->2030	(MTCO ₂ e)	Annual growth rate: 2012-->2040	(MTCO ₂ e)	Annual growth rate: 2012-->2050	(MTCO ₂ e)
Stationary Energy	Residential Buildings	205,495	0.62%	229,598	0.55%	239,622	0.55%	253,138
	Commercial & Institutional Buildings and Facilities	756,703	0.52%	831,211	0.47%	863,857	0.47%	905,698
	Manufacturing Industries and Construction	38,234	0.57%	42,358	0.51%	44,114	0.51%	46,426
	Energy Industries	194,907	1.99%	277,809	1.27%	277,809	0.94%	277,809
Transportation	On-road	153,993	0.59%	171,194	0.54%	178,940	0.54%	188,798
	Rail	8,945	0.59%	9,945	0.54%	10,395	0.54%	10,967
Waste	Solid Waste Disposal	92,051	0.57%	101,977	0.51%	106,206	0.51%	111,772
	Incineration and Open Burning	2,145	0.57%	2,377	0.51%	2,475	0.51%	2,605
	Wastewater Treatment and Discharge	2,146	0.57%	2,377	0.51%	2,476	0.51%	2,606
TOTAL		1,462,236	0.51%	1,677,284	0.61%	1,734,681	0.56%	1,809,067

2050 Forecasting Methodology with State and Local Policies

Several state and local policies that would reduce GHG emissions from the BAU scenario were incorporated into an adjusted BAU forecast for 2050. Table 4 describes these state and local policies that reduce transportation GHG emissions, as well as their GHG reduction potential. The methodologies for these reductions are described on subsequent pages.

Table 4 State and Local Policy GHG Reduction Potential

Scale	Measure	Description	Total Annual GHG Emissions Avoided by 2050 (MT CO ₂ e)
State	California Low Emission Vehicle Program	Massachusetts adopted the California motor vehicle standard which requires more fuel efficient and zero-emission vehicles within the vehicle fleet.	90,896
City	Reduce Vehicle Miles Traveled by Vehicles Registered in Cambridge <i>AND</i> Reduce Vehicle Ownership Per Household Rate	Cambridge has set internal targets to reduce community VMT by 5% below 2010 levels and reduce vehicle ownership per household by 15% below 1990 levels. These measures were combined to avoid double counting.	24,152
Total Transportation GHG Emissions Avoided with State and Local Policies (MT CO₂e)			115,048

California Low Emission Vehicle Program

To estimate the reduction potential of Massachusetts' adoption of the California Low Emission Vehicle Program, DNV GL utilized the California Air Resources Board (CARB)'s EMFAC database which contains historical and forecasted data on state-level vehicle emission rates through calendar year 2050. The EMFAC database accounts for efficiency improvements and increases in electric vehicle (EV) adoption that is aligned with the Advanced Clean Cars (ACC) program and Federal CAFE standards. The EMFAC model provides forecasts miles per gallon (MPG) fuel efficiency and the percent of total VMT that is electric which impacts on-road transportation emissions forecasts.

Table 5 illustrates these efficiency improvements between 2012 and 2050.

Table 5 Vehicle Efficiency Improvements

Vehicle Category	Data Description	2012	2030	2040	2050
Gasoline	Average MPG	18.8	33.8	38.0	39.0
Diesel	Average MPG	7.4	8.4	8.4	8.4
Electric	Average kWh/Mile	0.33	0.33	0.33	0.33
Gasoline	Percent of Total VMT	98.6%	91.8%	90.1%	89.9%
Diesel	Percent of Total VMT	1.4%	1.4%	1.4%	1.4%
Electric	Percent of Total VMT	0.02%	6.82%	8.55%	8.76%

Vehicle Category	Data Description	2012	2030	2040	2050
	Emissions Avoided from CAFE + Advanced Clean Car program (MT CO₂e)	N/A	64,211	78,273	84,735
	Emissions Avoided from Projected EV Market Growth	N/A	4,530	5,427	6,161
	Total Emissions Avoided from Vehicle Efficiency Standards + EV Market Growth	N/A	68,742	83,700	90,896

Reduce Vehicle Ownership Per Household Rate (City Measure 4) and Reduce Vehicle Miles Traveled by Vehicles Registered in Cambridge (City Measure 5)

Given the similarities between city measures to reduce VMT and reduce vehicle ownership per household, these reduction strategies were modeled together to avoid double counting the GHG reduction potential. The City of Cambridge considered reaching the MAPC Strong Region level of 0.84 vehicles per household as the equivalent of reaching the 15% reduction in vehicle ownership per household below 1990 levels. Using this assumption, the goal of a 15% reduction in vehicle ownership per household below 1990 levels by 2020 was translated to a goal of 9.3% reduction in vehicle ownership below 2012 levels by 2020. 2012 data on vehicles registered in Cambridge per household provided by MAPC was used to translate this target.

To avoid double counting, the 5% reduction in VMT was subtracted from the 9.3% reduction in vehicle ownership potential, resulting in a 4.3% reduction potential from reducing vehicle ownership and a 5% reduction potential from decreases in VMT. Since there was not a target after 2020, it was assumed this reduction potential would remain constant for forecast years 2030, 2040, and 2050. Despite decreases in emissions rates from improvements in vehicle efficiency, the emissions avoided from this city policy compared to BAU continues to increase due to the increasing BAU VMT from 2030-2050 that was informed by projected increases in households within Cambridge.

Overall, these state and local strategies reduce on-road transportation emissions by 61%, shown in Figure 2. Table 6 summarizes the avoided emissions with these strategies.

Figure 2 State and Local Policy Actions GHG Reduction Potential

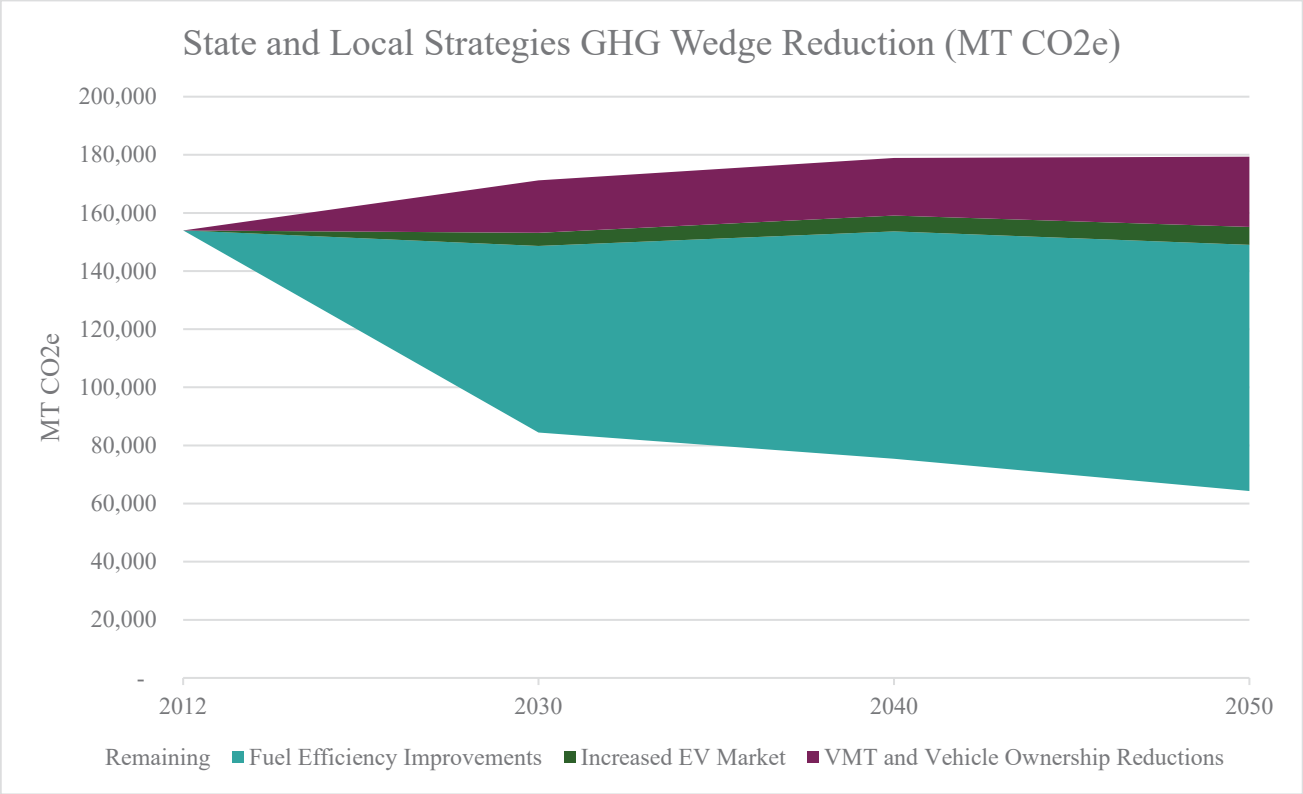
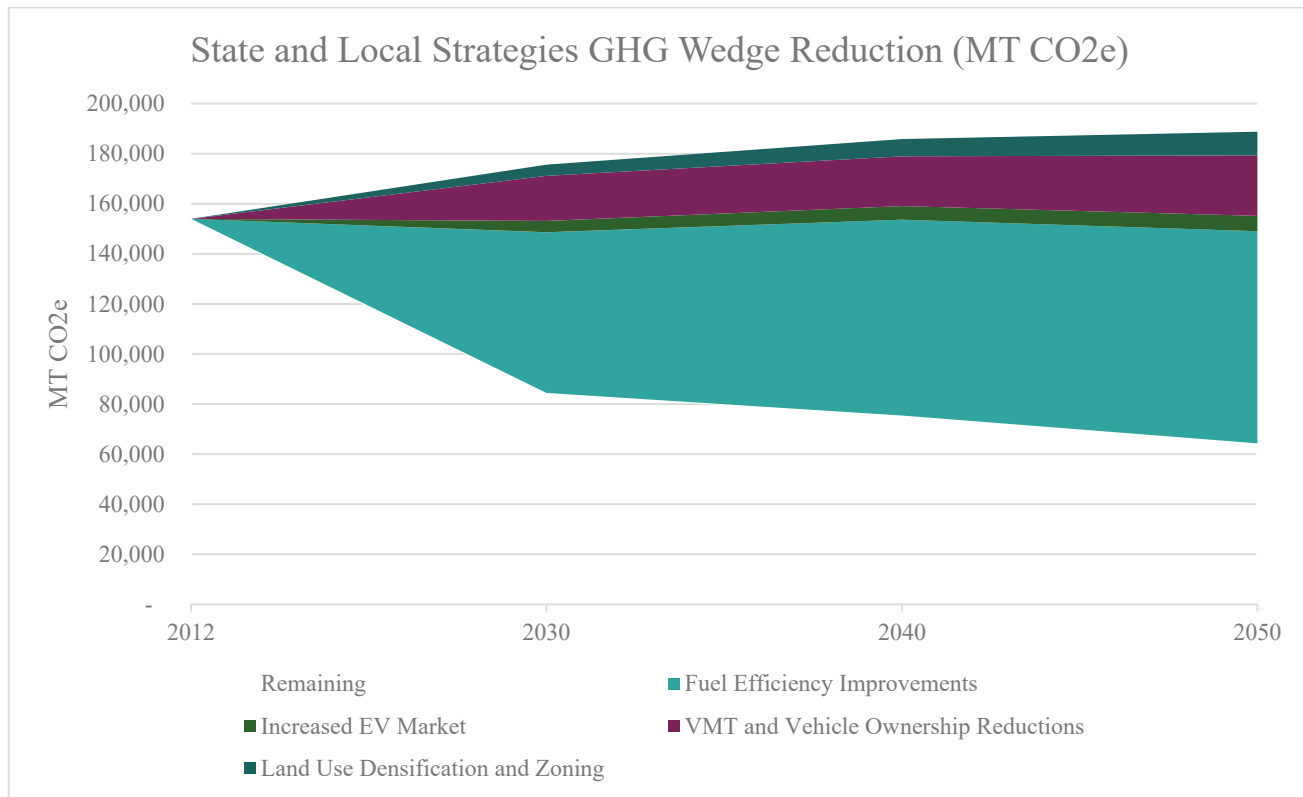


Table 6 Emissions Avoided from City Measures

Year	Business as Usual VMT	VMT with Measure 4 + Measure 5 in Place	Vehicle Emissions Rate (MT CO ₂ e/VMT)	Emissions Avoided (MT CO ₂ e)
2012	362,934,702	N/A	0.000413	N/A
2030	403,476,739	329,101,380	0.000242	18,025
2040	421,732,355	329,101,380	0.000214	19,847
2050	444,964,787	329,101,380	0.000208	24,152

2050 Forecasting Methodology with State and Local Policies Updates

2050 forecasts were adjusted to account for more aggressive land use strategies, including the densification of the existing housing stock in Cambridge, leading to an additional 5% reduction in transportation GHG emissions under existing State and Local policies (State actions at the time of this 2050 forecast do not account for MBTA electrification). Another 2% reduction was applied to account for improvements to vehicle fuel efficiency. Updates to the 2050 forecast establish a 68% total reduction potential from existing State and Local policies, as shown in Figure 3.

Figure 3 Adjusted State and Local Strategies GHG Reduction Potential

Spreadsheet Framework

The purpose of the Cambridge Net Zero Transportation Plan is to identify additional transportation emissions reduction strategies that are needed to fill the gap between the reduction potential for existing state and local policies (68%, as represented in Figure 1) and the city's goal for net zero transportation emissions by 2050. Several strategies were identified and assessed for their effectiveness in reducing GHG emissions from transportation. The assumptions and detailed calculations are summarized in subsequent sections of this report.

Analysis Methodology

The purpose of the NZTP GHG model was to develop an understanding of the relative effectiveness across reduction strategies and to identify required strategies that are needed to fill in the reduction potential gap to achieve net zero transportation emissions. Raw GHG reduction estimates, either derived through demand elasticity functions informed by empirical research or through case study research, were calculated to understand the reduction potential of a specific strategy in isolation. To account for the diminishing returns that can be anticipated when combining strategies, the reduction potential of strategies was indexed to their relative contribution to achieving net zero (e.g. the proportion of the reduction they contribute to achieve an additional 32% reduction in emissions).

Spreadsheet Tabs

Visualization Tab: User front end summarizing strategy effectiveness, including a bar chart of outputs identifying progress towards net zero.

GHG Calculations: Detailed calculations spreadsheet that includes inputs, constants, and assumptions that informed strategy reduction potential.

Visualization: Assumptions: Percent values assumed for strategies with less than 1% effectiveness or for supportive policies.

Crosswalk: Crosswalk between the Action Table – Live and the GHG model

State + Local Policies: Summary data from the 2017 ENV GL study that captures reduction potential of state and local policies, including recent updates.

Greenhouse Gas (GHG) Emission Reduction Strategies and Assumptions

CE-1 Provide a High Degree of City Support to Help Residents Navigate Transportation Changes, And Access Transportation Options and Discounts

Description: This action aims to provide comprehensive support to help residents navigate transportation changes and access various transportation options and discounts. The City would offer direct individual assistance for enrolling in income-eligible programs and other opportunities, available remotely, via phone, and in community locations. City staff would follow the example of the Cambridge Economic Opportunity Committee in sharing information and assisting with program signups, including food assistance. Support for transportation discounts could make transit and Bluebikes more affordable for low-income residents and provide effective transportation information and workshops widely accessible to all, with a focus on reaching underserved and historically excluded people. Outreach would be conducted through multiple channels, including non-traditional ones, to ensure a broad range of audiences, such as youth and college students, are informed about resources, engagement opportunities, and events.

Assumptions: Calculations were conducted assuming support is offered to all residents of Cambridge ($C/B = 1$), with an expected 19% participation rate (D). For those who participate, a 12% reduction in vehicle trips is assumed (E). There is a direct 1:1 relationship between the reduction in vehicle miles traveled (VMT) and the reduction in emissions (F). Additionally, current income-eligible Bluebikes enrollment stands at 516 members. An anticipated, a 15% increase in enrollment would add 77 people. Although this increase has a significant positive impact on the lives of participants, it is estimated to have a negligible effect on emissions, as bike share rides do not significantly reduce VMT, particularly if participants do not own cars.

Calculation: Per Equation T-22 from the *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity* (CAPCOA, 2021).

$$A = \frac{C}{B} \times D \times E \times F$$

Table 7: Equation T-22 Variables

Variable	Description	Value	Unit
B	User input; residences in plan/community	140,000	Residences
C	User input; residences in plan/community targeted with Community Based Travel Planning (CBTP)	140,000	Residences
D	Percent of targeted residences that participate	19	%
E	Percent vehicle trip reduction by participating residences	12	%
F	Adjustment factor from vehicle trips to VMT	1	Unitless

Note. From *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity* (CAPCOA, 2021), p. 163.

Reduction Potential: 2.30% raw GHG emissions reduction estimate. 1.1% adjusted GHG emissions reduction estimate.

CE-2 Encourage Community-Led Initiatives That Improve Awareness of Low-Carbon Transportation Options and Support a Culture of Sustainable Mobility

Description: This action aims to support community-led projects that raise awareness of low-carbon transportation options and foster a culture of sustainable mobility. It includes providing dedicated funding and staff resources for relationship-building, possibly through an expanded Community Engagement Team or other community-proposed initiatives. Neighborhood transportation and mobility "community connectors" would help residents access resources and opportunities, and address mobility issues (e.g., snow removal, carpooling, school bike buses, and walking school buses). This action also encourages community events like bike rides to promote sustainable transportation, facilitates ongoing conversations among diverse groups, and supports relationship-building efforts led by Transit, Bike, Pedestrian, and Climate committees. Various communication methods could deepen relationships and create mutually beneficial solutions, including an all-mode etiquette and education program. There is a focus on increasing community awareness and involvement in transportation decisions and fostering positive engagement through events.

Assumptions: There are several soft measures that could be taken to promote sustainable transportation. It will be important to track who gets involved and what effect this action has.

Calculation: N/A.

Reduction Potential: Supportive policy; no measurable emissions reduction.

CE-3 Conduct a Transportation Security Index Survey

Description: City staff would gather information on how residents' lives are affected by their transportation needs and options. The survey aims to understand the safety, ease, reliability, and comfort of people's transportation experiences, identify potential disparities among different communities, and track progress in closing disparities over time. It would use a wide range of tools to ensure accessible participation and report findings transparently and accessibly.

Assumptions: By identifying who experiences transportation insecurity and when, the initiative aims to reduce stress and improve overall transportation reliability.

Calculation: N/A.

Reduction Potential: Supportive policy; no measurable emissions reduction.

CE-4 Ensure Coordination Among CARE, Cambridge HEART, CPD, Transit Police, Campus Police, and City Transportation Staff About People's Transportation Challenges, Especially as They Show Up in Police Interactions, and Take Proactive Steps to Address Issues

Description: This ongoing action aims to enhance coordination among CARE, Cambridge HEART, CPD, transit police, campus police, and the City's transportation staff. By working together, these groups could understand and address transportation challenges, especially those that arise during police interactions. The goal is to proactively identify and respond to issues, ensuring a more effective and compassionate approach to transportation-related concerns. This action is still in development.

Assumptions: N/A.

Calculation: N/A.

Reduction Potential: Supportive policy; no measurable emissions reduction.

BAS-1 Enable Better Bus Frequency and Reliability by Installing Bus Priority Projects on Important Routes (Signal Priority, Queue Jumps, Or Bus Lanes)

Description: This action focuses on improving bus frequency and reliability by implementing bus priority projects on key routes. It includes creating more bus-only lanes to accommodate three times as many buses per hour on half the routes in Cambridge, as required by the MBTA for better bus service. Queue jumps and new signals at intersections would prioritize buses over private vehicles, potentially reducing travel times and on-street parking on some streets. It also aims to optimize street space for high-occupancy vehicles, enhance bus stops with shelters and real-time information, and promote regional leadership in funding and design solutions. Cambridge may also advocate for extended bus service hours.

Assumptions: By 2050, bus headways would need to improve by 200%, allowing for three times as many buses per hour (B) on 50% of the most heavily used routes (C). A 0.50 elasticity factor was assumed, meaning that for each 1% increase in transit frequency, transit ridership increases by 0.50% (D). Per Replica data, the current transit mode share for all trips is 6.6% (E), while the auto mode share (private auto and auto passenger) is 61.60% (F). The MA statewide mode shift factor is 58, representing the inverse of average vehicle occupancy (G). A Cambridge adjustment factor (CAF) of 0.50 is applied, considering fewer car trips to convert into transit trips in Cambridge compared to California. Note: Future emissions reductions are connected to % VMT that is reduced and doesn't forecast what modes trips shift to. 2050 forecast work for this project applied a linear growth rate to account for increases in rail emissions from population growth (e.g. more people need to run more trains).

Calculation: Per Equation T-25 from the *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity* (CAPCOA, 2021), with the inclusion of the CAF to adjust the California context of the equation.

$$A = -C \times \frac{B \times E \times D \times G}{F} \times CAF$$

Table 8: Equation T-25 Variables

Variable	Description	Value	Unit
B	User input; percent increase in transit frequency	200	%
C	User input; level of implementation	75	%
D	Elasticity of transit ridership with respect to frequency of service	0.50	Unitless
E	Transit mode share in plan/community	7	%
F	Vehicle mode share in plan/community	62	%
G	Statewide mode shift factor	58	%

Note. From *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity* (CAPCOA, 2021), p. 174. The CAF is specific to this deliverable and modifies the 2021 CAPCOA Handbook's equation.

Reduction Potential: 4.60% raw GHG emissions reduction estimate. 2.3% adjusted GHG emissions reduction estimate.

BAS-2 Improve On-Demand Shuttle Service for People with Disabilities and Seniors

Description: This action aims to offer accessible and reliable transportation for individuals with disabilities and seniors, enabling them to maintain their independence and actively engage in the community. The service would include specialized vehicles, trained and compassionate drivers, and coverage for key locations and trip purposes in the City and surrounding areas. Regional collaboration for expanded service on the Door2Door shuttle, with increased service hours and expanded trip-purpose eligibility, is one potential option. All on-demand shuttles would use electric vehicles.

Assumptions: The Door2Door service, currently serving about 400 trips per month, is expected to increase to 500 trips (25% increase). This slight expansion is not projected to significantly reduce GHG emissions, as new trips may not replace car trips. Vehicles in the program will switch to electric vehicles (EVs), but even with 100 new trips potentially taken from personal vehicles, the reduction in emissions would be less than 1%. It is assumed that none of the 100 new trips would convert from single-occupancy vehicle (SOV) trips.

Calculation: N/A.

Reduction Potential: 0.50% raw GHG emissions reduction estimate. 0.25% adjusted GHG emissions reduction estimate.

BAS-3 Expand Knowledge of, Access, And Comfort Navigating Transit Options, Including Existing Publicly Accessible Shuttles, Especially for Youth

Description: This action aims to enhance public transit information access and comfort navigating resources pertaining to transit options. City staff would collaborate with private and institutional shuttle providers to ensure public access to shuttles. Transit data would be formatted for inclusion in transit and trip-planning apps (i.e., GTFS). The availability of shuttles would be featured in transportation information and considered in transit-planning efforts. Education on using the public transit system would be incorporated into the middle school curriculum. Additionally, the City would explore options to expand CharlieCard subsidies for more students. Calculations have not been provided for this action due to the absence of current transit data for relevant routes, including frequency and routing information, which prevents an estimation of ridership.

Assumptions: N/A.

Calculation: N/A.

Reduction Potential: Supportive policy; no measurable emissions reduction.

WBM-1 Improve and Maintain Walking Infrastructure

Description: This action aims to enhance and maintain walking infrastructure with a focus on equitable maintenance for sidewalks in low-income and historically burdened neighborhoods. It includes new infrastructure to make walking comfortable in hot weather, such as water fountains, shade, and public benches. Walkability and safety would be improved with more raised crosswalks, better visibility at intersections, and flashing beacons at high-traffic locations. Sidewalks would be smooth, clear of obstructions, and have clear directions to accessible routes. The DPW's Five-Year Plan for Sidewalk and Street Reconstruction and the Miscellaneous Sidewalk Program would continue to receive funding and be implemented.

Assumptions: Safe pedestrian infrastructure is fundamental to other emissions improvements, though its maintenance has a minor impact on emissions. Brick sidewalks are challenging to navigate and should be minimized or eliminated. Enhancements to the pedestrian network, such as additional crosswalks, ADA ramps, and public realm improvements like street trees, can maximize the potential for reducing VMT. The calculation below assumes some sidewalk improvements across Cambridge's existing network.

Calculation: Per Equation T-17 from the *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity* (CAPCOA, 2021).

$$A = \left(\frac{C}{B} - 1 \right) \times D$$

Table 9: Equation T-17 Variables

Variable	Description	Value	Unit
B	User input; existing sidewalk length in study area	250	Miles
C	User input; sidewalk length in study area with measure	500	Miles
D	Elasticity of VMT with respect to the ratio of sidewalks-to-streets	-0.05	Unitless

Note. From *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity* (CAPCOA, 2021), p. 127.

Reduction Potential: 5.00% raw GHG emissions reduction estimate. 2.50% adjusted GHG emissions reduction estimate.

WBM-2 Improve Bicycle Infrastructure, Including Building the Citywide Bicycle Network Vision

Description: This action aims to create a network of streets that are safe and comfortable for cyclists of all ages and abilities, providing access to all city destinations. It may involve reducing car lanes and street parking. Future street congestion could decrease as more people shift from driving to cycling, although congestion might not immediately appear to decline during busy times. This action encourages reliance on bicycles for school and activity-related trips, promoting independent cycling among youth. Considerations include developing solutions for safer crossing of bike lanes for people with disabilities (in collaboration with CCPD), increasing access to charging and storage for e-bikes and e-scooters, and clarifying rules and regulations for e-scooters and other small e-devices.

Assumptions: Cambridge currently has 101 miles of bike lanes (B). The planned buildout will increase the existing network to approximately 126 miles (C), resulting in a 24.75% increase in mileage. By reviewing existing literature for comparable infrastructure conditions, the GHG reduction calculation assumes that a 7% increase in the City's bike network length (D) can reduce GHG emissions by 2% (E).¹

Calculation: An adjusted formula to control assumptions based on elasticity function is provided below.

$$A = \left(\frac{\left(\frac{C - B}{B} \right)}{D} \right) \times E$$

¹ Zahabi, S. A. H., et al., "Exploring the link between the neighborhood typologies, bicycle infrastructure and commuting cycling over time and the potential impact on commuter GHG emissions," *Transportation Research Part D: Transport and Environment*, 47 (2016): 89-103, <https://doi.org/10.1016/j.trd.2016.05.008>.

Table 10: WBM-2 Equation Variables

Variable	Description	Value	Unit
B	User input; existing bikeway miles in plan/community	101	Miles
C	User input; bikeway miles in plan/community with measure	126	Miles
D	Incremental increase in bikeway miles	7	%
E	GHG reduction potential per 7% increase in bikeway miles	2	%

Reduction Potential: 7.07% raw GHG emissions reduction estimate. 4% adjusted GHG emissions reduction estimate.

WBM-3 Improve Access to Bikes Through Support for Community Groups and Improvements to the Bluebikes System

Description: This action aims provide resources to community organizations to offer bike access, repair services, and riding lessons, as well as expand education efforts and community-led activities to ensure people have convenient, affordable access to bikes and know how to ride and repair them safely. This action would address anti-aid amendment issues to facilitate public access to non-polluting vehicles. Establishing a centralized Bluebikes governance structure for system improvement and adding more Bluebikes stations would ensure most residents of Cambridge are within a 3-minute walk from a station.

Assumptions: There is an assumption that some drivers will switch to biking, with CAPCOA estimating a maximum reduction of 0.06%. Research indicates that each Bluebikes station in the Boston area can reduce 2.11 annual tons of CO₂e.² Currently, Cambridge has 90 Bluebikes stations, but to achieve over a 1% emissions reduction, the City would need 250 stations. With a target of 250 total stations, each covering 0.5 miles of streets (0.25-mile radius), and considering Cambridge's 125 miles of streets, the emissions reduction potential increases with more e-bikes and an expanded system, allowing for longer trips on Bluebikes.

Calculation: N/A. Based on the CAPCOA maximum, emissions reduction would be less than 1%. Research shows that 40 miles (30% of 125) of Cambridge streets are covered by the current 80 Bluebikes stations. To achieve 100% coverage, 170 additional stations are needed, totaling 250 stations. Each station reduces 2.11 annual tons of CO₂e, and with expected annual emissions of 52,711 tons in 2050, the reduction would be 0.6%, which is confirmed by comparing emissions reductions in NYC and scaling them to Cambridge based on bike share system size.

Reduction Potential: 0.5% raw GHG emissions reduction estimate. 0.25% adjusted GHG emissions reduction estimate.

² Kou, Z., et al., "Quantifying greenhouse gas emissions reduction from bike share systems: a model considering real-world trips and transportation mode choice patterns," *Resources, Conservation & Recycling*, 153 (2020): 104534, <https://doi.org/10.1016/j.resconrec.2019.104534>.

RCT-1 Expand employer and property owner responsibility for supporting sustainable transportation

Description: This action aims to expand employer and property owner responsibility for supporting sustainable transportation. This can include requiring employers to provide transportation demand management (TDM) programming to their employees to encourage more multimodal commute trips. The DC Metro has implemented a policy that mandates employer sponsored TDM programs which resulted in a VMT per capita decrease of 1.5% across the city.³

Assumptions: Given similar urban characteristics between Washington DC and the City of Cambridge, including employment density and access to public transportation, a similar VMT reduction is anticipated by implementing this policy.

Calculation: N/A.

Reduction Potential: 1.5% raw GHG emissions reduction estimate. 0.75% adjusted GHG emissions reduction estimate.

Note: We recently changed the emission reduction potential of this action. It is now far lower than the 6.7% reduction we'd been assuming during this project. The newer methodology accounts for demand elasticity best practices and referenced a more relevant case study from Washington DC for regional policies that mandate/encourage employer sponsored TDM programs. The previous methodology used demand elasticities that were site-specific (and not as applicable for a citywide/community wide context).

RCT-2 Research Possible Approaches to Use Technology to Improve Cambridge Residents' Experience of Getting Around, With Financial Support for Residents with Low Incomes

Description: This action aims to use technology to improve Cambridge residents' transportation experience, with financial support for low-income residents. The City could sponsor access to a trip planning app and provide a subsidized mobility wallet for transportation expenses, such as bus/train fare, Bluebikes membership, and EV carshare. This wallet would offer additional relief beyond existing programs and support access to ride-hailing and carsharing services. However, this action has Anti-Aid Amendment implications and might benefit more from additional funding in existing programs like Cambridge Rise.

Assumptions: Mobility wallets reduce VMT by lowering the financial and behavioral barriers to using alternative transportation. By providing convenient, subsidized access to multiple modes, wallets encourage shifts from private car use to transit, biking, and walking. Early pilots show that wallets can lead to VMT reduction with estimates ranging from a 5-15% reduction in VMT per participant.

³ Metropolitan Washington Council of Governments. (2023, November 21). *Commuter Connections Transportation Demand Management (TDM) Analysis Report*. <https://www.mwcog.org/documents/2023/11/21/commuter-connections-transportation-demand-management-tdm-analysis-report-carsharing-commuter-connections-commuting/>

The Portland Transportation Wallet was a 2019-2020 pilot offered by PBOT to around 500 residents of affordable housing. Low-income residents were offered a \$300 prepaid Visa card, free bikeshare membership, and discounted ride-hail credits to use on options like TriMet transit, bikeshare, e-scooters, Uber/Lyft and carshare. Evaluation of the program by Portland State University found that nearly half of participants tried new modes they hadn’t used before, and many reported increased access to trip they otherwise couldn’t make. Program participants reduced their drive alone rates to 10% in 2023 from 23% in 2022, or a 13% reduction. This assumption was used to estimate the percent VMT reduction of offering a similar program to low income residents in Cambridge, which account for 12.4% of persons/families in Cambridge.

Calculation: Based on Portland Transportation Wallet program effectiveness.

$A = B \times C$

Table 11: Equation T-27 Variables

Variable	Description	Value	Unit
B	percent of persons/families with incomes below the poverty line based on 2019-2023 ACS	12	%
C	percent reduction in VMT with UBM program	13	%

Note. Portland State University Tools of Change, Portland’s Transportation Wallet evaluation: <https://www.toolsofchange.com/en/case-studies/detail/770>

Reduction Potential: 1.61% raw GHG emissions reduction estimate. 0..80% adjusted GHG emissions reduction estimate.

RCT-3 Participate in State and Regional Discussions About Congestion or Emission Pricing in Greater Boston

Description: This action entails engaging in state and regional dialogues about implementing congestion or emission pricing in Greater Boston. The City would coordinate with neighboring municipalities to explore regional congestion or emission-pricing, which requires state involvement. If the state implements such a scheme, drivers could pay a fee to enter the urban area, with higher fees for gas-powered cars and discounts for low-income individuals. This could significantly reduce traffic and air pollution, improve traffic safety, and generate funds for transportation improvements. Cambridge's input should reflect community needs and promote equity. A study on the emissions reduction potential of road pricing, possibly with other municipalities, would be beneficial. Additionally, considerations should be made to discuss the use of VMT as a metric for development project transportation impact review.

Assumptions: The impact of congestion or emission pricing in Cambridge depends on various factors, including pricing type (area, facility, or distance-based), user income, vehicle type, and behavior changes. While there's no perfect analogue for Cambridge, existing literature⁴ shows that American

⁴ Veitch, E., Rhodes, E., “A cross-country comparative analysis of congestion pricing systems: Lessons for decarbonizing transportation,” *Case Studies on Transport Policy*, 15 (2024): 101128, <https://doi.org/10.1016/j.cstp.2023.101128>.

cities like Atlanta and NYC provide some benchmarks, with estimated emissions reductions of 2% and 11%, respectively. Cambridge might aim for a 5% reduction due to higher transit usage than Atlanta and lower than NYC. Area-based pricing systems like NYC's have more impact than facility-based ones like Atlanta's. Emissions reduction potential is highly sensitive to implementation type and price. Studies show significant reductions in cities like Milan (20%), Atlanta (2%), NYC (17.5% particulate matter, 11% GHG), and Stockholm (20% traffic within cordon). The Massachusetts State government is in the process of authorizing a study on "regionally equitable public transportation, mobility, and congestion pricing."⁵

Calculation: N/A.

Reduction Potential: 5% raw GHG emissions reduction estimate. 2.5% adjusted GHG emissions reduction estimate.

RCT-4 Create Safe, Low-Stress Connections Between Transportation Modes

Description: This action aims to improve connectivity by making it easier for people to switch between different modes of transportation. Secure parking options for bikes and scooters, the availability of Bluebikes, EV charging stations, and designated carshare parking located along bus routes and at train stations are some ways to do this. To accommodate these enhancements, some on-street parking spots along bus routes may be moved to around a corner to allow space for a broader range of transportation options.

Assumptions: Increasing connectivity could involve creating new crossings over rail tracks and enhancing the overall street network density. A study conducted by Oregon Metro for the Portland Region found that better-connected multimodal street networks can lead to a 2% reduction in average regional VMT⁶. This indicates that improved connectivity can reduce longer vehicle trips and contributes to better livability within communities. Additionally, increasing the number of street connections or local street intersections enhances travel for bicycles and pedestrians. These modes of transport often involve shorter, local trips, making connectivity particularly beneficial.

Calculation: N/A.

Reduction Potential: 2% raw GHG emissions reduction estimate. 1% adjusted GHG emissions reduction estimate.

RCT-5 Further Expand Coordination with Neighboring Municipalities on Regional Projects and Key Advocacy Issues

Description: The action focuses on growing collaboration with neighboring municipalities on regional projects and key advocacy issues, particularly addressing transportation emissions as part of a larger system. This expanded coordination could lead to unified advocacy for state policies, joint grant

⁵ Order S.2625, 193rd (2023 - 2024). Order relative to authorizing the joint committee on Transportation to make an investigation and study of a certain current Senate document relative to mobility pricing. The General Court of the Commonwealth of Massachusetts.

⁶ Oregon Metro, "Street Connectivity: An Evaluation of Case Studies in the Portland Region," Report No. 2004-11008-PLN, <http://library.oregonmetro.gov/files/connectivityreport.pdf>.

applications, better multi-use paths, improved bus and commuter rail services, reduced traffic congestion, decreased air pollution, and improved traffic safety in Cambridge and surrounding areas.

Assumptions: The assumptions highlight that a large portion of trips on Cambridge streets (71%, according to Replica data) are from people traveling to and through the City, which requires regional collaboration as Cambridge cannot control these trips alone. The City acknowledges its unique position, with significant resources and job concentration, enabling it to play an active role in developing regional sustainable transportation solutions. While reducing emissions from commuters is critical, it will impact emissions but won't be reflected in Cambridge's official GHG inventory, as it is based on resident activity and not commuter-related emissions.

Calculation: N/A.

Reduction Potential: Supportive policy; no measurable emissions reduction.

RCO-1 Explore Meaningful Ways to Acknowledge Residents Who Have No Registered Vehicles, Including Eligibility for Households That Reduce Their Number of Cars

Description: The action explores ways to acknowledge and incentivize residents who own fewer or no vehicles, including offering eligibility to households that reduce their number of cars. Encouraging fewer car ownership could promote walking, biking, and transit use, while reducing parking demand and car traffic in Cambridge. This program could apply to homeowners, renters, college students, and unhoused individuals. Additionally, the City might consider a vehicle buy-back program. Considerations include the potential financial challenges, the need to ensure the program serves the public good, and avoiding benefits for those already financially able to own a car. This action aims to make living car-free easier for residents.

Assumptions: There is limited research on the effectiveness of this action in reducing emissions. Programs like Hoboken's Surrender Your Permit⁷ and Santa Monica's One Car Challenge⁸ provide examples of how such initiatives could support car-free living. California's SB-457, which proposed a \$1,000 rebate for residents living without a car, was however vetoed by the Governor. While a reduction in car ownership is expected, it is difficult to estimate the impact on emissions without conducting a detailed study.

Calculation: N/A.

Reduction Potential: 0.50% raw GHG emissions reduction estimate. 0.25% adjusted GHG emissions reduction estimate.

⁷ "Going Car-Free: It's On Us, Says Hoboken," *Streetsblog NYC*, October 6, 2010, <https://nyc.streetsblog.org/2010/10/06/going-car-free-its-on-us-says-hoboken>.

⁸ "Hey Santa Monica, Get Paid to Give Your Car a Rest," *The Source*, September 27, 2023, <https://thesourcearchives.metro.net/2023/09/27/hey-santa-monica-get-paid-to-give-your-car-a-rest/>.

EV-1 Increase Availability of Publicly Accessible Charging and Fast Charging for Electric Vehicle (EV) and Micromobility Devices (Ex. E-Bikes and E-Scooters), Either Curbside or Following “Gas Station” Model

Description: This action aims to significantly expand access to EV charging for the public through a mix of publicly owned, privately owned, curbside, and off-street options. By 2027, Cambridge plans to have 100 publicly accessible chargers, reaching 475 Level 2 (L2) chargers and 25 DC fast chargers (DCFCs) by 2050. Public charging areas will also accommodate e-scooters and e-bikes. Some parking spaces may be reserved exclusively for EV charging, and some sidewalk space could be designated for EV chargers. It will ensure accessibility for people with mobility limitations without restricting accessible spots solely for EVs. The City will advocate for solar EV charging legislation and carefully balance policies for residential property parking spaces with the growth of the publicly accessible EV charging network.

Assumptions: One L2 charger used moderately can reduce emissions by 5.50 metric tons annually (B), while one DCFC can reduce emissions by 25.60 metric tons per year (C). Cambridge is projected to have 100 publicly accessible chargers by 2027, including 475 L2 chargers (D) and 25 DCFCs (E) by 2050. With expected emissions in 2050 at 52,700 metric tons (F), Cambridge or a private company can install around 20 L2 chargers and one fast charger annually, adjusting based on usage data and vehicle adoption trends. The calculation assumes moderate utilization of charging stations for transportation as well as MA's specific energy portfolio.

Calculation: Variable values below were derived from the Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool, which was determined to be more relevant for Cambridge than the methodology in CAPCOA.

$$A = \frac{(B \times D) + (C \times E)}{F}$$

Table 12: EV-1 Equation Variables

Variable	Description	Value	Unit
B	User input; emission reductions from one L2 charger	5.50	Metric tons
C	User input; emission reductions from one DCFC charger	25.60	Metric tons
D	User input; quantity of L2 chargers in future scenario plan/community	475	Chargers
E	User input; quantity of DCFC chargers in future scenario plan/community	25	Chargers
F	User input; expected emissions in plan/community	52,700	Metric tons

Reduction Potential: 6% raw GHG emissions reduction estimate. 3% adjusted GHG emissions reduction estimate.

EV-2 Work with Affordable Housing Sites to Add EV Charging Stations and Micromobility Charging for Site Residents

Description: The action aims to collaborate with affordable housing sites to install EV charging stations and micromobility chargers for residents. This includes installing four L2 chargers at 20 locations to accommodate up to 80 vehicles. It would increase charging access for residents, visitors, and those using electric vehicles, e-bikes, or e-scooters. The program could also be paired with an EV carshare initiative, allowing residents to access electric vehicles without ownership. One consideration is the logistics and costs associated with installing these EV chargers and their impacts on housing costs.

Assumptions: The assumptions indicate that one L2 charger, used moderately, can reduce emissions by 5.50 metric tons annually (B). Cambridge is projected to have 100 curbside chargers by 2027, including 80 L2 chargers (C). The expected emissions for Cambridge in 2050 are 52,700 metric tons (E).

Calculation: Variable values below were derived from the Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool, which was determined to be more relevant for Cambridge than the methodology in CAPCOA.

$$A = \frac{(B \times C)}{E}$$

Table 13: EV-2 Equation Variables

Variable	Description	Value	Unit
B	User input; emission reductions from one L2 charger	5.50	Metric tons
C	User input; quantity of L2 chargers in future scenario plan/community	80	Chargers
E	User input; expected emissions in plan/community	52,700	Metric tons

Reduction Potential: 0.5% raw GHG emissions reduction estimate. 0.3% adjusted GHG emissions reduction estimate.

EV-3 Require New Developments to Install EV Charging (Level 2 or DC Fast Charging) to Serve 25% of Total Number of Parking Spaces and Make the Remaining 75% of Spaces EV-Ready

Description: The action proposes requiring new developments to install EV charging infrastructure, with L2 or DCFCs covering 25% of total parking spaces and the remaining 75% being EV-ready. This ensures that buildings are prepared for the future transition to electric vehicles. The policy will align with Boston's EV Readiness Policy, requiring developers to install necessary wiring and ensure sufficient electrical capacity for future charger installations across all parking spaces.

Assumptions: The assumptions include a projected 17.7% population growth in Cambridge from 2019 to 2050, based on MAPC projections (B). It assumes that 25% of parking spaces must be dedicated to EVs (C), with electrical capacity provided for 100% of parking spaces to support future EVs. New

residents are expected to generate the same VMT as current residents. Additionally, it is assumed that Eversource will offer incentives to low-rise single- or multi-family homes for installing chargers, similar to their incentive program in Connecticut.

Calculation:

$$A = \frac{B \times C}{100}$$

Table 14: EV-3 Equation Variables

Variable	Description	Value	Unit
B	User input; population growth in plan/community	17.7	%
C	User input; percentage of VMT from EVs in plan/community	25	%

Reduction Potential: 5% raw GHG emissions reduction estimate. 2.5% adjusted GHG emissions reduction estimate.

EV-4 Advocate That Eversource Provide Discounted EV Charging Rates at Off-Peak Times

Description: The action involves advocating for Eversource to offer discounted EV charging rates during off-peak times. This would provide a more affordable charging option, making EV ownership more accessible to low-income residents.

Assumptions: The assumptions include that 69% of households own cars, covering all income levels (B). If every low-income household switched to an EV, it could result in a 69% decrease in emissions. The impact assumes that offering lower off-peak pricing would encourage 10% of families to purchase an EV (C). There is little research on the impact of charging incentives, and because charging is already comparable in price to purchasing gas (often cheaper), this is expected to have a small impact on encouraging people to purchase EVs, compared to other incentives like tax breaks or subsidies. Additionally, during off peak times, utilities draw from a more diversified portfolio of energy sources, including renewable energy (which is not reliable enough to use during the peak). During peak times, utilities are more likely to rely on more polluting power generation

Calculation:

$$A = \frac{B \times C}{100}$$

Variable	Description	Value	Unit
B	User input; percentage of households with cars in plan/community	69	%
C	User input; percentage of households who transition to EV ownership	10	%

Reduction Potential: 6.90% raw GHG emissions reduction estimate. 3.46% adjusted GHG emissions reduction estimate.

EV-5 Provide High Degree of Support to Help Residents Access Existing State and Federal Incentives and Rebates for Buying EVs, and Learn More About Using and Charging EVs

Description: The action focuses on providing extensive support to help residents access state and federal incentives and rebates for purchasing EVs, as well as resources for using and charging them. This would make it easier for residents to understand and utilize incentives, helping them transition from gas-powered to electric vehicles more quickly. The program would involve collaboration with Electrify Cambridge and the Climate Committee to support these efforts.

Assumptions: Research shows an 8% annual increase in EV registrations for every \$1,000 rebate offered, with direct purchase rebates being the most effective at encouraging behavior change.⁹ Incentives like state income tax credits are less effective in shifting purchasing behavior. As EV adoption progresses, the impact of direct purchase rebates is expected to diminish, with 2039 being the year when they will likely no longer have a significant impact. Increasing the value of the subsidy would likely lead to greater emissions reductions, while a shorter program duration would result in fewer emissions reductions.

Calculation: BAU forecasts were adjusted to include 8% more EVs in 2050 and 8% fewer ICE personal vehicles in 2050.

Reduction Potential: 5% raw GHG emissions reduction estimate. 2.5% adjusted GHG emissions reduction estimate.

⁹ Clinton, B. C., Steinberg, D. C. "Providing the Spark: Impact of financial incentives on battery electric vehicle adoption." *Journal of Environmental Economics and Management*, 98 (2019): 102255, <https://doi.org/10.1016/j.jeem.2019.102255>.

Mint Julep

