"Use Less and Green the Rest"

The City of Newton's Five-Year Climate Action Plan

A Living Plan for 2020-2025

Green Buildings:
Zervas Elementary School

Clean vehicles:
City Hall EV charging station

Renewable Energy:
Solar array at Rumford Avenue

November 15, 2019

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Acknowledgements

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Executive Summary

Long-term success is a **carbon-neutral Newton by 2050**. **That is our goal.**

This plan addresses **six (6) areas of action.**

Six Areas of Action
A. Implementing Newton's Climate Action Plan: The City is committed to ensuring the success of this Climate Action Plan by adapting internal operations and working with dedicated partners.
B. Promoting Clean and Renewable Energy: "Greening" the sources supplying electricity to the City is vital to the pathway to carbon neutrality. The City will promote and expand Newton Power Choice, increase local renewable energy production through the installation of municipal solar arrays and the promotion of private solar installations, and offset its own GHG emissions with the purchase of renewable electricity supply.
C. Greening Newton's Transportation and Streetscapes: The second largest source of GHG emissions in Newton comes from on-road transportation. The City will support Newton's residents, workforce, and visitors in switching to battery electric and plug-in hybrid vehicles; reducing single-occupancy vehicle trips; and increasing biking, walking, telecommuting, public transportation, and shared trips.
D. Improving New Construction and Major Renovations: Energy use reduction and electrification are the backbones of any GHG emissions reduction plan. As new developments are built and renovations are undertaken, the choices made by developers and architects will have a significant impact on the City's GHG emissions profile. To the extent legally permissible, the City will take steps to ensure that construction meets standards necessary to achieve carbon neutrality by 2050.
E. Improving Existing Buildings: Existing residential and commercial buildings in Newton are responsible for a majority of the City's GHG emissions. The City will work with owners to increase energy efficiency, reduce reliance on natural gas and heating oil, and increase the use of efficient electric technologies in the City's existing building stock. Moving the needle for existing buildings will require the City to put in place "carrots and sticks" to incentivize significant action by the private sector.
F. Reducing Emissions associated with Consumption and Disposal: We will work to protect and enhance the City's natural resource base and help Newtonians limit their consumption of goods and services and disposal of materials.

Each action area identifies strategies and specific actions to get us well on our way to our goal of carbon neutrality. There are 18 strategies and 55 actions recommended in this plan. **The top 10 recommended strategies are:**

Top 10 Recommended Strategies
Establish Teams and Partnerships
1. Create a City implementation team, develop appropriate municipal planning and budgeting processes, and ensure regular Plan evaluations and updates (A.1.)
2. Work with partners to build awareness and drive action (A.2.)
Use Less
3. Increase rate of biking, walking, telecommuting, shared rides, and use of shuttles and public transit, while reducing single-occupancy vehicle trips (C.4.)
4. Advocate for a more energy-efficient and climate-smart building code (D.1.)
5. Work with City Council to adopt Zoning Ordinance amendments that require and/or incentivize high-efficiency performance, such as Passive House and/or net-zero new construction – within the next 12 months (D.3.)
Green the Rest
6. Increase the amount of electricity provided by New England renewable energy resources (B.1.)
7. Ensure that municipal infrastructure and operations are as "green" as possible (C.1.)
8. Incentivize residents to switch to EVs with a goal of having 10% of all vehicles on the road be EV, BHEV, ZEM, PHEV+ by 2025 (C.2.)
9. Transition to electric and thermal heating and cooling in residential and commercial buildings (E.2.)
10. Consider initiatives to engage businesses and residents in reducing GHG emissions resulting from corporate operations and individual activities (F.1.)

The top 20 recommended actions of the 55 actions recommended in this plan, are as follows.

Top 20 Recommended Actions
A. Implementing Newton's Climate Action Plan
A.1.1. Transform the existing Major Projects and Infrastructure Cluster into the Major Projects, Infrastructure, and Climate Change Cluster to oversee implementation of this Plan.
A.1.2. Develop more concrete estimates of costs and fiscal benefits for each municipal action recommended in this plan and incorporate funding categories or appropriate metrics in the FY 2021 CIP prioritization process to reflect the priorities of this plan and other related plans (such as the Climate Change Vulnerability Assessment and Transportation Plan).
A.2.2. Develop an Energy Coach role.
A.2.3. In collaboration with the Utilities, work with the largest energy users in the City to reduce their GHG emissions.
A.2.4. Work with the Newton-Needham Chamber of Commerce and the NCCE to explore possible structures for a "Green Ribbon Commission" and implement the preferred model.
B. Promoting Clean and Renewable Energy
B.1.1. Encourage residents and businesses to opt up to 100% renewable energy through Newton Power Choice.
B.2.1. Support Green Newton's efforts to implement the Newton Solar Challenge for residents and businesses which encourages the installation of rooftop solar.

C. Greening Newton's Transportation and Streetscapes
C.1.3. Install EV charging stations in village centers, school facilities, and other priority municipal sites, primarily through the Make Ready and GreenSpot programs.
C.2.3. Continue to work with partners (such as Make Ready) to install EV charging stations on private properties throughout the City.
C.3.1. Support local non-profits, for-profits, and advisory groups such as Green Newton, the NCCE, and Newton-Needham Chamber of Commerce, the Transportation Advisory Group (TAG), Safe Routes to School, the utilities, and local businesses efforts in education, events (such as test drives and Tour du Newton), and literature dissemination.
C.4.1. Work with City Council to develop a Transportation Demand Management (TDM) program to reduce single-occupancy vehicle trips through amendments to the Zoning Ordinance.
C.4.2. Work with City Council to explore reducing or eliminating the minimum parking requirement in the Zoning Ordinance and instead setting a maximum on parking allotments.
C.4.3. Create and encourage the use of safe bicycle and pedestrian facilities for commuters and residents.
D. Improving New Construction and Major Renovations
D.1.1. Register and educate all eligible representatives to ensure strong City participation in the vote on the International Energy Conservation Code (IECC) to increase base building efficiency and support electrification and other carbon reduction strategies, and advocate to the Board of Building Regulations and Standards (BBRS) for a net zero Stretch Code.
D.3.1. Work with City Council to amend the Zoning Ordinance to require new construction and major renovations seeking a Special Permit maximize energy efficiency, maximize the use of renewable energy including thermal energy, and use electricity for heating and cooling.
D.3.2. Work with City Council to require that all new construction and major renovations analyze the costs, benefits, and GHG impacts of maximizing energy efficiency; utilizing electric heating, cooling, and hot water; and using renewable energy, including thermal energy.
D.3.5. Work with City Council to adopt Zoning Ordinances that encourage additional, appropriate low-carbon, housing near public transportation.
E. Improving Existing Buildings
E.3.2. Explore opportunities for requiring a standardized, broadly accepted, building energy performance scorecard, to be obtained by a potential seller and disclosed to potential buyers.
F. Reducing GHG Emissions Associated with Consumption and Disposal
F.1.1. Work with the Economic Development Director and the Newton-Needham Chamber of Commerce to explore incentive programs for businesses to reduce GHG emissions associated with consumption and disposal.
F.1.2. Explore adoption of a voluntary program that would allow contributions to a municipal program to help offset GHGs produced by air travel.

To meet the overall goal of carbon neutrality by 2050, implementation of various strategies, including the following, will be necessary. These strategies, metrics, and milestones may change or be improved over time.

Metrics	2025 Milestones	2050 Goals
B. Clean Energy		
Percent renewables as Newton Power Choice base	100%	100%
Percent of residents opted up to 100% NPC match	15%	n.a.
C. Transportation		
Percent reduction in vehicle miles traveled	5%	20%
Percent of private cars in Newton that are electric	10%	100%
D. New Construction		
Percent of all-electric buildings	100%	100%
E. Existing Residential Buildings		
Number of home energy (re)assessments/year	4000[1]	TBD
Number of insulation installations/year	800[2]	all homes are insulated
Number of heat pump installations/year	450[3]	all homes have heat pumps
Percent reduction in total energy consumption	3%	20%
Percent of all-electric buildings	5%	100%
F. Existing Commercial Buildings		
Percent reduction in total energy consumption	15%	50%

[1] Home energy assessments are projected to climb from 2700 in FY21, to 3500 in FY22, to 4000 in FY 23.
[2] Insulation projects are projected to climb from 600 in FY21, to 700 in FY22, to 800 in FY 23.
[3] Heat pump installations are projected to climb from 100 in FY21, to 250 in FY22, to 450 in FY 23.

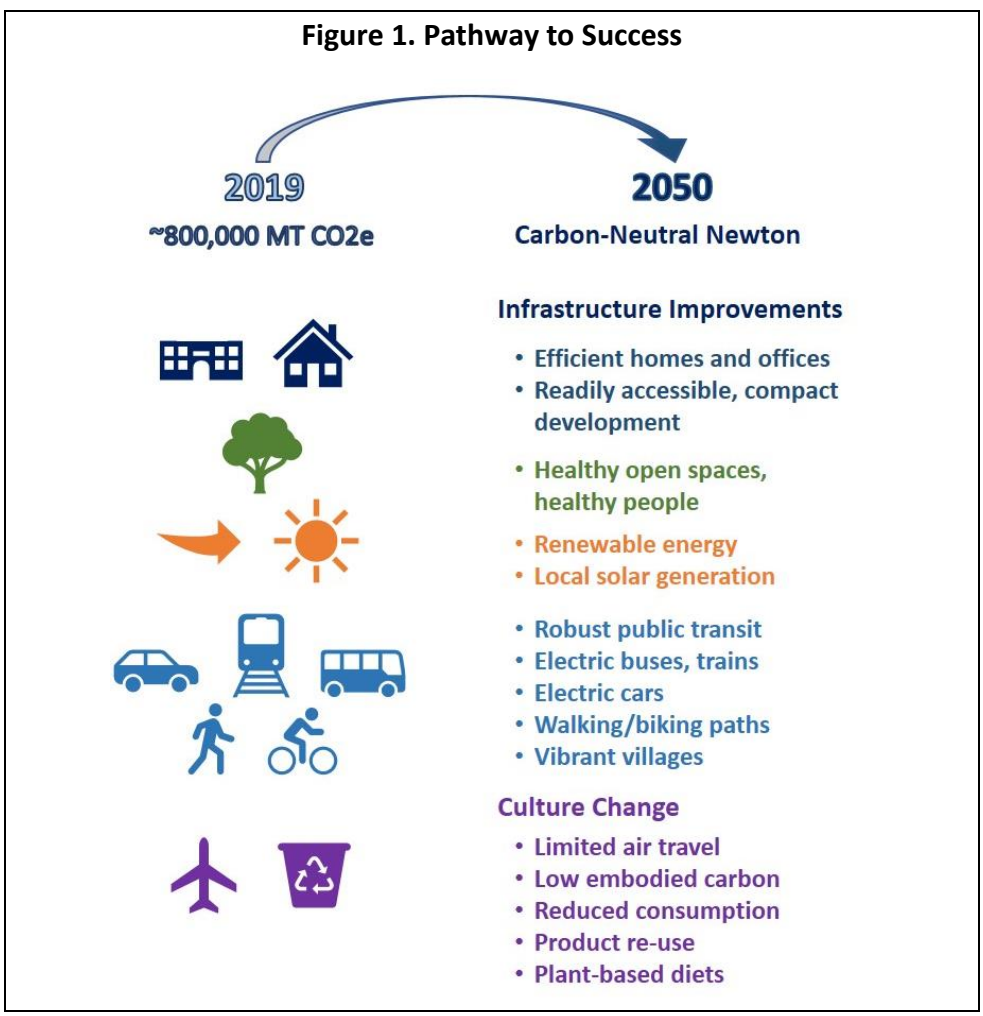
Introduction: Newton's Climate Challenge

Stepping up to the Plate: Creating a Brighter Future

Newton developed this, our first Climate Action Plan, informed by our citizens, shared values, and recent accomplishments. Newton's Climate Action Plan builds on recent efforts and outlines the steps that the City will take during the next five years (2020-2025) to significantly reduce greenhouse gas (GHG) emissions across the community and meet our goal of a carbon-neutral Newton by 2050 (**Figure 1**).

In its Climate Action Plan, the City will seek to equip our residents and businesses with the tools and support needed to make climate-conscious choices that reduce the community's GHG emissions while also leading by example.

Figure 1. Pathway to Success



Global, State, and Local Contexts

Global Context

Climate change is an increasingly urgent crisis and will continue to worsen unless we make significant changes, particularly in our building and transportation sectors. The longer we delay taking ambitious action to reduce GHG emissions, the greater the environmental, public health, and economic problems will be and the harder it will be to achieve our goal. In the Northeastern U.S., climate change will continue to lead to more severe weather events such as heat waves, heavy downpours and droughts; dramatic sea level rise; population relocation; compromised infrastructure, agriculture, and fisheries; and significant changes in the local ecosystems on which we depend. Inaction will exacerbate these occurrences to a catastrophic degree.

The Intergovernmental Panel on Climate Change[4] (IPCC) emphatically states that aggressive, near-term action is required to ensure that global temperatures do not increase more than the upper limit of 1.5ºC. The Fourth National Climate Assessment[5] (2018) underscores the deleterious impacts of climate change already experienced across the country and highlights the gravity of the specific challenges facing people in the Northeast, including changing seasons, sea level rise, changing coastal and ocean habitats, and threats to human health.[6] In light of the crisis, action at the local level – by municipalities and individuals – is essential.

Scientific consensus tells us that we must reduce global GHG emissions by 50-60% in the next 10 years and achieve net zero global GHG emissions by 2050 to avoid catastrophic climate change. The sooner we reach those goals, the better off we will be (**Figure 2**).

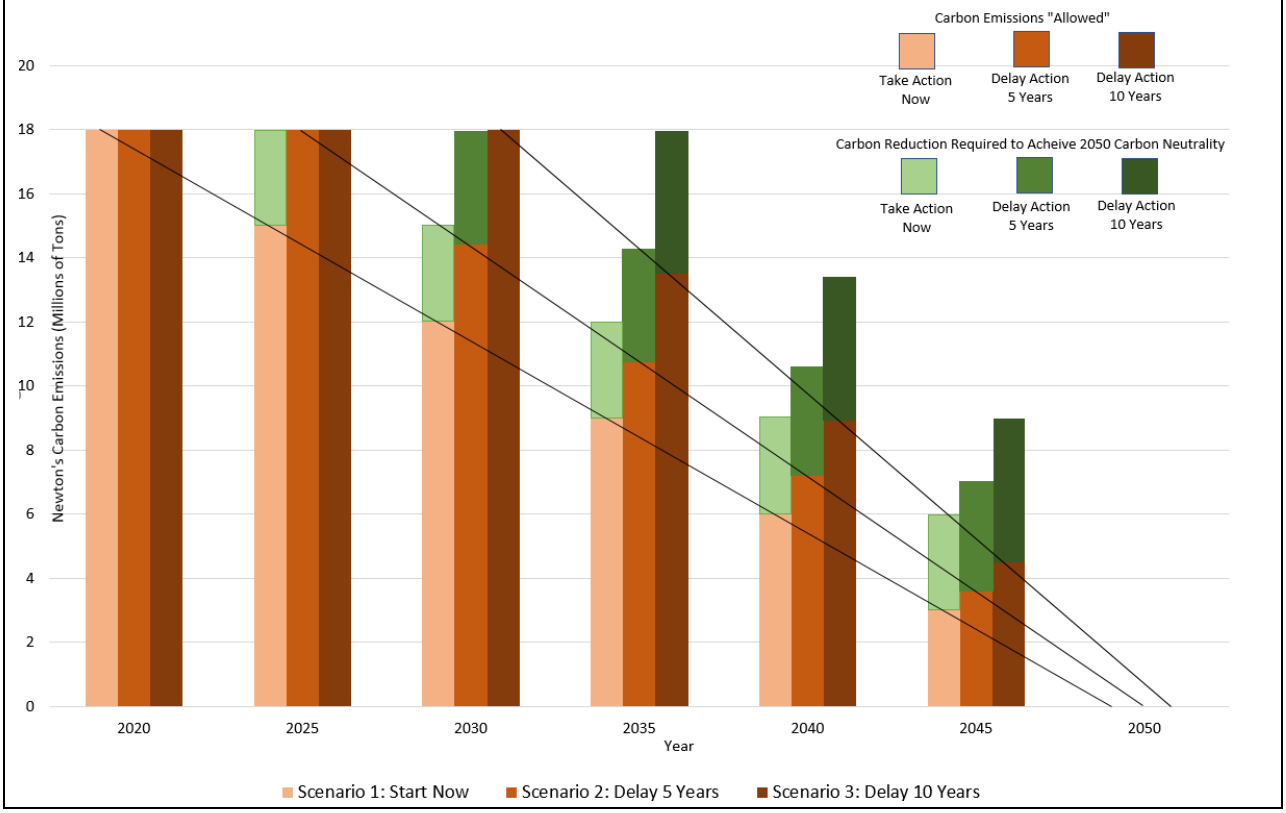
In construction, heating/cooling, and transportation, there have been challenges in increasing efficiencies and in converting from fossil fuels to clean fuels. Fortunately, in the past few years, many more affordable and more reliable solutions have come into the market. Solutions now exist to deliver the necessary GHG emissions reductions in the coming years. The City will enact the appropriate policies and programs to encourage and support rapid adoption.

[4] The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change.

[5] The Fourth National Climate Assessment (NCA4), completed in November 2018, is a comprehensive and authoritative report on climate change and its impacts in the United States.

[6] Dupigny-Giroux, L.A., E.L. Mecray, M.D. Lemcke-Stampone, G.A. Hodgkins, E.E. Lentz, K.E. Mills, E.D. Lane, R. Miller, D.Y. Hollinger, W.D. Solecki, G.A. Wellenius, P.E. Sheffield, A.B. MacDonald, and C. Caldwell, 2018: Northeast. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 669–742. doi: 10.7930/NCA4.2018.CH18

Figure 2. Newton's Required Reductions to Reach Net Zero - Delay Scenarios



State Context

The Commonwealth of Massachusetts committed to tackle GHG emissions in the Global Warming Solutions Act of 2008, with requirements to reduce GHG emissions 25% from 1990 levels by 2020, and 80% by 2050.[7] (Net zero emissions means reducing GHG emissions to zero or balancing GHG emissions with removal or sequestration.) The Commonwealth has developed energy efficiency and renewable energy programs and incentives to support residents, businesses, and municipalities. However, more efforts are needed. In the models developed by the IPCC, keeping global temperatures from rising more than 1.5ºC requires that we reduce global GHG emissions 45% from 2010 levels by 2030 and that we reach net zero GHG emissions by 2050.[8] State and local climate leaders are committing to the deep GHG emissions reductions necessary to mitigate the current and imminent impacts of climate change.

[7] *An Act Establishing the Global Warming Solutions Act*, Chapter 298 of the Acts of 2008. https://malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter298

[8] IPCC, 2018: Summary for Policymakers. In: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.

Local Context

This City has important roles to play in combating climate change: educator, initiator, and facilitator. The City will reach out to its residents and partners to tackle the problems together.

While working with residents and business owners, the City will be mindful of the disparate ability of individual residents and businesses to make lifestyle changes, operational changes, and capital investments. Broadly speaking, the effects of our fossil-fuel economy and climate change are being felt disproportionately by people of lower wealth and lower income and people in other parts of the country and the world where increased flooding, heat waves, tornadoes, and poor air quality already being experienced. Newton will be careful to ensure that as it steps up to meet the challenges of reducing its greenhouse gas emissions, it does so with a sensitivity to more vulnerable populations and without endangering the economic security of any resident or business.

Many improvements to residences and businesses will positively affect GHG emissions as well as climate change resiliency. Improved insulation, for example, protects occupants against severe cold and heat events and lowers GHG emissions associated with heating and cooling. Air-source heat pumps, for example, lower heating and cooling costs for residents and lower GHG emissions associated with heating and cooling. Through this mitigation plan and the City's Climate Change Vulnerability Assessment and Action Plan, the City will work to address the needs of its more vulnerable residents.

To ensure that we will reach our goal of a carbon neutral Newton by 2050, we must achieve interim milestones along the way. Implementers of this 5-year plan will track some metrics to ensure timely achievement of the milestones.

Metrics	2025 Milestones	2050 Goals
B. Clean Energy		
Percent renewables as Newton Power Choice base	100%	100%
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C. Transportation		
Percent reduction in vehicle miles traveled	5%	20%
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D. New Construction		
Percent of all-electric buildings	100%	100%
E. Existing Residential Buildings		
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Number of insulation installations/year	800[10]	all homes are insulated
Number of heat pump installations/year	450[11]	all homes have heat pumps
Percent reduction in total energy consumption	3%	20%
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[9] Home energy assessments are projected to climb from 2700 in FY21, to 3500 in FY22, to 4000 in FY 23.
[10] Insulation projects are projected to climb from 600 in FY21, to 700 in FY22, to 800 in FY 23.
[11] Heat pump installations are projected to climb from 100 in FY21, to 250 in FY22, to 450 in FY 23.

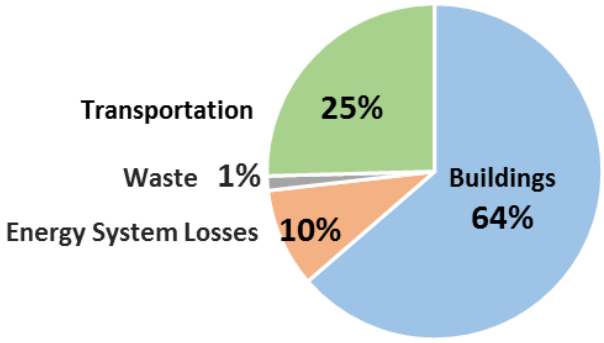
Note: This Plan refers to many technologies, both existing and emerging. Such references are intended to reflect current best practices and intentional trends; such references are not intended to limit exploration or implementation of newer, improved, or alternative technologies. As this 5-year plan is reviewed and updated, references to technologies will be reviewed and updated.

Achieving carbon neutrality will require the combined efforts of many players, in many arenas, and in a multitude of ways. Different combinations of efforts can be brought to bear on the problem and result in success. So, when efforts succeed, we should trumpet our success far and wide, and when our efforts fail, as some are sure to do, we be equally vocal and share the lessons we have learned with all around us, because the knowledge gained from failure is as valuable as that learned by success.

Newton is already experiencing the effects of climate change. We have more frequent and more intense floods and more dangerously hot days.

In 2013, the baseline year for this plan, Newton emitted 785,068 metric tons of carbon dioxide equivalent (CO_2e). Emissions from buildings accounted for 64% of Newton's overall emissions, and emissions from transportation made up another 25% (**Figure 3**). These sectors will be the focus of this plan.

Figure 3. GHG Emissions in Newton by Sector (2013)



Newton is the "Garden City," a place known for its Olmsted-designed parks, verdant neighborhoods, and 13 village centers. We are a community of thinkers, learners, and doers. Newton's motto, "Liberty and Union," conveys the City's respect for individual freedom along with its understanding of the importance of collective action to advance the common interest.

Newton is also known for its hills: "Heartbreak Hill" has been the undoing of many a Boston Marathoner. The Marathon is an apt metaphor for the process we are beginning with this plan. Decarbonizing our homes, our businesses, our transportation, and our society will be a long trek. The sooner we start, the sooner we will reach the finish line. There will be many challenges and hills to climb along the way, but together we can reach our goal – carbon neutrality.

The City of Newton is facing the challenge of climate change head on.

"Working together, we must think globally but act locally. That means reducing emissions of CO_2... It means improving the energy efficiency of our City buildings and installing solar panels on more of them. It means moving toward sustainable energy."

~ Mayor Ruthanne Fuller

This plan focuses on points of municipal leverage: where municipal regulation, leadership, investment, and advocacy can have the greatest impact.

"Given the magnitude of the changes required, it is clear that residents and business owners will need to be strong partners for the City as a whole to make meaningful reductions in greenhouse gas emissions."

~ Mayor Ruthanne Fuller

With this Climate Action Plan, the City is committing to implement significant GHG emission reduction strategies in the next five years, with goals to reduce – and ultimately eliminate – the City's GHG emissions.

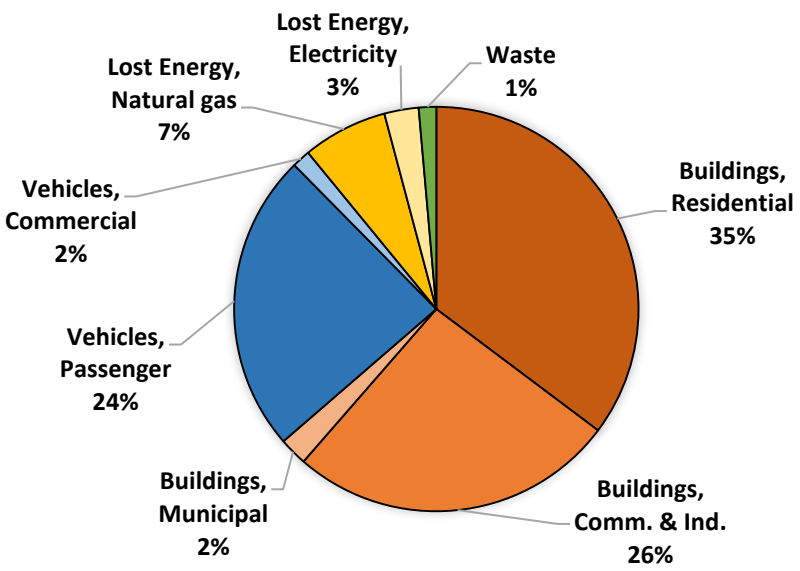
Newton has been addressing issues of sustainability for some time. Newton is designated as a "Green Community" by the Massachusetts Department of Energy Resources. Newton recently completed its Climate Change Vulnerability Assessment Plan (CCVA) and Action Plan, a plan that specifically addresses issues of resiliency in the face of climate change, but which contains many recommendations similar to and supportive of the recommended actions in this mitigation-focused plan. Newton recently updated its Hazard Mitigation Plan. As the City works to implement this Climate Action plan, it will look closely at these other plans to ensure optimal coordination and efficiency. See **Appendix A** for recommendations from the Climate Change Vulnerability Assessment and Action Plan.

Newton's GHG Baseline

As a part of the City's climate action efforts, the City conducted a GHG emissions inventory with a baseline year of 2013 [based on available data and prior work completed by the Newton Citizens' Commission on Energy (NCCE)]. The Metropolitan Area Planning Council expanded on the work completed by the NCCE to provide the City with a methodology that would be simple and easy to update on a regular basis to track progress toward the City's climate action goals (see **Appendix B**).

The GHG inventory work found that in 2013, 785,068 metric tons of carbon dioxide equivalent (CO_2e) were directly emitted from the activities of residents and businesses in Newton. **Figure 4** provides a summary of Newton's GHG emissions. We can organize this information by sector, as in **Figure 4,** revealing that buildings and transportation are the largest contributors, or by responsible party (see **Figure 8**), revealing that residents and businesses are the largest contributors.

Figure 4. Newton's GHG Emissions (2013) by Sector



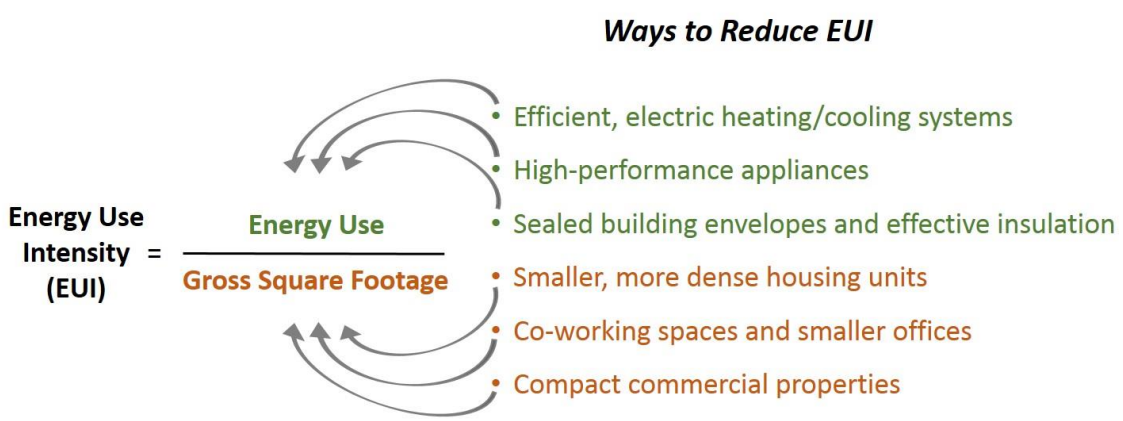
It should be noted that the sector-based approach of the Global Protocol of Community-Scale Greenhouse Gas Emissions Inventories ("GPC") method applied in Newton's 2013 GHG inventory does not include the global impact of GHG emissions from Newton residents' consumption of goods and services. Existing resources point to the need for reducing resource consumption and maximizing of the reuse of materials as important strategies to address the lifecycle GHG emissions associated with goods and services. That said, we are aware that our definition of "carbon neutral" addresses the community's direct GHG emissions from buildings, transportation, etc., and does not focus on "embodied" or indirect consumption-related emissions. Estimates of embodied energy vary widely, depending in part on the timeframe involved.

GHG Contributions by Sector: Buildings (64%)

In Newton, the building sector, excluding municipal buildings, emitted 64% of total GHG emissions identified in the 2013 GHG Inventory baseline. Residential buildings in the City are responsible for the

largest portion of GHG emissions (35.2%), followed by commercial and industrial buildings (26.2%). Energy Use Intensity (EUI) measures the relative efficiencies of buildings of the same size (**Figure 5**) For residential, commercial, and industrial buildings in Newton, an opportunity exists to reduce GHG emissions through energy efficiency, weatherization, and the purchase or generation of renewable energy supply. Municipal buildings are a much smaller contributor to overall GHG emissions; nevertheless, they represent an opportunity for the City to lead by example through the reduction or elimination of natural gas and heating oil in municipal buildings, utilization of clean heating and cooling technologies, and use of and support for renewable energy.

Figure 5. How to Calculate Energy Use Intensity (EUI) and Ways to Reduce EUI



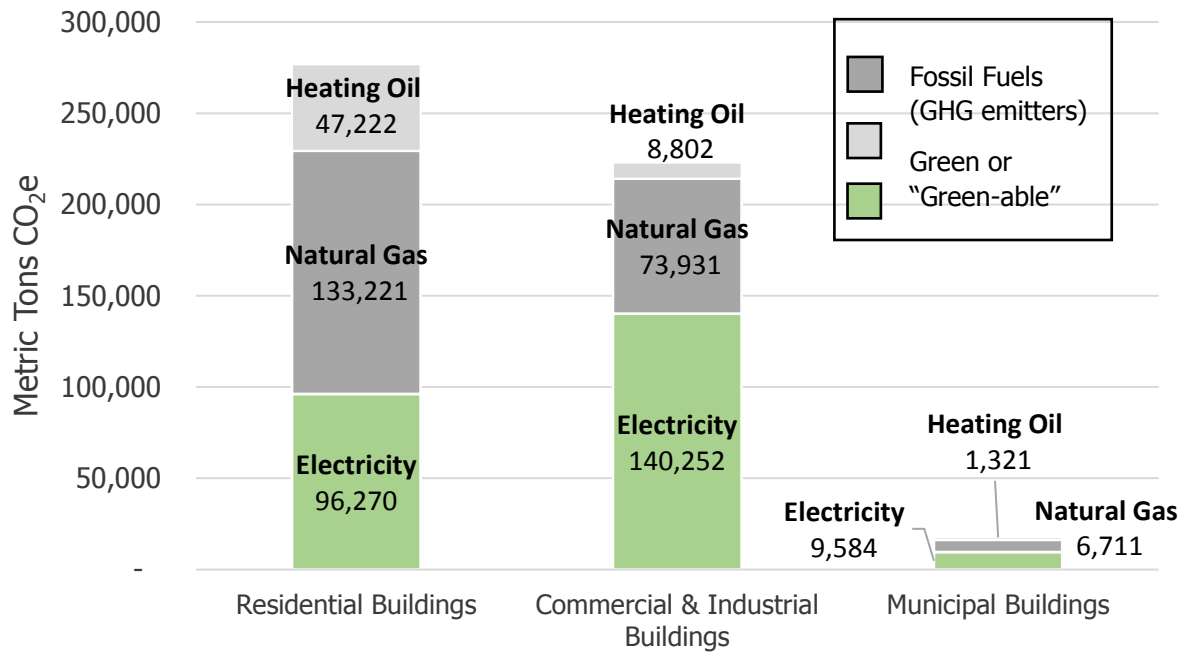
In Newton's residential buildings, natural gas and oil for heating consumption account for nearly two-thirds of total GHG emissions from residential buildings (see **Figure 6**). Natural gas and oil are fossil fuels that contribute greatly to GHG emissions. We can reduce these GHG emissions by increasing the efficiency of buildings and electrifying then. Using electricity allows building owners to utilize power generated from solar, wind, or other "green"/renewable sources of energy as they become available. In this way we can (re)build our infrastructure to become ever more sustainable as more and more renewable electricity becomes available. Achieving carbon neutrality in the building sector rests on three essential approaches:

(1) For existing buildings currently using natural gas or oil for heat, hot water, and appliances, transitioning to electric and/or renewable power;

(2) For existing buildings with inadequate insulation, retrofitting with air-sealing and insulation to reduce energy losses; and

(3) For all new construction, using low embodied energy materials and building to low energy use standards (e.g., Passive House – see text box on page 49)

Figure 6. Newton's Building Sector Emissions (2013) by Fuel Type



GHG Contributions by Sector: Transportation (26%)

GHG emissions from passenger and commercial vehicles in Newton are the second largest source of GHG emissions and make up a quarter (25.5%) of the City's emissions.

Achieving carbon neutrality in the transportation sector rests on two essential approaches:

(1) mode shift (to reduce the number of single-occupancy vehicle trips); and

(2) transition of passenger and commercial vehicles to zero-emission vehicles, namely battery electric vehicles (or plug-in hybrid electric vehicles as an interim step to fully electric).

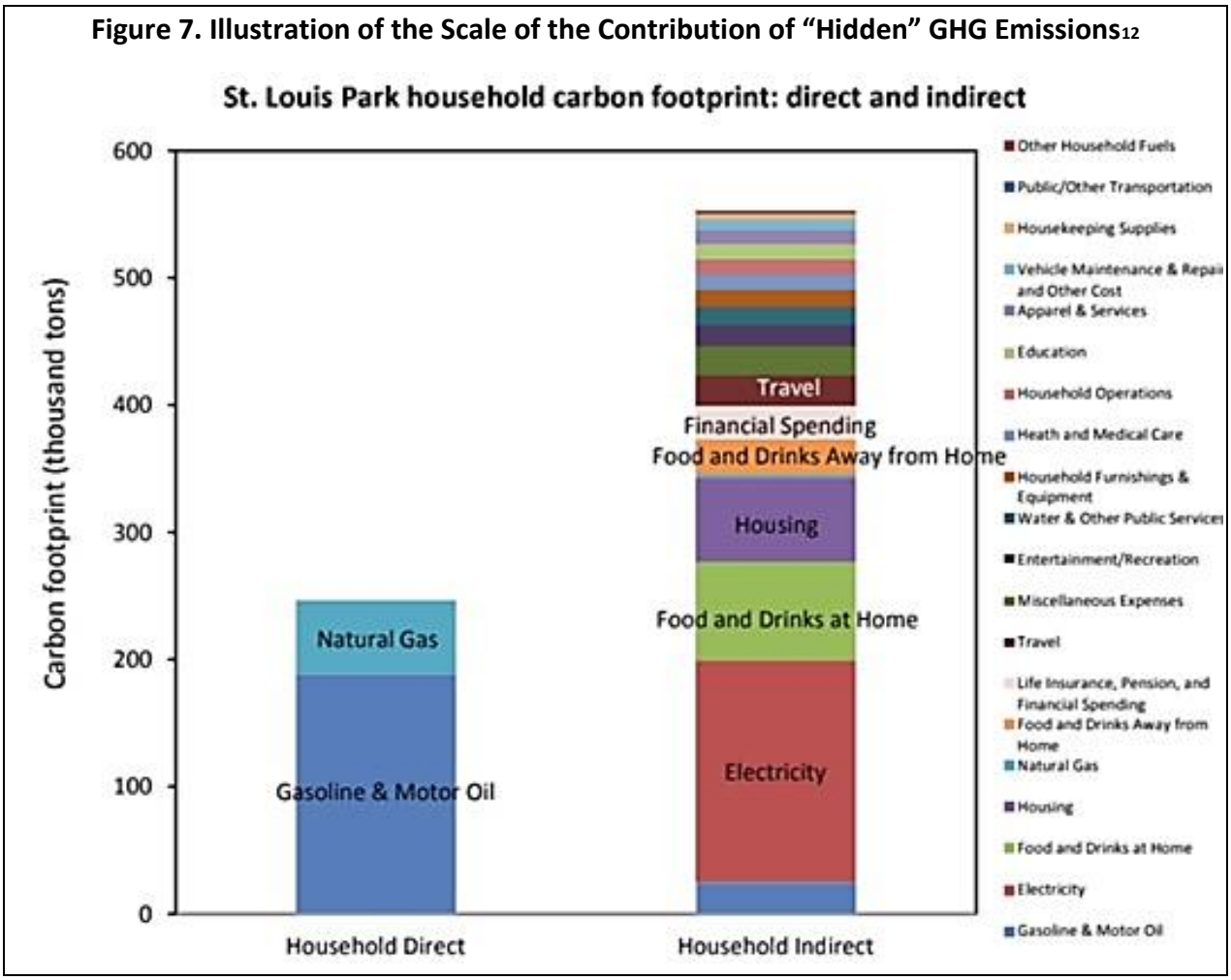
GHG Contributions by Sector: "Hidden" Contributions (Significant)

There are two additional "hidden" but huge contributing "sectors" not accounted for in Newton's GHG inventory.

"Embodied energy" or "embodied carbon" is the greenhouse gas emitted during the production and transport of materials consumed in Newton, from building supplies to furniture, to clothing. It can represent an additional 50-100% of total emissions (see **Figure 7**).

The GHG emissions associated with air travel are also not accounted for in Newton's GHG inventory, yet they are one of the largest contributors to global GHG emissions. Reduction of air travel is one of the most effective means of reducing an individual's carbon footprint. People can explore their own "carbon footprints" at a number of websites, including: https://www3.epa.gov/carbon-footprint-calculator/ and https://www.carbonfootprint.com/calculator.aspx

Figure 7. Illustration of the Scale of the Contribution of "Hidden" GHG Emissions[12]



See Section F for more discussion on these issues.

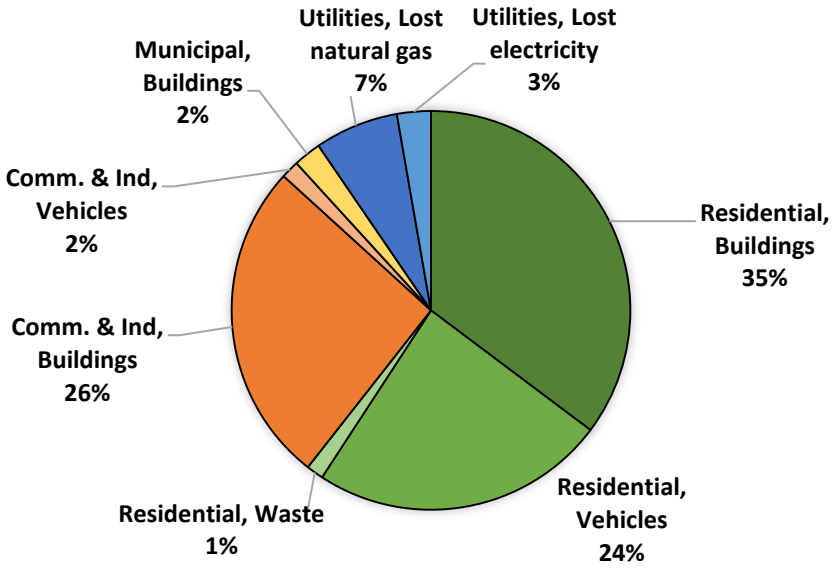
GHG Contributions by Contributing Party: Residents (59%)

Figure 8 breaks down GHG emissions in Newton by responsible party. This figure highlights the point that the greatest opportunities -- and responsibilities -- to reduce the City's GHG emissions lie in the hands of Newton residents and businesses.

The sections of **Figure 8** shown in shades of green illustrate that 59% of all direct GHG emissions result directly from citizens' activities. Private homes and vehicles are the single largest contributing factor to our overall carbon footprint. This means that choices made by the residents of Newton will be the single most important determinant in mitigating GHG emissions.

[12] Front and Centered, Oregon https://frontandcentered.org/what-counts-when-we-count-carbon-pollution-lessons-from-oregon/

Figure 8. Newton's GHG Emissions (2013) by Responsible Party



GHG Contributions by Contributing Party: Businesses (27%)

Those sections shown in shades of orange in **Figure 8**, 28% of all GH emissions, illustrate the contributions by Newton's businesses and industries. Newton's businesses will play a key role in impacting the community's GHG emissions.

GHG Contributions by Contributing Party: Utilities (10%) and Municipal Operations (3%)

Those sections shown in yellow and shades of blue in **Figure 8** illustrate that the remaining 14% of GHG emissions result from energy distribution system losses, municipal building and fleet operations, and domestic and industrial waste and wastewater. Energy system losses reflect the sum total of leaking gas, electricity lost in transmission, and other system losses.

What Success Looks Like for Newton and How to Get There

Long-term success is a **carbon-neutral Newton by 2050**. **That is our goal.**

The carbon-neutral Newton of 2050 will have electrified vehicles, homes, and appliances; an energy-efficient built environment; transit-oriented neighborhoods and business districts; robust, electrified public transit from the MBTA; significant use of solar panels; well-developed and well-used walking and biking trails; and a generous street tree canopy. These conditions will provide the associated benefits of new job opportunities, reduced energy costs, reduced traffic congestion, improved air quality and improved public health.

Carbon Neutrality

"Carbon neutrality" is achieving net zero greenhouse gas emissions. This is accomplished by eliminating carbon and other GHG emissions altogether and by balancing any remaining GHG emissions with "carbon sequestration" (removing GHG emissions from the air by storing it in natural areas, like trees and soils, or manmade "mines"), and potentially by "carbon offsetting" (buying carbon credits from elsewhere).

In the shorter term, success will set Newton on a pathway to carbon neutrality. The steps laid out for the first five years of the City's commitment to climate action, when implemented, put the City on the pathway toward achieving this goal. The success of this plan will be measured through action-specific performance indicators outlined herein.

To achieve its goal, Newton will have to embrace the strategic mantra:
"Use less and green the rest."

Use Less: We must take every opportunity to reduce the energy consumed by and embodied in buildings and transit by insulating our homes, reducing travel, and reducing consumption.

Green the Rest: We must take every opportunity to stop using fossil fuels to generate power in our buildings (coal, natural gas, and oil are the greatest contributors of GHG emissions) and instead use renewable energy sources (solar and wind) to create clean/green electricity. We must replace our gasoline-powered cars and lawn mowers and our natural gas fired boilers and water heaters with efficient electric replacements. And we must capture carbon from the atmosphere by expanding our urban forests and green infrastructure.

Image from Newton Mothers Out Front

Concerted individual efforts and new partnerships will be necessary for success. The Administration and staff will have to direct the power of City Hall to help educate, advocate, and promote real change. And residents and businesses will have to accept the magnitude of the challenge and make the changes necessary to achieve success. Individuals must take one or more actions over the next five years for this plan to be a success, and then build on that.

The Top 10 strategies to be employed are:

Establishing Teams and Partnerships

1. Create a City implementation team, develop appropriate municipal planning and budgeting processes, and ensure regular Plan evaluations and updates (A.1.)
2. Work with partners to build awareness and drive action (A.2.)

Use Less

3. Increase rate of biking, walking, telecommuting, shared rides, and use of shuttles and public transit, while reducing single-occupancy vehicle trips (C.4.)
4. Advocate for a more energy-efficient and climate-smart building code (D.1.)
5. Work with City Council to adopt Zoning Ordinance amendments that require and/or incentivize high-efficiency performance, such as Passive House and/or net-zero new construction – within the next 12 months (D.3.)

Green the Rest

6. Increase the amount of electricity provided by New England renewable energy resources (B.1.)
7. Ensure that municipal infrastructure and operations are as "green" as possible (C.1.)
8. Incentivize residents to switch to EVs with a goal of having 10% of all vehicles on the road be EV, BHEV, ZEM, PHEV+ by 2025 (C.2.)
9. Transition to electric and thermal heating and cooling in residential and commercial buildings (E.2.)
10. Consider initiatives to engage businesses and residents in reducing GHG emissions resulting from corporate operations and individual activities (F.1.)

"Reducing energy use is not about doing without – it is about doing without waste."

~ Daniel Yergin (author, speaker, energy expert, and economic historian)

The following **6 sections or focus areas** identify 53 specific specific actions to reduce GHG emissions and make significant progress toward achieving carbon neutrality by 2050. The recommended actions focus on points of municipal leverage where the City can reduce municipal emissions or support emissions reductions in the broader Newton community.

A. **Implementing Newton's Climate Action Plan**: The City is committed to ensuring the success of this Climate Action Plan by adapting internal operations, working with dedicated partners, and tracking our progress with specific metrics.

B. **Promoting Clean and Renewable Energy**: "Greening" the sources supplying electricity to the City is vital to the pathway to carbon neutrality. The City will promote and expand Newton Power Choice, increase local renewable energy production through the installation of municipal solar arrays and the promotion of private solar installations, and offset its own GHG emissions with the purchase of renewable electricity supply.

C. **Greening Newton's Transportation and Streetscapes**: The second largest source of GHG emissions in Newton comes from on-road transportation. The City will support Newton's residents,

workforce, and visitors in switching to battery electric and plug-in hybrid vehicles; reducing single-occupancy vehicle trips; and increasing biking, walking, telecommuting, public transportation, and shared trips.

D. **Improving New Construction and Major Renovations**: Energy use reduction and electrification are the backbones of any GHG emissions reduction plan. As new developments are built and renovations are undertaken, the choices made by developers and architects will have a significant impact on the City's GHG emissions profile. To the extent legally permissible, the City will take steps to ensure that construction meets standards necessary to achieve carbon neutrality by 2050.

E. **Improving Existing Buildings**: Existing residential and commercial buildings in Newton are responsible for a majority of the City's GHG emissions. The City will work with owners to increase energy efficiency, reduce reliance on natural gas and heating oil, and increase the use of efficient electric technologies in the City's existing building stock. Moving the needle for existing buildings will require the City to put in place "carrots and sticks" to incentivize significant action by the private sector.

F. **Reducing Emissions associated with Consumption and Disposal**: We will work to protect and enhance the City's natural resource base and help Newtonians limit their consumption of goods and services and disposal of materials.

Recommended Actions: 2020-2025

A. Implementing Newton's Climate Action Plan

Newton's Implementation Leadership Strategies

- Create an appropriate municipal implementation structure and processes
- Foster collaboratives of businesses promoting adoption of clean energy technologies and practices to build awareness and drive action

A plan is only as good as its implementation. The City is committed to ensuring the success of this Climate Action Plan by revising internal coordination and working with dedicated partners.

A.1. Create a City implementation team, develop appropriate municipal planning and budgeting processes, and ensure regular Plan evaluations and updates

A.1.1. Transform the existing Major Projects and Infrastructure Cluster into the Major Projects, Infrastructure, and Climate Change Cluster to oversee implementation and track the progress of this Plan.

The new Cluster (an interdepartmental working group) will include, but not be limited to, representatives from the Sustainability Department, Planning Department, Department of Public Works; Public Buildings Department; Parks, Recreation, and Culture Department, and the Mayor's Office. Decision makers will view all decisions with a climate focus, spanning the panoply of municipal endeavors. While the Sustainability Director(s) will be the project manager(s) for the implementation of the Climate Action Plan, all members of this Cluster will help oversee the implementation of the plan, analyze the efficacy of actions (based on the "key performance indicators" for each action), and ensure that annual progress reviews are undertaken.

Members of the Cluster will collaborate with the Newton Citizens Commission on Energy, City Council, Newton-Needham Chamber of Commerce, Green Newton, Charles River Watershed Association, neighboring communities and other local and regional advocacy and action groups.

Members of the Cluster will coordinate with the Metro Mayors Coalition (MMC) Climate Preparedness Taskforce to share best practices learned, access shared resources, and advocate for changes at the state level.

The primary tasks for the Cluster to undertake include:

- Developing clearer estimates of the costs and benefits of proposed municipal actions (A.1.2.)
- Tracking the primary metrics (A.1.3.)
- Updating the City's GHG inventory (A.1.4.)
- Reviewing the Climate Action Plan (A.1.5.)
- Updating the Climate Action Plan (A.1.6.)

- Providing updates to the City Council and the public (A.1.7.)

- Examples: Existing Newton City Hall clusters
- Metric(s): Regular Cluster meetings, identification of specific projects and project leaders
- Implementer: Major Projects, Infrastructure, and Climate Change Cluster

A.1.2. Develop more concrete estimates of costs and fiscal benefits for each municipal action recommended in this plan and incorporate funding categories or appropriate metrics in the FY 2021 CIP prioritization process to reflect the priorities of this plan and other related plans (such as the Climate Change Vulnerability Assessment and Transportation Plan).

The Cluster will assess the City's staff capacity to determine whether it will be necessary to add additional staff and/or hire consultants to support the implementation of this and other climate-related plans. The Cluster will engage relevant City staff in implementation of initiatives and will ensure that the plan is used to inform municipal priorities.

This plan reflects Newton's first effort to compile background information and generate a comprehensive set of recommended actions designed specifically to reduce GHG emissions. This plan does not contain detailed information on the anticipated costs of individual reduction efforts (capital, operating, staff, etc.) or the magnitude of expected GHG reductions. Such information is important and will be added as the plan is refined and updated. It is clear, however, that the success of this plan requires investments of time and money. It is understood that both time and money are in short supply, and many worthy investments, from public safety to affordable housing, also deserve increased funding and human resource support.

As a community we also have to think strategically about how costs and benefits are evaluated. We must consider and compare all benefits and all costs of action and inaction over long time horizons. Individual residents will have to commit their own resources of time, money and behavior change.

As priority actions are identified, **costs** will be scrutinized, and questions will be wrestled with.

- Who will pay for new initiatives? The City's taxpayers? Individual residents? Businesses?
- Are the proposed costs short-term or long-term?

Benefits will also be scrutinized. It should be noted that taking action to address climate change not only reduces GHG emissions, it can also result in cost savings and quality of life improvements (see **Figure 9**). Some actions raise costs in the short term but save money in the longer term. Other actions can result in immediate cost savings. For example, new net-zero buildings, some brands of electric vehicles, and additional City staff devoted to implementation of new programs may require significant investment up front but will save money in the long term. On the other hand, by installing solar panels and switching to LED lighting, the City has saved millions of dollars in the short run. Similarly, individuals who adopt energy efficiency measures, unplug unused devices, participate in the Newton Power Choice program, and eat less meat save money, even in the short run. Some actions cost more yet have significant reductions in GHG emissions. The City should continue to pursue all "win-win" actions and should encourage residents and businesses to do the same.

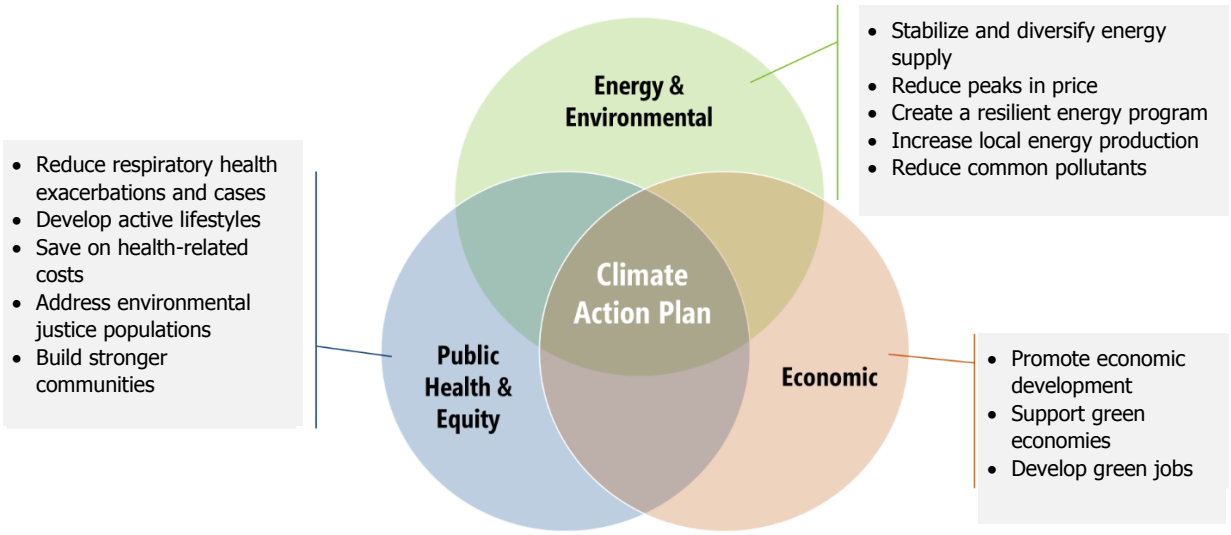
Similarly, **"externalities"** (costs that we all pay but don't recognize or explicitly account for) need to be considered. Examples of externalities include the health care expenses associated with breathing dirty air or the costs of providing flood relief. Addressing climate change can help eliminate these "silent costs."

The **value of leadership** in addressing climate change will also be considered. One example of the benefits of strong leadership is the City's experience with Newton Power Choice, the City's "municipal electricity aggregation" program. By choosing a high standard level of renewable resources (i.e., 60%), Newton has encouraged other cities and towns, like Lowell and Watertown, to increase the percentage of renewables in their own aggregation programs. Newton should continue to consider the importance of its leadership role as it makes difficult policy choices.

Ultimately, climate change priorities will have to be incorporated in the City's Capital Investment Plan (CIP) and annual operating budgets.

- Examples: none
- Metric(s): Clear documentation of project costs and benefits, information incorporated in CIP documents
- Implementer: Major Projects, Infrastructure, and Climate Change Cluster, CFO

Figure 9. Co-Benefits of Climate Action



A.1.3. Evaluate the success of initiatives in this plan -- collect data on immediate and measurable results.

Ultimately, the Climate Action Plan will be successful to the extent that it results in lower GHG emissions.

Directly measuring the City's GHG emissions is difficult and often the data isn't available until years after the fact. For example, as of late 2018, MAPC had released data on GHG emissions from miles driven by vehicles registered to Newton residents only through 2014.

In addition, the actions of the City itself will have only indirect impacts on GHG emissions. For example, while the plan calls for providing EV chargers and preferred parking for EVs as a way to generate awareness and to entice residents to make EV purchases, in the end, it is the residents

who make EV purchases. After the City has implemented a well-executed preferred parking program and if EV purchases have not met targets, the City should reevaluate its plans and consider new initiatives.

Additionally, many of the actions the City will take between 2020 and 2025 will have a very small impact on emissions in the near term. For example, it would be a major accomplishment to have 20 new homes built to Passive House standards in 2020. However, that accomplishment would have a negligible impact on 2020 emissions. Nonetheless, 20 new homes built to Passive House standards is important.

Despite these challenges, the City will collect data on immediate and measurable results and will consider ways to publicize this information as it is updated (e.g., with a web-based "dashboard"), because only through continuous adaptation based on measurable results can the City achieve its climate goals.

1. Clean Energy
    a. Percent of renewables as Newton Power Choice baseline
    b. Percent of residents opted up to 100% NPC match
2. Transportation
    a. Percent reduction in vehicle miles traveled
    b. Percent of all private cars in Newton that are electric
3. New Construction
    a. Percent of all-electric buildings
4. Existing Residential Buildings
    a. Number of home energy assessments per year
    b. Number of insulations and number of heat pump installs per year
    c. Percent reduction in total energy consumption
    d. Percent of buildings that are all-electric
5. Existing Commercial Buildings
    a. Percent reduction in total energy consumption
    b. Percent of new units with HERS ≤40
6. The other individual performance indicators identified in this plan

- Examples: none
- Metric(s): Annual reports provided to the public, documentation from individual projects
- Implementer: Major Projects, Infrastructure, and Climate Change Cluster, Sustainability Department

A.1.4. Update the Greenhouse Gas Inventory every 3 to 5 years.

Appendix C provides the City with an easily updatable framework for the GHG inventory. **Appendix B** provides a detailed description of the methods applied and data sources for the inputs necessary to update the inventory.

- Examples: the GHG inventory in Appendix E
- Metric(s): A current GHG inventory
- Implementer: Major Projects, Infrastructure, and Climate Change Cluster, Sustainability Department

A.1.5. Incorporate action items (and milestones) from this Plan into annual departmental work plans.

The members of the Cluster will work to adapt individual annual departmental work plans to incorporate all relevant aspects of this Plan.

- Examples: none
- Metric(s): Regular reporting to and through the Cluster
- Implementer: Major Projects, Infrastructure, and Climate Change Cluster, with municipal, volunteer, and private partners

A.1.6. Review the Climate Action Plan regularly and update the plan as needed, but at least every 5 years.

The City will review the Climate Action Plan (and its specific actions and metrics) regularly throughout the process of detailed planning, budgeting and implementation to ensure that we are on a path to success. The City will continue to evaluate the need and opportunity for the increased stringency of this plan. This plan will be updated as needed to account for the City's progress in meeting its goals, fiscal conditions, policy changes, technological advancements, and other developments beyond the control of the municipal government. At a minimum, it will be updated every 5 years.

- Examples: This Plan
- Metric(s): Revised Climate Action Plan
- Implementer: Major Projects, Infrastructure, and Climate Change Cluster

A.1.7. Provide annual updates to the City Council and the public.

Annual reports will be provided to the City Council and the public on progress made under this plan. Metrics identified in A.1.3. that can be readily updated more frequently will be updated on the City's website. The City will consider creating a "dashboard" to facilitate publication of critical metrics.

- Examples: none
- Metric(s): Annual reports provided to the City Council and the public
- Implementer: Major Projects, Infrastructure, and Climate Change Cluster

A.2. Work with partners to build awareness and drive action

A.2.1. Promote energy efficiency and GHG emission reduction in the Newton community through a Memorandum of Understanding with Eversource and National Grid.

Eversource and National Grid, Newton's electric and natural gas providers, have ratepayer funded programs available to help all customers make their buildings more efficient and support the installation of EV charging stations. These programs provide customers energy assessments, financial incentives, and information, primarily through the Mass Save organization.

The City is working with both utilities and the Newton Citizens Commission on Energy to develop a Memorandum of Understanding (MOU) with the utilities, with a goal of increasing uptake by Newton customers of these energy programs. The goal of this MOU is to get greater participation by more Newton customers in the programs. The MOU will address programs for residences and businesses to help them implement more measures that will save energy and reduce GHG emissions.

- Examples: none
- Metric(s): Signed MOU
- Implementer: Sustainability Department, Mayor's Office

A.2.2. Develop an Energy Coach role.

In order to implement certain aspects of this plan, a new role in the City, an "Energy Coach," will be necessary. Such a role will be initiated in FY 2021 if funding is made available (see action A.2.1.). The Energy Coach will, initially:

(1) Create and maintain a repository of locally relevant energy information and provide information on the City's website, www.newtonma.gov/climate, through the climate action newsletter, and in-person at City Hall.

(2) Build relationships with qualified contractors to increase participation in energy efficiency upgrades.

(3) Provide information to residents, developers, and businesses applying for building permits, wetland permits, and special permits about clean heating and cooling technologies and efficient appliances and about grants or other financing for buildings currently heated with gas or oil (currently more than 90% of residential, retail, and office buildings in Newton). The Energy Coach will develop outreach programs to improve access to incentive programs across the community and particularly in underserved sectors (e.g., landlords/renters), targeting buildings with the worst energy performance, such as the 9,000+ homes and businesses in Newton currently heated with oil, and other areas of greatest opportunity. The Energy Coach will focus on ways to tighten building envelopes through the Mass Save program and other vendors. The goal is to triple the number of homes and businesses participating in energy assessments and implementation of major energy efficiency measures.

(4) Coordinate with community organizations to implement a community-wide, energy-efficiency outreach program to significantly increase uptake of energy efficiency measures including clean heating and cooling technologies.

(5) Promote the resources available from Mass Save, the Massachusetts Clean Energy Center (MassCEC), and others to support the installation of these systems.

- Examples: Boston[13], Cambridge[14],Energy Smart Bangor[15]
- Metric(s): Creation of an Energy Coach role; number of homes and businesses undertaking energy efficiency retrofits; dollars of energy system upgrade incentives; dollars of private investment leveraged
- Implementer: Sustainability Department(with support from, the Newton Citizens Commission on Energy, and local environmental groups), Utility Providers

[13] City of Boston, MA. "Greenovate Boston 2014 Climate Action Plan Update," p. 32 https://www.boston.gov/sites/default/files/greenovate_boston_2014_cap_update.pdf

[14] City of Cambridge, MA. "The Getting to Net Zero Framework," p. 17 https://www.cambridgema.gov/CDD/Projects/Climate/~/media/D74193AF8DAC4A57AC96E2A53946B96B.ashx

[15] The City of Bangor, Maine used unexpected budget surplus funds left over after oil prices were lower than anticipated to start the Energy Smart Bangor program which provided additional incentives for its residents to participate in the Efficiency Maine program, similar to Mass Save. More information at http://www.bangormaine.gov/energysmartbangor.

A.2.3. In collaboration with the Utilities, work with the largest energy users in the City to reduce their GHG emissions.

Newton is home to many large businesses and institutions that can play key roles in making Newton a Green City and in the implementation of this Climate Action Plan and reducing the community-wide greenhouse gases in Newton. Establishing a leadership group will help raise the visibility of the Climate Action Plan among commercial property owners, businesses, and institutions, and encourage them to develop their own initiatives to reduce GHG emissions and share best practices. Membership in such a collaborative would likely begin with the City's largest energy users. Members would develop MOUs with the utilities pledging to achieve specific GHG improvements (e.g., reductions in energy use, installation of EV charging stations, and on-site solar generation) in return for incentives from the utilities. By engaging a relatively small group of stakeholders and by leveraging their support for smaller local businesses to undertake similar improvements, significant reductions of GHG emissions could result.

The Sustainability Department will work with the Newton Citizens Commission on Energy, Newton-Needham Chamber of Commerce, the Economic Development Director, and Green Newton to develop the right group mechanism to support, incentivize, and educate businesses and organizations in the City of all sizes. That group will also work with Eversource and National Grid to recruit and support new members of an enlarged leadership group in developing MOUs for energy efficiency.

- Examples: none
- Metric(s): Number of large users participating in MOU
- Implementer: Mayor's Office, Sustainability Department, Planning Department, and Partners

A.2.4. Work with the Newton-Needham Chamber of Commerce and the NCCE to explore possible structures for a "Green Ribbon Commission" and implement the preferred model.

Explore models that would best educate and incentivize businesses of all sizes to reduce their GHG emissions. Consider advertising and promoting achievers with awards and public recognition events.

- Examples: Boston Green Ribbon Commission[16], Cleveland's 2030 District[17]
- Metric(s): Establishment of Green Ribbon Commission, GHG reduction commitments from participating members
- Implementer: Mayor's Office, Sustainability Department, Planning Department, Economic Development Commission, N-N Chamber of Commerce, Green Newton

[16] The Boston Green Ribbon Commission is a "group of business, institutional, and civic leaders in Boston working to develop shared strategies for fighting climate change in coordination with the City's Climate Action Plan." https://www.greenribboncommission.org/

[17] 2030 Districts are "organizations led by the private sector, with local building industry leaders uniting around a shared vision for sustainability and economic growth – while aligning with local community groups and government to achieve significant energy, water, and emissions reductions within our commercial cores." http://www.2030districts.org/

CASE STUDIES: Successful Community Engagement Strategies from other Cities

Community Summits have been highlighted as a successful tool to engage community in Boston, Chicago, and other cities. The City of Chicago's Climate Action Plan recommends bringing stakeholders together every five to six months to keep stakeholders informed of progress and ensure community-wide buy-in. http://www.chicagoclimateaction.org/

External Advisory Groups for focus areas with representatives from key partner organizations such as business and industry associations, other levels of government, non-government organizations and academia has been a highlight throughout multiple CAPs to ensure accountability for goals progress. Identifying a responsible group of individuals to implement certain goals helped many cities to stay on track and collect better data.

The City of Paris engages stakeholders in a creative way by providing an opportunity to become **"Partners" in the Paris Climate and Energy Action Plan**. By signing a partnership agreement, stakeholders receive the status of "Sustainable Paris Doers." This stakeholder network, led by the City of Paris, acts as a social network and lists all eco-actions and showcases Doers, encourages exchange of sustainable ideas, offers practical tools, and hosts monthly free events that are open to public. https://parisactionclimat.paris.fr/fr/propos

Newton's Municipal Climate Leadership Accomplishments and On-Going Efforts

- As a Green Community, Newton has leveraged over $1.3 million dollars of grants for municipal energy conservation measures in buildings and fleet resulting in 12% less municipal energy use since 2010.
- The City has transitioned nearly half of the interior lighting in its buildings and all of its streetlights to energy-efficient fixtures.

B. Promoting Clean and Renewable Energy

Newton's Clean and Renewable Energy Strategies

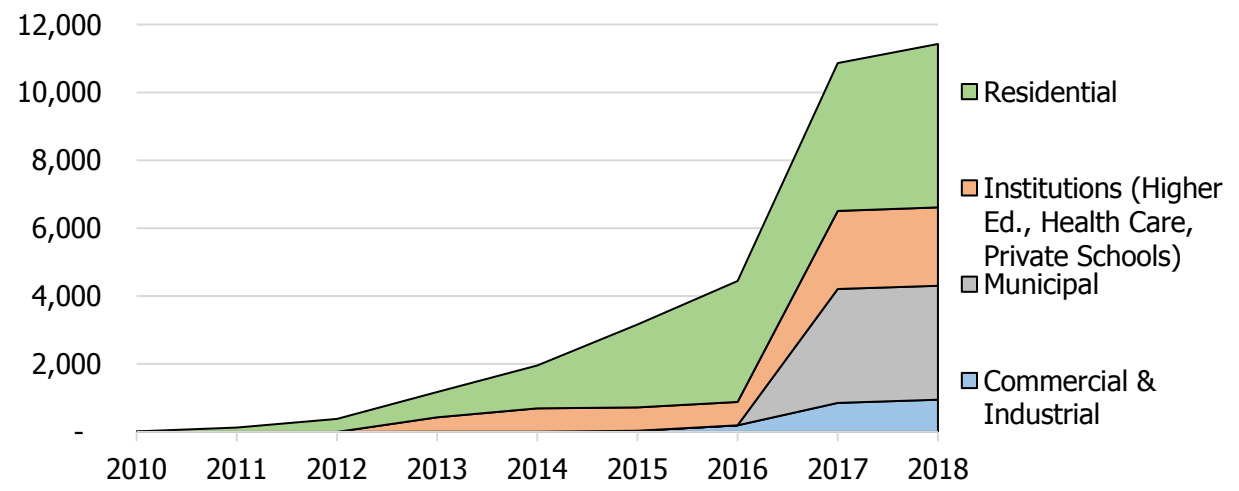
- Increase renewable energy production in New England and the percentage of residents and businesses opting up to 100% renewable energy through Newton Power Choice
- Increase residential and commercial solar production in Newton
- Support advocacy groups' efforts to transition from natural gas to renewable energy systems

To eliminate carbon emissions altogether or to achieve a net-zero carbon footprint will necessitate deep reductions in overall energy consumption through increased energy efficiency, energy conservation, and management of energy demand *and* a transition from fossil fuels to renewable energy. We must, therefore, work to harness clean energy from renewable sources (e.g., solar and wind) for the generation of "clean" electricity.

While an impressive amount of solar PV has already been installed in Newton (see **Figure 10**), there is more untapped potential for solar on the rooftops of Newton's homes, municipal buildings, and businesses as well as solar canopies on parking lots.

Both solar thermal and geothermal energy present other opportunities to increase the use of renewable sources of energy in Newton.

Figure 10. Renewable Energy in Newton Total kW of Nominal Capacity* (DOER 2018 SREC Data)



**Nominal Capacity* is the theoretical full-load sustained output of a facility (e.g., power plant, generator,

B.1. Increase the amount of electricity provided by New England renewable energy resources

B.1.1. Encourage residents and businesses to opt up to 100% renewable energy through Newton Power Choice.

To increase the percentage of residents and business that choose to opt up through Newton Power Choice, the City will continue its ambitious "Opt-Up" campaign involving a variety of public outreach mechanisms to encourage electricity customers to choose 100% renewable power. This includes installing signs throughout the City, sending email messages and other communications from the City to electricity customers, and continuing a well-publicized competition between Newton and Brookline to achieve the highest percentage of opt-up customers. By mid-2019, more than 6% of Newton residents who were on Eversource Basic service have opted up to 100%. This is higher than any other Massachusetts municipality.

- Examples: Newton[18], Arlington[19]; Somerville[20]; Brookline[21]
- Metric(s): Number of customers that opt up through Newton Power Choice, additional renewable energy purchased
- Implementers: Sustainability Department, Local Environmental Organizations

B.1.2. Explore increasing the percentage of MA Class 1 RECS in the City's next Newton Power Choice contract.

As of mid-2019, Newton Power Choice has a higher standard level of renewables (i.e., 60%) than any other municipal aggregation program in the State. When the current Newton Power Choice 22-month contract expires, Newton will go out to bid again for an electricity supplier and, bid prices permitting, will increase the standard percentage of renewables in the program. With the next contract, Newton will again engage in an ambitious campaign to persuade electricity customers to choose 100% renewables.

Newton will also continue its efforts to persuade the state Department of Public Utilities (DPU) to facilitate the adoption of successful "green" municipal aggregation programs in other communities.

- Examples: none
- Metric(s): Increased percentage of Class I MA RECs
- Implementer: Sustainability Department, Mayor's Office

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[18] Through Newton Power Choice, residents and business in Newton are buying renewable electricity to match 60% of their electricity use, which is the highest amount of any community electricity aggregation program in Massachusetts. https://masspowerchoice.com/newton

[19] The Town of Arlington provides residents and businesses with a simple way to opt up to 100% renewable energy through their Community Choice Aggregation website. https://arlingtoncca.com/opt-up/

[20] The City of Somerville offers an option online for residents and business to subscribe to 100% local green energy through their community choice electricity program. https://somervillecce.com/opt-up-to-premium-100-local-green/

[21] The Town of Brookline provides residents and businesses with a simple way to opt up to 100% renewable energy through their community choice aggregation website. https://brooklineoptup.com/

B.1.3. Explore increasing the percentage of MA Class 1 RECS in the City's next municipal electricity contract.

Like other large electricity customers, Newton enters into a contract for electricity with a competitive supplier, in order to minimize the electricity costs for the City as compared to the cost of Eversource Basic Service. In the pending contract, entered prior to the City's launch of Newton Power Choice, the City matches 5% of its electricity consumption with MA Class I RECs. When that contract expires, the City will seek new bids for electricity and, prices permitting, will increase the percentage of MA Class I RECs in its power purchase or consider joining Newton Power Choice.

- Examples: none
- Metric(s): Increased percentage of Class I MA RECs
- Implementer: Sustainability Department, Mayor's Office

B.2. Support the installation of residential and commercial solar

B.2.1. Work with City Council to adopt a zoning requirement that all new buildings with a certain roof area require solar PV where technically feasible, and other "eco-roof" treatment where appropriate. (See D.3.4.)

B.2.2. Support Green Newton's efforts to implement the Newton Solar Challenge for residents and businesses which encourages the installation of rooftop solar.

To follow up on the implementation of Solarize Newton in 2013, the City will support community groups' efforts to implement a Solarize Plus program for residents.

- Examples: Lowell[22]; Lincoln, Wayland, and Sudbury[23]
- Metric(s): Number of renewable energy installations by technology and size
- Implementer: Green Newton, Sustainability Department

[22] The City of Lowell participated in the 2018 Solarize Plus Mass program offered by MassCEC. Their outreach program provides educational information and advertises solar and heat pump options for residents. https://solarizelowell.com/

[23] The Towns of Lincoln, Wayland, and Sudbury participated in the 2017 Solarize Plus Mass program offered by MassCEC. Their outreach program provided education information and advertised solar and solar hot water options for residents. https://solarflair.com/solarize/solarize-lincoln-wayland-sudbury/

B.2.3. Work with the Housing Authority to install solar PV on their buildings under the state's SMART incentives.

The City will explore project options in partnership with the Housing Authority (which controls ~360 units at 10 locations) that may allow the City to access low-income community shared solar incentive "adders." Adders, offered through the Department of Energy Resources' SMART program[24], increase the incentive amount if the proposed solar system has other desirable features (e.g., energy storage capabilities, community shared solar, etc.).

- Examples: Resonant Energy Pilot Projects in Boston[25]
- Metric(s): Number of low-income customers served
- Implementer: Sustainability Department, Planning Department, Newton Housing Authority

B.3. Support advocacy groups' efforts to transition from natural gas to renewable energy systems

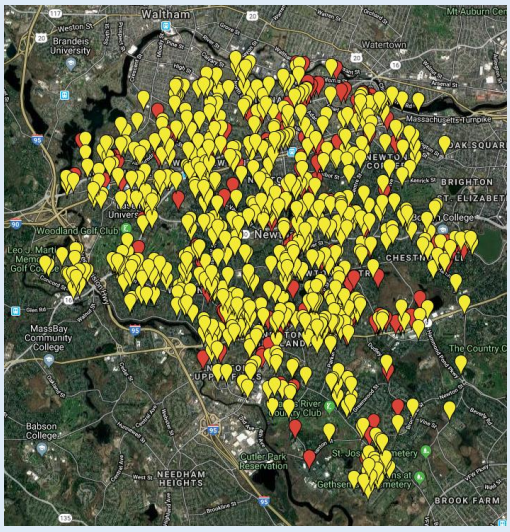
B.3.1. Support HEET in its efforts to pilot neighborhood-scale conversion to all-electric heating and cooling systems for neighborhoods in which there is a high prevalence of leak-prone gas infrastructure.

HEET, a non-profit working on energy efficiency, gas leak repair, and clean energy transition, is in the midst of studying the feasibility of GeoMicroDistricts to wean neighborhoods off of natural gas and onto clean heating and cooling systems. To address emissions from fugitive natural gas leaks, HEET will use data from National Grid to identify high-opportunity neighborhoods where there is high prevalence of leak-prone infrastructure, and then assess the feasibility of a neighborhood-level full electrification pilot in partnership with National Grid – supporting the transition from fossil fuel infrastructure to a clean heating and cooling systems.

- Examples: none
- Metric(s): Number of customers switching to clean heating and cooling systems
- Implementer: Sustainability Department, Planning Department, Department of Public Works

Gas Leaks in Newon

Mothers Out Front report 689 unrepaired (yellow) and 201 repaired (red) gas leaks in Newton. In 2014, the Massachusetts legislature passed "An Act Relative to Natural Gas Leaks" establishing a grading system for leaks and requiring that dangerous leaks be fixed. In 2016 the Mass. legislature passed "An Act to promote energy diversity," directing regulatory agencies to develop a plan to identify and repair gas leaks that have a "significant environmental impact" or "super-emitters." In 2018, the Mass. legislature passed a bill requiring the utilities to provide a detailed breakdown of their "lost and unaccounted for gas" each year. Newton closely coordinates National Grid's gas line repairs with City road repairs.



[24] DOER created the Solar Massachusetts Renewable Target (SMART) Program to create a long-term sustainable solar incentive program that promotes cost-effective solar development in the Commonwealth. This webpage provides an overview of past and planned public meetings, relevant documents, presentations, and reports related to the new program. https://www.mass.gov/solar-massachusetts-renewable-target-smart

[25] Through partnerships with local nonprofits, Resonant Energy delivers high quality solar arrays for houses of worship, affordable housing providers, and homeowners regardless of income. http://www.resonant.energy/

Newton's Clean and Renewable Energy Accomplishments and On-Going Efforts

- Solar PV
  - The City has installed more municipal solar PV than any town or city in Massachusetts and will build another 2.1 MW of solar in its third phase. Newton now has solar PV installations on 12 municipal buildings and parking lots and has 17 more installations in progress.
  - The 12.01 megawatts of renewable energy already installed across Newton generates roughly 14,000 megawatt hours of electricity – the equivalent of 30% of today's municipal electric demand or 2,000 average homes in Newton.
  - The City is now working on "Phase III" of its solar installation efforts.
- Newton Power Choice
  - The City set a 60% renewable energy default for its program, 46% above the state's Renewable Portfolio Standard of 14%. As of mid-2019, it is the highest renewables default levels of any municipal aggregation program in Massachusetts. Residents automatically match 60% of their electricity use with renewable energy and can "opt up" to 100%.
- Solarize
  - Solarize Newton facilitated the installation of 64 residential solar arrays.

C. Greening Newton's Transportation and Streetscapes

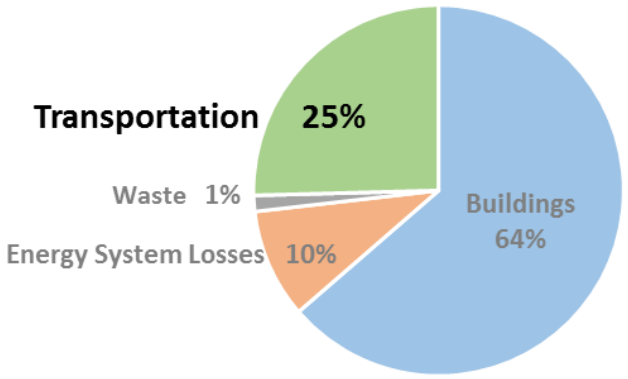
Newton's Green Transportation and Streetscape Strategies

- Decrease single occupancy vehicle trips and vehicle miles travelled (VMT) by engaging with third-party partners to increase the rate of biking, walking, telecommuting, shared rides, and use of shuttles and public transit
- Increase adoption of EVs by engaging with third-party partners to promote EVs.
- Improve municipal infrastructure and implement programs and policies that are as "green" as possible
- Incentivize residents to switch to EVs with a goal of having 10% of all vehicles on the road be EV, BHEV, ZEM, PHEV+ by 2025

Newton residents own nearly 73,000 cars, an average of over 2 cars per household. Every year, Newton residents purchase roughly 6300 new vehicles, making the average car ownership period 9.2 years. In Massachusetts in 2018, almost 70% of all new vehicle purchases were SUVs, light trucks, and vans (vehicles with very low fuel economy). Newton drivers average over 40 miles per day and average only 23 miles per gallon. Only 5% of cars in Newton are hybrids and only 1% are electric. [Data collection Courtesy of Newton Citizens Commission on Energy and the Newton Citizen Climate Action Plan (May 2019).] Fortunately, prices of EVs have been dropping rapidly and, with greater competition, will likely continue to drop. EV charging stations are becoming more common, and EV technologies are improving rapidly.

GHG emissions from passenger and commercial vehicles registered within the City of Newton make up a quarter of City-wide emissions and are the second-largest emitting sector after building energy consumption (**Figure 11**). This data includes all trips taken by Newton residents inside and outside of the City; it does not account for emissions that result from pass-through traffic of non-Newton vehicles (e.g., vehicles that drive through Newton on the Massachusetts Turnpike).

Figure 11. GHG Emissions (2013) in Newton: Transportation Sector



In 2018, only roughly 1% of all vehicles registered were battery electric (**Figure 12** and **Figure 13**). There is, therefore, a tremendous opportunity to reduce vehicular carbon emissions by transitioning to more low- and zero-emission vehicles. The increasing trend of EVs and PHEVs being purchased is encouraging and is increasing.

Figure 12. Number of Cars Registered in Newton

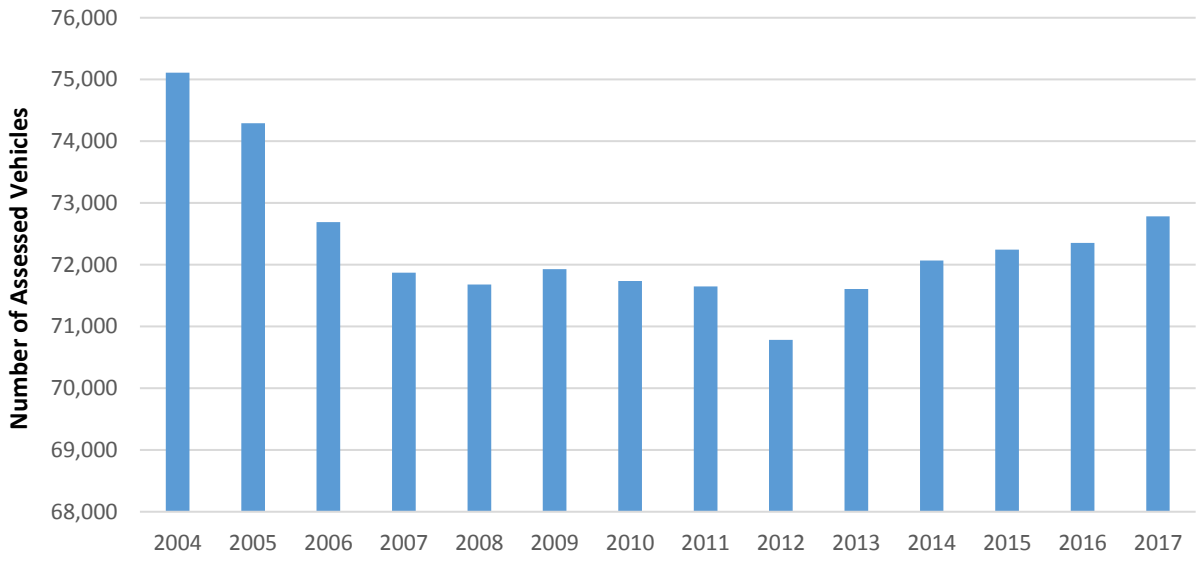
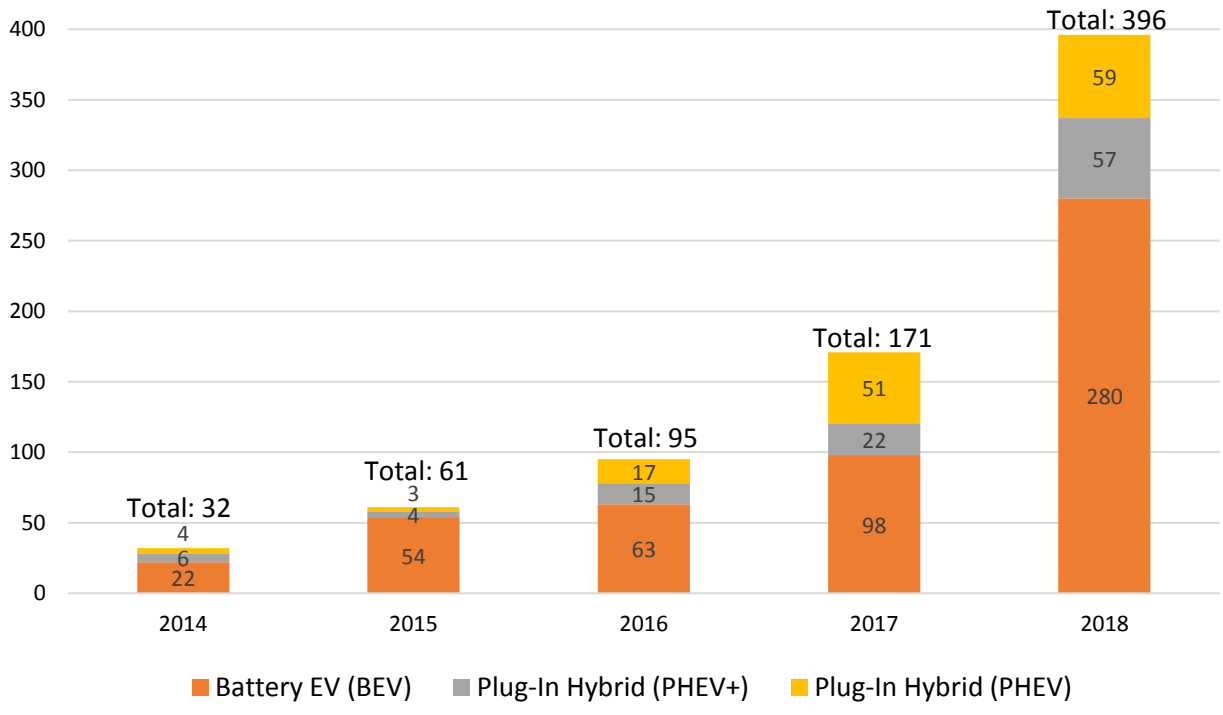


Figure 13. Electric Vehicle Purchases in Newton (by Year and Type)

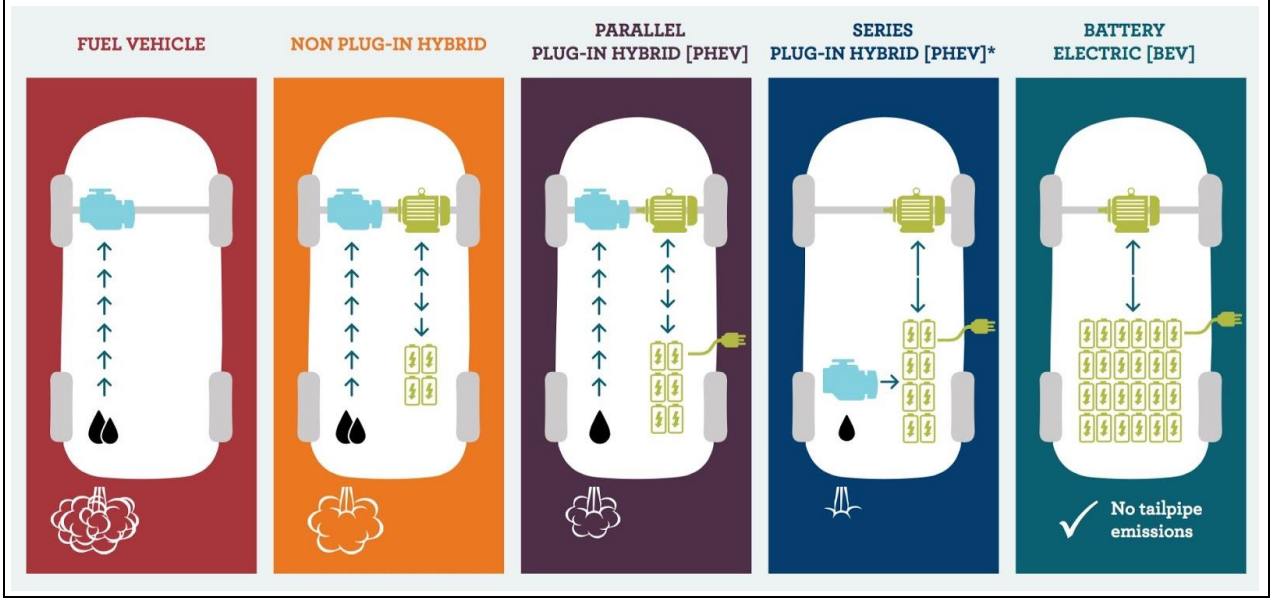


Newton must help to accelerate the current trend to be on track for a 50% reduction of fossil-fuel vehicles in 10 years. We must work to combat the perception of the low cost of driving. Since public transit requires payment for each trip, it can appear to be more expensive than driving, but the private capital and maintenance costs of cars is large and the public subsidies for roadways and parking lots makes the true cost of cars relatively great.

Transitioning passenger and commercial vehicles to zero emission and hybrid (see **Figure 14** for an illustration of different kinds of vehicles) will support the City's transition away from fossil fuels, improve public health, and enable trips that are powered by electricity that can be supplied increasingly by renewable sources. Providing support to for residents to use public transportation, bicycles, and walking paths will also help reduce GHG emissions.

The City of Newton can best support these interests by providing improved infrastructure within the municipal realm and requiring or incentivizing similar improvements within the private realm.

Figure 14. Types of Vehicles[26]



C.1. Ensure that municipal infrastructure and operations are as "green" as possible

C.1.1. Replace 100% of the City's own passenger vehicles with EVs or other zero-emission vehicles.

The City will reassess its fleet annually to determine if additional vehicles are candidates for replacement based on availability of new alternatives. Continuing implementation over the course of the plan will significantly reduce emissions from the municipal fleet and provide a visible example for Newton residents of the feasibility of switching to zero-emission vehicles. Electric vehicle technology is developing rapidly, including for police vehicles, so the options available to the City may increase over the next five years.

- Examples: Climate Mayors Electric Vehicle Purchasing Collaborative[27]

[26] Better NZ Trust, Championing Sustainable Initiatives*https://www.leadingthecharge.org.nz/nz_electric_car_guide*
[27] https://driveevfleets.org/

- Metric(s): Number and percent of EVs purchased, fuel use reduction
- Implementer: Public Works Department

C.1.2. Reduce GHG emissions from all municipal non-passenger vehicles.

Reduce emissions from municipal fleet vehicles by determining the vehicles in the City's fleet with high likelihood of idling and install anti-idling systems. Investigate electrification and new technology options for different fleet vehicles.

Additional measures to reduce idling will include: (1) imposing and enforcing a strict policy banning idling in all other municipal vehicles, (2) exploring ways to incorporate anti-idling language in the City's school bus contracts, and (3) enforcing state-level anti-idling laws.

- Examples: Columbus, OH – Police Department implementation of idle reduction technology[28]
- Metric(s): Number and percent of vehicles with anti-idling, electrification, and/or other GHG reduction systems in place
- Implementer: Department of Public Works, School Department

C.1.3. Install EV charging stations in village centers, school facilities, and other priority municipal sites, primarily through the Make Ready and GreenSpot programs.

In addition to the 11 EV chargers already installed, the City is planning to install EV charging stations and/or designate preferential parking for EVs in municipal and school parking lots and in other priority municipal sites, such as the main library and City Hall.

Preferential parking for EVs is a measure to drive demand for EVs that uses signage and paint to designate spaces. (See also C.2.2.)

- Examples: none
- Metric(s): Number of charging stations installed
- Implementer: Department of Public Works, Planning Department, Newton Public School Department

C.1.4. Initiate small, medium, and large Green Infrastructure and Complete Streets projects specifically aimed at supporting bike/pedestrian travel, reducing GHG emission, increasing tree and shrub installations.

Streets are the City's most extensive type of infrastructure and one area where the CIty can have a large impact on GHG emission. Complete Street principles, as identified in the Street Design Guide (2018), of incorporating green infrastructure stormwater features along with bicycle and pedestrian improvements, can result in: a reduction of impervious areas, a reduction in car-centric travel (and the associated emissions), and an increase in tree and shrub plantings and so an increase in carbon capture.

- Examples: various

[28] AssetWorks. "Case Study: City of Columbus, Ohio GPS." https://www.assetworks.com/resource-items/fleet-columbus-gps-case-study/

- Metric(s): Miles of bike lanes added, number of Complete Streets projects completed
- Implementer: Department of Public Works, Planning Department

C.1.5. Facilitate municipal employees' use of alternate modes of transportation.

To reduce vehicle miles traveled and improve personal health, Newton will advertise to its employees the benefits of getting to work by means other than single-occupancy vehicles. (See also C.4.4.) The City will offer information to facilitate carpools, biking, ride-share, train, bus, and shuttles and will offer incentives, such as gift cards, to the top performers.

- Examples: Longwood Medical/MASCO[29]
- Metric(s): Change in employee commute mode share (percent of trips of each mode)
- Implementer: Watertown Transportation Management Authority (TMA) with support from the City

C.1.6. Prioritize street tree preservation, tree planting, and landscaping, with special consideration given to hot spot areas identified in the Climate Vulnerability Assessment.

Trees provide cooling shade, carbon sinks, and improved storm water quality. Hot spots are defined as the top five percent of the hottest land area in the MAPC region. The City's 2018 Climate Change Vulnerability Assessment (CCVA) identifies the hot spots, also known as heat islands, in Newton which primarily correspond with areas zoned for commercial and industrial use, but there are some residential hot spots identified as well. The City is intending to plant hundreds of new street trees, carefully selected to thrive and be resilient, in areas highly impacted by these heat islands, and special attention will be placed on areas identified in the CCVA over the next several years.

- Examples: Newton CCVA Report identifies locations[30]
- Metric(s): Number of trees planted in hot spot areas
- Implementer: Parks, Recreation, and Culture Department

[29] As the Transportation Management Association for the Longwood Medical and Academic Area, CommuteWorks helps employees and students better plan their commutes with info about MBTA, ridesharing, shuttle, walking and biking options. https://www.masco.org/directions/commuteworks

[30] The City of Newton's Climate Change Vulnerability Assessment and Action Plan, adopted December 2018. http://www.newtonma.gov/civicax/filebank/documents/94675

C.2. Incentivize residents to switch to EVs with a goal of having 10% of all vehicles on the road be EV, BHEV, ZEM, PHEV+ by 2025

CASE STUDY:
City of Boston EV Policy

For projects that are substantial renovations, new construction, or located in a parking freeze zone, the City of Boston requires that at least 5% of parking be equipped with electric vehicle chargers and that an additional 10% be EV-Ready.

In an effort to further streamline and standardize the presence of EV charging stations in Boston, the City has developed and approved standard signage to alert community members of the availability of charging stations.

C.2.1. Incorporate electric vehicle charging station requirements into the Zoning Ordinance and a criterion for large multi-family, commercial, and mixed-use developments.

A majority of electric vehicle owners charge their vehicles primarily at home.[31] Proposed and future development needs to anticipate the demand for at-home and at-work charging capacity as more and more Newton residents make the switch to electric vehicles. The October 2018 draft Zoning Ordinance includes requirements that new and expanded parking lots with 20 or more spaces equip 10% of parking spots with EV charging stations and an additional 10% with EV-ready infrastructure. The City will ensure that these requirements are incorporated into the evaluation criteria for large developments. In the near-term, that includes evaluation of the proposals for the Riverside, West Newton, and Northland developments. Reduced requirements for parking should be incorporated into the Zoning Ordinance.

- Examples: City of Boston EV Policy[32]
- Metric(s): Number of installed EV charging stations at large multi-family, commercial, and mixed-use developments, increase in electric vehicles registered in Newton
- Implementer: City Council, Planning Department

C.2.2. Provide preferential parking for EVs to make it easier to park.

With striping, ground marking, and EV-only signage, the City will provide preferential parking for electric vehicles at City-owned parking lots, school parking lots, and other priority locations. These spots will serve to incentivize electric vehicle adoption in the community and make more visible the presence of electric vehicles.

- Examples: none
- Metric(s): Number of preferred parking places established
- Implementer: Planning Department, Sustainability Department, Department of Public Works

C.2.3. Continue to work with partners (such as Make Ready) to install EV charging stations on private properties throughout the City.

Through MOUs with the utilities private businesses will be encouraged to install EV charging stations on their properties.

- Examples: none

[31] Idaho National Laboratory, *Plugged In: How Americans Charge Their Electric Vehicles*, https://avt.inl.gov/sites/default/files/pdf/arra/PluggedInSummaryReport.pdf

[32] The City of Boston's EV resources and policy regarding requirements for EV charging infrastructure. https://www.boston.gov/departments/environment/ev-boston-electric-vehicle-resources

- Metric(s): Number of EV charging stations installed on private property
- Implementer: Sustainability Department, Planning Department

C.3. Engage with third-party partners to promote EVs and encourage biking walking, public transit and shared transportation

C.3.1. Support local non-profits, for-profits, and advisory groups such as Green Newton, the NCCE, and Newton-Needham Chamber of Commerce, the Transportation Advisory Group (TAG), Safe Routes to School, the utilities, and local businesses efforts in education, events (such as test drives and Tour du Newton), and literature dissemination.

Non-profits and local businesses excel at working with the community and creating interest in new opportunities.

- Examples: Green Newton's leadership in Newton Power Choice
- Metric(s): n.a.
- Implementer: Local Community Groups, with support from the Sustainability Department

C.3.2. Support local environmental organizations and car dealerships in implementing group-purchasing discounts and other incentivization efforts.

As more vehicle manufacturers set goals related to electric vehicles, more opportunities may arise to partner directly with manufacturers to increase incentives for the purchase of electric vehicles. For example, Nissan offers a "Fleetail" rebate program in partnership with municipalities, universities, and private sector employers. Nissan works with its partners to establish a unique rebate code and develop outreach materials and provides participating dealers with a discount off Manufacturer's Suggested Retail Price (MSRP) for the Nissan Leaf. Other successful local and national models exist for time-limited group buy programs in partnership with local dealerships.

CASE STUDY:
Colorado EV Group Buy Program

In 2015, Boulder County, Adams County, and the City and County of Denver came together to pilot a group-purchasing program for solar panels and electric vehicles. The program made time-limited discounts on solar panels and electric vehicles available to the counties' residents.

In Boulder County alone, the Nissan dealership saw a 4-fold increase in sales for the Nissan Leaf as a result of the program.

Key components to a successful group purchase program include having an engaged dealership partner, available EV inventory, coordinated outreach with partners, and good media coverage.

- Examples: Northeast region offer; Drive Green[33]; Colorado[34], Mass Drive Clean[35]; Greater Portland Council of Governments[36] San Joaquin Valley Charging Roadmap[37].
- Metric(s): Sales of electric vehicles to Newton residents
- Implementer: Local environmental organizations, car dealerships, with support from the Sustainability Department

C.3.3. Engage the transportation network companies (TNCs) and private shuttle operators to increase adoption of electric vehicles, primarily in partnership with other metro Boston communities.

While TNCs are regulated at the state level, there are opportunities for the City, working with other communities in the area, to partner directly with TNCs to implement programs that support driver and rider awareness and adoption of electric vehicles. The City will engage with TNCs to gauge their interest in partnering to provide similar services that TNCs have offered nationally and internationally. For example, Uber has worked with the City of Los Angeles to provide drivers with notifications about the benefits of electric vehicles and the availability of rebates and incentives and has worked with the City of San Diego to provide electric vehicle drivers with an additional dollar per ride over the normal fare. Lyft Express Drive provides drivers with the option to rent electric vehicles, rather than own or use their personal vehicles. This includes a rental offering for the Chevy Bolt and cost coverage for vehicle charging. In order to effectively measure the impact of any partnership, the agreement should include terms for data sharing.

- Examples: Uber EV Champions Initiative[38], Lyft Green Mode and Express Drive electric vehicle options[39]
- Metric(s): Number and percent of TNC drivers in Newton driving electric vehicles, number and percent of TNC electric vehicle miles driven in Newton

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[33] The Green Electricity Consumers Alliance provides pre-negotiated discounts on electric vehicle models through their Drive Green program to buyers in Massachusetts and Rhode Island. https://www.greenenergyconsumers.org/drivegreen

[34] Southwest Energy Efficiency Project evaluated the group purchasing pilots implemented in the Colorado area for electric vehicles in 2016. https://www.swenergy.org/data/sites/1/media/documents/publications/documents/Colorado_EV_Group_Purchase_Programs_Mar-2016.pdf

[35] Mass Drive Clean is the nation's first state-sponsored electric vehicle test drive campaign. The campaign is sponsored by Eversource, National Grid, and private entities and supported by Plug In America, the Massachusetts Executive Office of Energy and Environmental Affairs, MassDEP, and its event partner REACH Strategies. http://www.massdriveclean.org/

[36] The Greater Portland Council of Governments provides its stakeholders with access to their EV Lending Program. Through this program, stakeholders can borrow a Chevy Bolt for up to a week to test drive how a battery electric vehicle can meet their day-to-day travel needs. https://www.gpcog.org/clean-transportation/

[37] In 2014, the Center for Sustainable Energy completed Charging Roadmap for the San Joaquin Valley to recommend optimal locations for siting electric vehicle charging stations. https://energycenter.org/sites/default/files/docs/nav/programs/pev-planning/san-joaquin/san_joaquin_valley_siting_analysis-web.pdf

[38] Uber launched its EV Champions Initiative in 2016, in partnership with seven initial communities: Austin, Los Angeles, Montreal, Sacramento, San Diego, San Francisco, and Seattle https://www.uber.com/newsroom/electrifying-our-network/

[39] Lyft Express Drive provides drivers with the option to rent vehicles, rather than own or use their personal vehicles. This includes a rental offering for the Chevy Bolt and cost coverage for vehicle charging. In 2019, Lyft began a pilot "Green Mode" in Seattle, WA, that allows riders to opt for an EV or Hybrid driver. https://blog.lyft.com/posts/2019/2/6/making-cities-more-liveable-with-electric-vehicles

- Implementer: Planning Department, Mayor's Office, TNCs, shuttle operators, City Council Public Safety and Transportation Committee

C.4. Increase the rate of biking, walking, telecommuting, shared rides, and use of shuttles and public transit, while reducing single-occupancy vehicle trips

C.4.1. Work with the City Council to develop a TDM program to reduce single-occupancy vehicle trips through amendments to the Zoning Ordinance.

The introduction of transportation demand management (TDM) requirements into the Zoning Ordinance is an important component of the Zoning Redesign project. Working with the City Council, the City will explore ways to refine its approach to TDM requirements and metrics, establishing thresholds at which projects must provide TDM aligned with the goals of the Climate Action Plan. The overall objective is to create predictable, measurable, and enforceable TDM programs that ensure that property owners are actively incentivizing modes of transportation that shift building occupants away from single-occupancy vehicle trips.

- Examples: Cambridge PTDM ordinance[40]
- Metric(s): Reductions in single-occupancy vehicle trips in areas of new development
- Implementer: City Council, Planning Department

C.4.2. Work with the City Council to explore reducing or eliminating the minimum parking requirement in the Zoning Ordinance and instead setting a maximum on parking allotments.

Together with the City Council, the City will explore reductions in, or elimination of, minimum parking requirements in the Zoning Ordinance, including the introduction of maximum parking requirements by establishing a cap on how many parking spaces a property can have. Appropriate parking caps may limit expanses of asphalt, limit other negative effects of parking, increase available developable land, and increase opportunities for green space.

- Examples: Hartford, CT[41]
- Metric(s): Zoning Ordinance changes that remove parking minimums and create parking caps
- Implementer: City Council, Planning Department

C.4.3. Create and encourage the use of safe bicycle and pedestrian facilities for commuters and residents.

In all major street repaving or reconstruction projects, the City will prioritize implementation of the bicycle and pedestrian improvements as outlined in the City's Transportation Strategy, including but not limited to:

1) Upgraded bus stops
2) The buildout of the calm, off-road biking and walking network, including MAPC's Landline[42] Greenway Network, Riverside area trails, trail connections along

[40] The City of Cambridge adopted its Parking and Transportation Demand Management ordinance in 1998. Their ordinance includes specific single occupancy vehicle trip reduction targets for large developers. https://www.cambridgema.gov/CDD/Transportation/fordevelopers/ptdm

[41] Shared-Use Mobility Center. "Parking Minimums Eliminated, Citywide, Hartford, Connecticut, 2017." http://policies.sharedusemobilitycenter.org/#/policies/997

[42] https://www.mapc.org/resource-library/landline-vision-plan/

Commonwealth Avenue, the aqueducts, and the California/Bridge Street gap in the Charles River Path,
3) Network of calm/safe streets (Note: this can limit the need for sidewalks)
4) More bike lanes emphasizing protected bike lanes,
5) More connected bike paths,
6) More and better sidewalks,
7) More protected bike parking,
8) Better lighting,
9) More frequent painting of crosswalks, and
10) Policies designed to reduce vehicle trips to schools

as well as other "bike/ped" priorities that may emerge from the City's updated Open Space and Recreation Plan.

- Examples: Cambridge Bicycle Plan[43]
- Metric(s): Added miles of walking and biking infrastructure, bike racks installed
- Implementer: Planning Department, Department of Public Works

C.4.4. Support local transportation partners, such as Safe Routes to School, MassRides, and others in allowing Newton residents to reduce single-occupancy vehicle trips.

The City will partner with community groups to increase awareness about public transit, bike share, and other alternative transit options in the City, effectively developing Transportation Demand Management (TDM) plans for the schools and City buildings. As a part of this effort, the City will develop and/or promote targeted transportation options such as NewMo and MassRides. The City will integrate Safe Routes to School into transportation and school facility planning.

- Examples: Safe Routes to School (https://www.mass.gov/safe-routes-to-school)
- Metric(s): Case by case
- Implementer: Planning Department, Sustainability Department, Newton Public School Department, local environmental organizations

C.4.5. Explore public-private partnerships to develop shared and electric shuttles to support first- and last-mile connections.

The Transportation Strategy prioritizes creation of shuttles within Newton and just beyond Newton's borders to provide first- and last-mile connections to transit and an alternative to single-occupancy vehicle trips. With reliable connections to and from the existing limited network of train and bus stops in Newton, residents and commuters are more likely to take public transit. This effort aligns with the City's efforts to increase bike and pedestrian infrastructure and support first- and last-mile connections through programs like the bike share program.

[43] City of Cambridge's 2015 Bicycle Plan, https://www.cambridgema.gov/CDD/Transportation/bikesincambridge/bicyclenetworkplan

- Examples: NewMo[44], Lexington Lexpress fixed route shuttle[45], Bedford The Dash on-demand shuttle service[46]
- Metric(s): Number of passengers served/Ridership rates of shuttles
- Implementer: Planning Department, Mayor's Office

C.4.6. Explore opportunities to contract with companies that supply electric school buses.

Since school buses sit idle for much of the day, charging is readily available. The City will consider contracting with a company that can supply all electric buses.

- Examples: none
- Metric(s): Number of electric buses used
- Implementer: School Department

C.4.7. Advocate for Newton's transit service needs, including: frequent and accessible service, expanded routes and service hours, transit station upgrades, dedicated lanes for buses and zero-emission vehicles on the MassPike, and other measures during planning processes at the MBTA and MassDOT.

The City will advocate for its needs in several regional transit planning efforts. Near-term opportunities include MBTA's Phase II Better Bus Project, Bus Network Redesign, and Commuter Rail Accessibility Upgrades. Long-term opportunities include Urban Rail Vision, Green Line Transformation Project, and Focus40. Specific advocacy efforts can focus on:

- Accessibility upgrades at Newton's three commuter rail stations.
- Service improvements to critical local bus routes (such as the 59 and 52 bus routes).
- Additional service on the Framingham/Worcester commuter rail line to bring frequency up to the frequency of the Green Line D Branch.
- Electrification of the commuter rail line.
- Bus stop upgrades including improved shelters, real-time information, bike facilities, the possibility of dedicated bus lanes in appropriate locations, and implementation of public transit vehicle signal priority.

The City will explore and advocate for all effective funding opportunities to achieve these goals.

- Examples: none
- Metric(s): Incorporation of Newton specific improvements in the MBTA's final bus network redesign and commuter rail service options
- Implementer: Mayor's Office, Planning Department

[44] "Via and the City of Newton Launch Microtransit Network Aimed to Support Local Seniors." https://ridewithvia.com/2019/06/via-and-the-city-of-newton-launch-microtransit-network-aimed-to-support-local-seniors/

[45] The Town of Lexington operates a fixed route neighborhood minibus for residents called the Lexpress. https://www.lexingtonma.gov/lexpress/pages/rider-information

[46] The Bedford DASH is an on-demand transportation service being piloted by the Town of Bedford in partnership with the Middlesex 3 Transportation Management Association. The DASH provides trips to Bedford, Billerica, Burlington, Concord (Monday and Tuesday only), and Lexington. https://www.bedforddash.com/

Newton's Green Transportation Accomplishments and On-Going Efforts

Green Infrastructure and Street Tree Planting

- In 2016, the City adopted a Complete Streets Policy that committed the City to creating a street network that prioritizes green infrastructure while meeting everyone's needs, regardless of age, ability, income, or mode of transportation.
- The City has a 15-year Street Tree Planting Plan to plant 800+ trees/year along city streets and in parks to mitigate urban heat island impacts and sequester carbon.

Transportation

- In 2017, the City developed a progressive vision for transportation in Newton in a strategic plan for 2040, Newton in Motion Transportation Strategy ("Transportation Strategy"). The plan identifies strategies to build a transportation system that will be safe, smart, accessible, livable, and sustainable.
- In 2019, Newton joined the Watertown Transportation Management Authority, a public/private non-profit that promotes driving less and taking transit, shuttles, carpooling, and biking/walking.
- Newton implemented bike share with Lime Bike in 2018 and now provides residents with electric bike share services.
- In the spring of 2019, the City launched NewMo, a shared-trip shuttle service for seniors, in partnership with Via.
- The City signed a contract with electric vehicle car share company GreenSpot in 2019.
- In 2017, the City implemented traffic calming processes and has successfully completed many such projects.
- In 2018, the City completed our comprehensive Complete Streets Design Guide and identified 24 priority projects (four of which were completed as of November 2018).
- Village enhancement road reconstructions in the Village Centers of West Newton and Newtonville are imminent.

Municipal Fleet

- The City has transitioned 61% of its passenger fleet to all-electric or other zero-emission vehicles. The City has 28 EVs, 10 hybrids, and 3 plug-in hybrids. Lease agreement will lead to 100% of City sedan passenger vehicles being EV by the end of 2020.
- The City has installed 11 EV charging stations in municipal parking lots and is currently planning for more chargers and preferential parking in municipal and school lots for EVs.

D. Improving New Construction and Major Renovations

Newton's New Construction and Major Renovations Strategies

- Advocate for a more energy-efficient and climate-smart 2021 International Energy Conservation Code that will update the Massachusetts state building code
- Ensure that new and renovated municipal buildings meet the highest energy efficiency standards possible
- Work with City Council to adopt Zoning Ordinance amendments that require and/or incentivize high-efficiency performance and/or net-zero new construction
- Develop and provide to residents, developers, and businesses educational resources about clean heating and cooling technologies

Newton is seeing a development boom. Several new large-scale construction projects are pending. They are bringing a mix of commercial and residential space to Newton. As dense, transit-oriented developments, they represent a real opportunity for Newton to benefit from new clean-energy and energy-efficient spaces.

Like all cities and towns in Massachusetts, the City of Newton is limited in its ability to set high energy standards for new buildings because municipalities are not permitted to exceed the Stretch Code standards approved by the Massachusetts Board of Building Regulations and Standards (BBRS). However, through zoning, special permits, and design review, Massachusetts municipalities can improve energy performance and reduce greenhouse gas emissions associated with new construction and major renovations.

According to data provided by the Newton Assessor's Office, 58% of the new buildings constructed in Newton since 2014 are single-family homes; that is 308 new single-family homes or an average of 77 homes per year that could be built to new high standards.

The actions listed below, designed to create a new stock of low-carbon buildings, are ambitious yet achievable and are important steps toward ensuring that future development moves the City towards its climate action goals.

D.1. Advocate for a more energy-efficient and climate-smart building code

D.1.1. Register and educate all eligible representatives to ensure strong City participation in the vote on the 2021 International Energy Conservation Code (IECC) to improve the state base building code (with regard to energy efficiency, electrification, and other carbon reduction strategies), and advocate to the Board of Building Regulations and Standards (BBRS) for a net zero Stretch Code.

Creating energy efficiency standards within state building and energy codes is one of the most effective ways to reduce GHG emissions. The state building codes (base code and Stretch Code) set the requirements for energy efficient design in new buildings. Cities and towns are not permitted under Massachusetts law to adopt their own building codes. Passing a strong base building energy code and Stretch Code is one of the best ways to ensure that new buildings use progressively less energy. Newton can register up to eight municipal officials per eligible department to vote on the IECC in 2019 and help shape the future of building energy codes in

Massachusetts and around the country.[47] Educating registered Newton staff about options for updating the code will be critical.

- Examples: none
- Metric(s): Number of municipal officials voting on the IECC, BBRS net zero Stretch Code
- Implementer: Sustainability Department

D.2. Ensure that new and renovated municipal buildings meet the highest energy efficiency standards possible

D.2.1. Require that all new and renovated municipal buildings continue to meet the City's Sustainability Guidelines for Public Buildings (see **Appendix G**): (1) minimize Energy Use Intensity (EUI), (2) transition away from fossil fuel use, (3) have solar photovoltaics (PV) panels or are solar-ready, and (4) have EV chargers and/or are charger-ready. Ensure that such goals are reflected in the CIP.

The City will require that new municipal buildings optimize energy use. The use of an Energy Use Intensity (EUI) indicator provides the means to standardize the way energy use is compared among various sizes and types of buildings and to evaluate ways of reducing overall energy consumption. Through EUI, energy use is expressed as a function of a building's total annual energy consumption divided by its total area, typically expressed in energy used per square foot per year.

The City will develop a protocol for evaluation (including building envelope assessments) and will transition to clean heating and cooling technologies in all new construction and major renovations. In all new and significantly renovated municipal buildings, the City will minimize and phase out the use of fossil fuels, transitioning to electric (or other low-carbon) heating systems and other appliances. Several economically viable and commercially-ready technologies exist for municipal buildings – the most applicable being variable refrigerant flow (VRF) heat pumps and ground-source heat pumps.

The City is actively pursuing Phase 3 of its solar PV installation program and will install roof top panels and parking lot canopies on municipal and school buildings and municipal and school parking lots in Newton.

The City is currently developing a strategy to install EV chargers and to create preferential parking for EVs in village centers, school parking lots, and other priority locations.

- Examples: Wayland[48]
- Metric(s): Plan in place and reflected in the CIP, EUI of new and renovated buildings
- Implementer: Public Buildings Department, Planning Department, Department of Public Works

[47] For information on how to get involved in the IECC adoption process, visit https://www.mapc.org/resource-library/building-codes-climate/#takeaction

[48] At its 2018 Town Meeting, Wayland committed to "seek cost-effective design and construction of all new municipal building construction and substantial renovation projects to minimize carbon-based energy use through cost-effective energy efficient design, building system controls, and on-site renewable energy generation and energy storage."

D.3. Work with City Council to adopt Zoning Ordinance amendments that require and/or incentivize high-efficiency performance, such as Passive House and/or net-zero new construction – within the next 12 months

D.3.1. Work with City Council to amend the Zoning Ordinance to require new construction and major renovations seeking a Special Permit maximize energy efficiency, maximize the use of renewable energy including thermal energy, and use electricity for heating and cooling.

Working with the City Council, the City will work to amend the Zoning Ordinance to require builders and developers to incorporate, to the maximum extent possible, energy efficiency measures and the use of renewable energy in newly constructed and substantially renovated buildings where a special permit is required. Working with the City Council, City staff will evaluate the size of developments and retrofits to which these requirements will apply.

City staff will consider the Green Newton Green Building Principles when developing guidelines and evaluation criteria including Passive House and other systems.

City staff will consult with IDEA (International District Energy Association) on the local potential for district energy and, where appropriate, encourage Special Permit applicants to explore the possibility of district energy for heating and cooling as well as microgrids for resiliency and the reduction of GHG emissions.

Passive House Standards
(from Modernize.com)

- **Space Heating Demand:** The heating in the house may not exceed 15 kWh per square meter of treated floor area annually or 10 watts per square meter during peak demand.
- **Space Cooling Demand:** Cooling systems in the home must meet the same requirements as the heating, with a small allowance for dehumidification, depending on the climate.
- **Primary Energy Demand:** All together, the home must use less than 120 kWh annually for all its energy consumption, including heating and cooling needs.
- **Airtightness:** Homes must pass a blower test to indicate airtightness. The requirement for this is a maximum of 0.6 air changes per hour at 50 Pascals pressure (ACH50), as verified with an onsite pressure test (in both pressurized and depressurized states).
- **Thermal Comfort:** All parts of the home must stay below 25 degrees Celsius at least 90 percent of the time.

- Examples: none
- Metric(s): Adoption of special permit requirements
- Implementer: City Council, Planning Department, Sustainability Department

D.3.2. Work with City Council to require that all new construction and major renovations analyze the costs, benefits, and GHG impacts of maximizing energy efficiency; utilizing electric heating, cooling, and hot water; and using renewable energy, including thermal energy.

City staff, working with the City Council, will work to amend the Zoning Ordinance to include a requirement that proposals for new construction and major renovations include an analysis of the costs and benefits of incorporating, to the maximum extent possible, energy efficiency measures and the use of renewable energy, even where a Special Permit is not required. The City will determine the size/types of buildings to which this requirement will apply. The large proposed developments, such as the redevelopment projects on Needham Street, the Riverside MBTA station area, and along Washington Street, provide tremendous opportunity to implement net zero and/or Passive House building practices.

- Examples: Boston[49], Cambridge[50]
- Metric(s): Adoption of new program, LEED/high- performance buildings constructed
- Implementer: City Council, Planning Department, Sustainability Department, Inspectional Services Department

D.3.3. Work with City Council to adopt a zoning requirement that all new parking lots above a certain size require EV charging stations.

Working with the City Council, City staff will evaluate a requirement that all new parking lots above a certain size, to be determined, include EV charging stations in their parking facilities.

- Examples: none
- Metrics: Adoption of special permit requirements
- Implementer: City Council, Planning Department

D.3.4. Work with City Council to adopt a zoning requirement that all new buildings with a certain roof area require solar PV where technically feasible, and other "eco-roof" treatment where appropriate.

Working with the City Council, the City will evaluate a requirement in the Zoning Ordinance that all new buildings and major renovations and additions with roof area larger than a certain size (to be determined), require solar PV. Where solar is infeasible due to shading, roof orientation, or other condition, other "eco-roof" approaches may be required.

Maximizing solar production is critical, but where it is not feasible due to shading or building orientation, "eco-roofs" offer alternative benefits. Eco-roofs may include white roofs (to reflect/prevent solar gain), blue roofs (to collect stormwater), and green roofs (to do both). Eco-roofs have multiple benefits including reducing GHG emissions, decreasing the urban heat island effect, and lowering temperatures during sunny summer days. Such a requirement would allow flexibility for builders and developers to choose from different options for eco-rooftop design. In some instances, solar may be combined with other eco-roof options.

- Examples: Watertown for solar[51]
- Metric(s): Passage of zoning amendment, number of solar and eco roofs installed
- Implementer: City Council, Planning Department, Sustainability Department

D.3.5. Work with the City Council to adopt Zoning Ordinances that encourage additional, appropriate low-carbon housing near public transportation.

The Zoning Ordinances can allow increases in the number of housing units if the housing is near public transit and is low carbon either because of the way it is designed (e.g., small units) or otherwise highly energy efficient. While housing developments must be appropriate for the neighborhood in many other ways, the City should incentivize new construction and major renovations that are climate-friendly by decreasing dependence on automobiles, reducing the

[49]Boston Planning and Development Agency. "Article 37 Green Building Guidelines." https://www.cityofboston.gov/images_documents/Article%2037%20Green%20Buildings%20LEED_tcm3-2760.pdf

[50] City of Cambridge. "Sustainable Building Requirements." https://www.cambridgema.gov/~/media/Files/CDD/ZoningDevel/Ordinance/zo_article22_1397.ashx

[51] Town of Watertown, MA. Solar Energy Zoning Requirements, 11/12/18. https://www.watertown-ma.gov/DocumentCenter/View/26235/2018-11-27-Zoning---Solar-Assessments

size of living space, and/or otherwise being highly energy efficient. Determining the appropriate additional number of housing units and/or height allowed will be an important part of the work of the City Council and Planning Staff. Further facilitating the development of Accessory Dwelling Units can help achieve this objective.

- Examples: Watertown[52]
- Metric(s): Zoning Ordinance changes that promote density and transit access
- Implementer: City Council, Planning Department

D.4. Develop and provide to residents, developers, and businesses educational resources about clean heating and cooling and renewable technologies

D.4.1. Provide educational resources to developers, residents, and businesses applying for municipal permits about the financial and lifestyle benefits of clean heating and cooling and renewable technologies.

The Energy Coach (see A.2.2.) and City staff will provide information to developers, residents, and businesses about the latest widely available and cost-effective clean heating and cooling technologies and the resources available from Mass Save, MassCEC, and others to support the installation of these systems.

- Examples: Boston[53], Cambridge[54]
- Metric(s): Number of residents, businesses, developers engaged with resources
- Implementer: Sustainability Department, Planning Department

[52] Town of Watertown, MA. "Watertown Comprehensive Plan." https://www.watertown-ma.gov/DocumentCenter/View/14558/2015-Watertown-Comprehensive-Plan---Adopted-June-23-2015

[53] Boston provides information and resources for building owners and developers through its website: https://www.boston.gov/departments/environment/building-energy-reporting-and-disclosure-ordinance

[54] Cambridge provides information to building owners and developers through its website: https://www.cambridgema.gov/CDD/climateandenergy/greenbuildings

Newton's New Construction and Major Renovations Accomplishments and On-Going Efforts

- The City has registered all staff eligible to participate in the upcoming International Code Commission vote regarding energy efficiency updates to the national building code.
- The City is requiring and will continue to require new municipal buildings to minimize Energy Use Intensity (EUI) and minimize the use of fossil fuels. It evaluates and invests through the CIP to replace fossil fuel systems with alternatives such as electric, variable refrigerant flow (VRF) heat pumps and ground-source heat pumps, or other carbon-free heating and cooling systems and appliances.
- Many of the City's newest buildings and all new school buildings are LEED certified and have roof-mounted solar.
- The City has adopted Building Design and Construction Sustainability Guidelines intended to reduce energy use as much as possible, maximize the use of on-site renewable power, and define a path to net zero for all new public buildings and renovations of existing buildings.
- The City Council is working to re-draft of the Zoning Ordinance to promote climate-friendly development projects.
- The City Council, as the Special Permit Granting Authority, has established its ability to condition new development on higher standards of performance.
- The City Council is working to enhance Special Permit criteria requiring conservation of energy and natural resources.

E. Improving Existing Buildings

Newton's Existing Building Strategies

- Advance energy efficiency and weatherization in existing homes and businesses by helping homeowners and contractors understand options (see Section D on new construction and major renovation)
- Transition to clean heating and cooling by electrifying heating and cooling in residential and commercial buildings
- Work with City Council to adopt zoning ordinances for energy efficiency and clean energy technologies

Newton's housing stock is old and therefore relatively inefficient, but it is undergoing change. Newton has roughly 32,000 households (in 25,700 residential buildings). Roughly 77% of these were built before 1960 and over 50% were built before 1930. Over 90% are heated by fossil fuels. Annually, roughly 650 homes change hands, 120 homes get substantial additions, and over 100 homes are torn down. Roughly 34% of single-family homes are under 1850 square feet; new single-family homes average 4048 square feet. Buildings built three to four decades ago had HERS energy ratings of roughly 135 (reflecting their relative inefficiency); homes built to current code have HERS ratings of roughly 55 (i.e., more efficient). But even older homes periodically get new roofs, new heating systems, and new appliances – and these are real opportunities for improvement. [Data collection and **Figure 15**, Courtesy of Newton Citizens Commission on Energy and the Newton Citizen Climate Action Plan (May 2019).]

Newton's "commercial" building stock consists of 935 buildings. Relatively few owners control a large portion of the commercial stock. [Data collection Courtesy of Newton Citizens Commission on Energy and the Newton Citizen Climate Action Plan (May 2019).]

Buildings account for 64% of Newton's GHG emissions, by far the most of any sector (see **Figure 16**). Making changes to existing buildings is challenging, but essential. And with the current rates of remodels, energy audits and retrofits, and tear-downs, opportunities abound.

Figure 15. Newton's Households (by type) Divided by Size (in sq. feet)

(Figure courtesy of the Newton Citizens Climate Action Plan (May 2019))

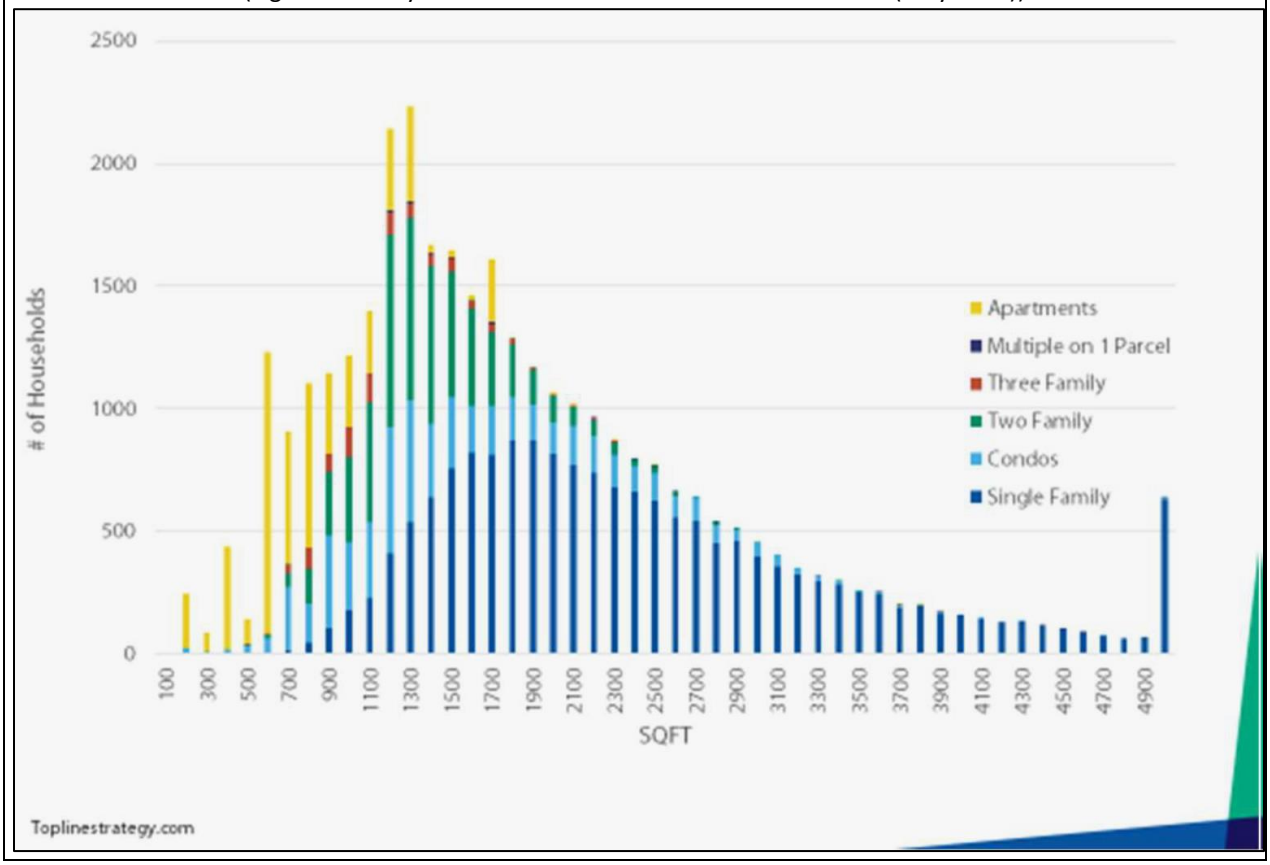
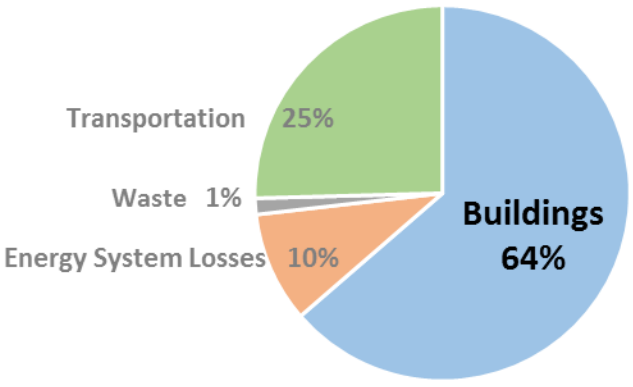
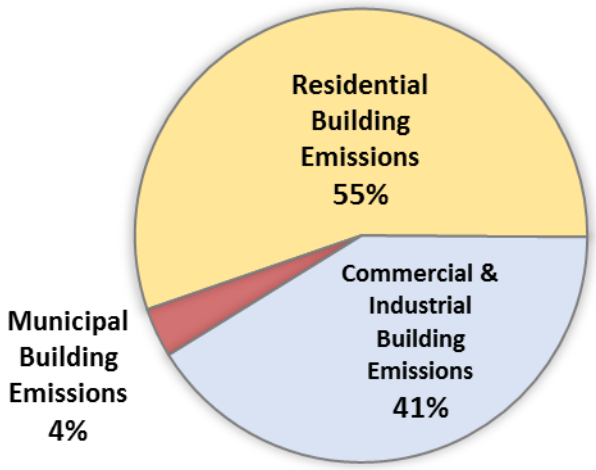


Figure 16. GHG Emissions (2013) in Newton: Building Sector



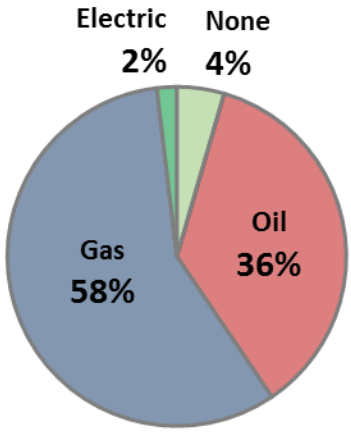
Emissions from buildings systems and appliances account for 64% of Newton's GHG emissions. Of that, residential buildings (single-family and multifamily) account for 55%; commercial, institutional, and industrial buildings account for another 41%; and municipal buildings account for 4%, as shown in **Figure 17**.

Figure 17. Breakdown of Total Newton Building Emissions (2013) by Building Type



More than 90% of buildings in Newton are heated with gas or oil (see **Figure 18**). Finding ways to transition heating and cooling in these buildings to cleaner and more efficient technologies will be a crucial part of reducing GHG emissions in Newton.

Figure 18. Heat Sources of Newton Buildings*



**It should be noted that this chart is based on data from the Newton Assessor's database which likely does not capture all conversions from to oil to natural gas and so may underestimate the percentage of buildings heated by natural gas.*

63% of all buildings in Newton are single-family homes, making single-family homeowners critical to the success of this plan. There are 15,301 single-family homes in Newton built before 1970. Many of these homes are poorly insulated and could be made significantly more energy efficient with energy retrofits

offered through the Mass Save program. Many newer homes are also be inefficient and could benefit from the energy efficiency program offerings available.

E.1. Advance energy efficiency and weatherization in existing homes and businesses by helping homeowners and contractors understand options (see Section D on new construction and major renovation)

E.2. Transition to electric and thermal heating and cooling in residential and commercial buildings

E.2.1. Implement a Solarize Plus, HeatSmart, or similar outreach program for residents and businesses to encourage adoption of electric and clean heating and cooling technologies such as air-source heat pumps, ground-source heat pumps, and thermal options.

The Energy Coach will support community organizations to build on Green Newton's Solarize campaign initiated in 2013 to encourage the transition to clean heating and cooling, weatherization, and energy efficiency improvements. Engage contractors and developers to build awareness about air-source heat pumps and other clean heating and cooling technologies.

CASE STUDY: Heat Smart Mass

In some Newton neighborhoods, more than 40% of households use high-cost, less-green heating options such as oil, propane, or electric resistance, making them strong candidates for conversion to clean heating and cooling systems (Source: Mass CEC).

The HeatSmart Mass program helps communities increase the adoption of clean heating & cooling technologies by aggregating the buying power of residents to lower the cost of installation. As of 2019, 13 Massachusetts communities have participated in the HeatSmart program.

- Examples: HeatSmart Mass[55] and Solarize Mass Plus[56], MassEnergize[57])
- Metric(s): Number of solar PV arrays/installed generating capacity (kW), number of heat pumps installed, number of EV charging stations installed/purchased
- Implementer: Local environmental organizations, Energy Coach

E.3. Work with City Council to adopt zoning ordinances for energy efficiency and clean energy technologies

E.3.1. Work with City Council to allow by right the installation of GHG-reducing building improvements.

The City will explore ways to allow by-right installation of certain GHG-reducing improvements in existing buildings. Covered improvements may include enhancements to the building envelope (e.g., vestibules, insulation wraps, etc.), renewable energy generating equipment, high-efficiency heating and cooling equipment, and electric vehicle charging stations. Planning staff will evaluate what GHG-reducing improvements would still require a special permit.

[55] HeatSmart Mass. https://www.masscec.com/heatsmart-mass-0

[56] Solarize Mass. https://www.masscec.com/solarize-mass

[57] MassEnergize is a shared program and platform launched by the Towns of Wayland and Natick, MA. https://massenergize.org/

- Examples: Green Communities solar zoning[58], Massachusetts model solar zoning ordinance[59]
- Metric(s): Adoption of by-right zoning amendments, number of building improvements installed connected to special permit review process
- Implementer: City Council, Sustainability Department, Planning Department, Inspectional Services Department

E.3.2. Explore opportunities for requiring a standardized, broadly accepted, building energy performance scorecard, to be obtained by a potential seller and disclosed to potential buyers.

It is extremely difficult to reduce GHG emissions from existing building stock. One of the few points of leverage is at the time of a sale, when a potential buyer pays attention – or could be encouraged to pay attention – to a building's energy performance.

Starting in 2020, the State will require utilities to provide an energy efficiency scorecard to the owners of all buildings for which an energy audit is requested. City staff will work with local realtors to encourage use of scorecards during real estate transactions, or to require them if that becomes legally permissible.

- Examples: None
- Metric(s): Compilation of options
- Implementer: Planning Department, Sustainability Department

Newton's Existing Building Accomplishments and On-Going Efforts

- The City has converted 24 municipal buildings from fluorescent and incandescent lighting to LED lighting (in addition to converting street lights to LED).
- Energy management systems are now installed in several existing buildings (and in all new buildings).
- The City has upgraded the Lower Falls Community Center, resulting in a 70% reduction in energy use.

[58] Massachusetts Department of Energy Resources (DOER). "Becoming a Designated Green Community: Criterion 1." https://www.mass.gov/guides/becoming-a-designated-green-community#criterion-1

[59] DOER. "Model Zoning for the Regulation of Solar Energy Systems." https://www.mass.gov/files/documents/2016/08/nc/model-solar-zoning.pdf

F. Reducing GHG Emissions Associated with Consumption and Disposal

Newton's Consumption and Disposal Strategies

- Reduce GHG emissions resulting from corporate operations and individual activities
- Maximize recycling and other waste diversion

Consumption

It is relatively easy to determine a "direct production-based" GHG footprint, i.e., the GHG released directly by a vehicle, a company, a building, or a sector. But a total greenhouse gas footprint is far more than the emissions for which the subject is immediately and directly responsible. For example, we are each responsible for the emissions associated with the share of goods and services we consume. A complete ("consumption-based") GHG footprint includes the emissions associate with housing materials, furniture, medical supplies and services, transportation (transit and infrastructure), travel (transit and accommodations), food, clothing, and all other consumer goods and services. The difference between the two can be significant.

"Embodied energy" refers to all the GHG emissions associated with the manufacture, transport, and construction of materials, together with the end-of-life GHG emissions from these materials. Understanding and accounting for embodied energy is vital to mitigating climate change because there is the potential for a *nominally* "net zero" building to have a substantial climate impact if materials with high amounts of embodied energy are used in its construction. For example, if a home is built with concrete or foam insulation, the GHG emissions released in making that concrete and foam are large and should be accounted for to understand the full picture of GHG emissions associated with the home.

Figure 19 illustrates the relative contributions of direct AND indirect GHG emissions. It is clear that for a representative household, indirect and travel-associated contributions can be very significant. And, as household income rises, so to do GHG emissions (see **Figure 20**)

Neither this Climate Action Plan nor the NCCE Plan directly addresses embodied energy. Embodied energy will need to be addressed in the future, as accounting methodologies and mitigation strategies continue to be developed.

Figure 19. Scale of the Contribution of "Hidden" GHG Emissions

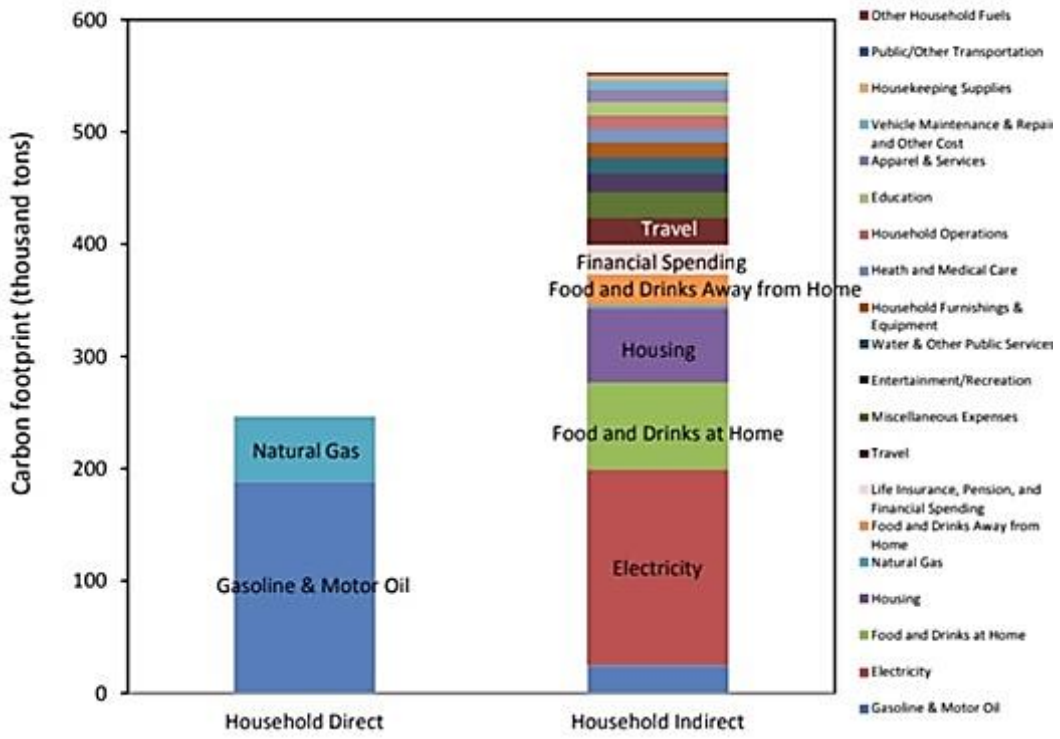
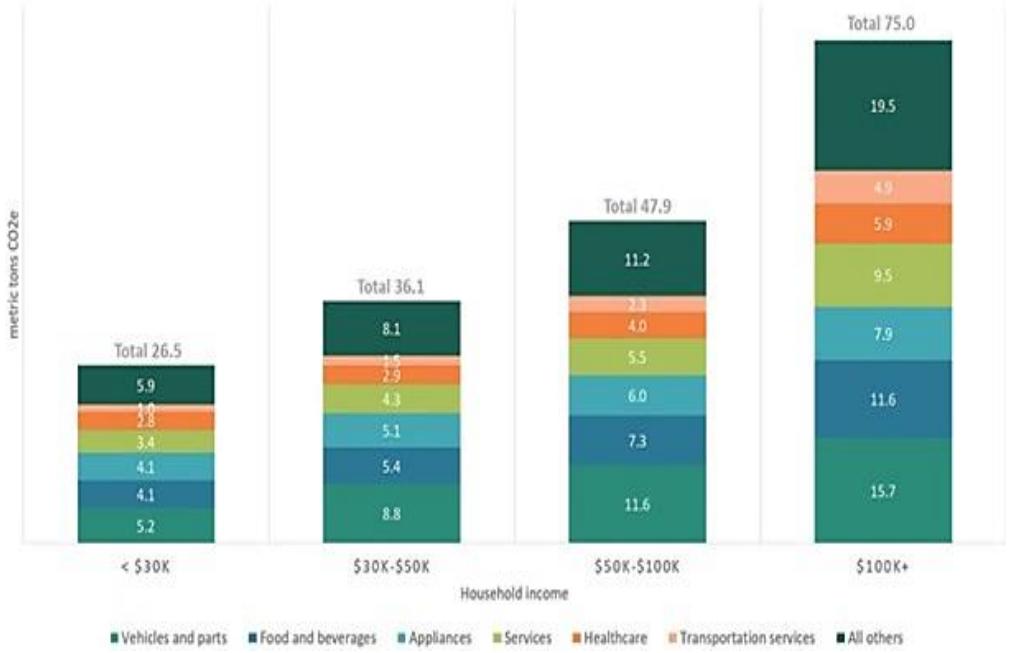


Figure 20. Average per Household Consumption-Based GHG Emissions (MTCO2e/household) in Oregon, by Income Group[60]

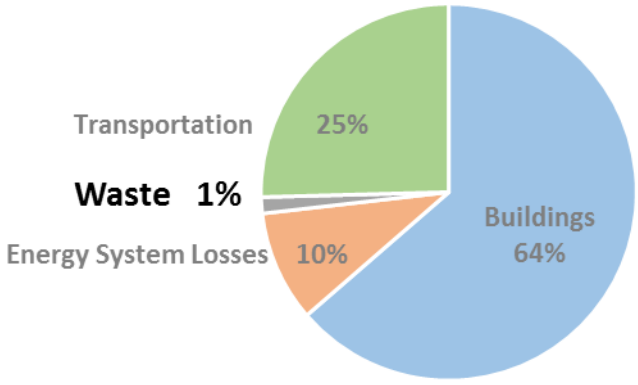


[60] https://frontandcentered.org/what-counts-when-we-count-carbon-pollution-lessons-from-oregon/

Solid Waste Disposal in Newton

The waste stream contributes a very small amount to Newton's overall GHG emissions (see **Figure 21**); nevertheless, there are opportunities to reduce the contribution from that sector.

Figure 21. GHG Emissions (2013) in Newton: Waste Sector



While GHG emissions from Newton's municipal solid waste and wastewater represent less than 2% of the City's emissions profile, this sector should be not overlooked when considering a holistic approach to community-wide climate action. The City has in place a robust sustainable materials management program that promotes waste reduction, reuse, and recycling.

Newton has been recycling since 1971. In 1990, dual stream recycling became mandatory, meaning all acceptable recyclable materials were separated into two streams: paper products and bottles/cans. Newton switched to single-stream recycling in April 2009. Opened in 1990, the City's Resource Recovery Center on Rumford Avenue is where Newton residents can bring excess curbside recycling as well as many other items that are only accepted through drop-off programs, such as CFL light bulbs. Household hazardous waste collection events are also held at this site. As of the 2013 GHG Inventory, 29% of the City's municipal solid waste was diverted to recycling and 20% of waste was composted. Yard waste and Christmas trees are collected at curbside and composted. The remaining municipal solid waste is disposed of at Wheelabrator-Millbury, a waste-to-energy facility located in Millbury, MA.

F.1. Consider initiatives to engage businesses and residents in reducing GHG emissions resulting from corporate operations and individual activities

F.1.1. Work with the Economic Development Director and the Newton-Needham Chamber of Commerce to explore incentive programs for businesses to reduce GHG emissions associated with consumption and disposal.

Consider assisting local businesses to develop a program to reduce GHG emissions, for example, reducing on-site food waste, reducing air travel by encouraging virtual meetings. Engage local groups such as the Newton-Needham Chamber of Commerce, Green Newton, Green Leaders (A.2.3.), and the Green Ribbon Commission (A.2.4.).

- Examples: none
- Metric(s): Number of businesses participating in the program

- Implementer: Planning Department, Sustainability Department

F.1.2. Explore adoption of a voluntary program that would allow contributions to a municipal program to help offset GHGs produced by air travel.

Work with a community partner to establish a carbon offset program. For example, Newtonians could be encouraged to contribute to a local Newton tree planting fund every time they take an airplane flight.

- Examples: City Forest Credits (CFC) Program[61], Forest Carbon Program in King County, WA[62]
- Metric(s): GHG emissions logged, funds generated to fund city trees
- Implementer: Parks, Recreation, and Culture Department, Sustainability Department

F.1.3. Make available to residents and business information about the GHG impacts of different habits of consumption, including travel, appliances, food, and vehicles.

Work with community partners and the Energy Coach to develop and disseminate information about the carbon footprints of daily living.

- Examples: None
- Metric(s): Educational materials developed
- Implementer: Sustainability Department

F.2. Evaluate strategies to improve waste reduction and diversion among residents, businesses, and municipal operations in Newton

F.2.1. Consider citywide mandatory commercial recycling.

MassDEP encourages municipalities through its guidance document, Best Practices for Municipalities Developing Private Hauler Regulations, to improve waste diversion from the commercial sector by combining mandatory recycling with regulating private haulers to require bundled waste disposal with recycling service.

- Examples: Town of Brookline[63]
- Metric(s): Inspections done at businesses, number of permitted haulers
- Implementer: Department of Public Works, Health and Human Services Department

F.2.2. Solicit ideas for a consumption/waste reduction campaign.

Working with members of Newton's Solid Waste Commission and community organizations, like Green Newton, develop a public engagement campaign to reduce consumption and waste. Incentive-based waste reduction programs could be considered.

- Examples: Recycle Bank[64]
- Metric(s): Trash tonnage, recycling tonnage

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[61] City Forest Credits seeks to make American cities greener, healthier, and more equitable by enabling urban tree-planting and preservation projects to earn carbon credits. https://www.cityforestcredits.org/
[62] King County's Forest Carbon Program is a component of the region's Land Conservation Initiative. https://kingcounty.gov/services/environment/water-and-land/land-conservation/forest-carbon.aspx
[63] "Brookline Commercial Recycling," Town of Brookline. https://www.brooklinema.gov/1235/Commercial-Recycling
[64] Recycle Bank provides incentives for residents in communities whose waste haulers have partnered with Recycle Bank for waste diverted from landfills. https://www.recyclebank.com/

- Implementer: Department of Public Works, Solid Waste Commission

F.2.3. Work to implement organics diversion programs for Newton residents.

In 2018, the City piloted curbside organics collection with 200 households for four months. Over the next 3-12 months, the City will investigate a subscription program with a preferred vendor to offer curbside organics collection at a favorable price to all residents.

- Examples: Newton's 2018 Composting Pilot[65], Natick Composting Pilot[66], Cambridge[67]
- Metric(s): Number of residents participating, tons of waste composted annually
- Implementer: Department of Public Works

F.2.4. Increase waste diversion through recycling and household hazardous waste efforts.

Ongoing efforts include curbside recycling, drop-off recycling options, the Swap Shop, and household hazardous waste collection events at the Resource Recovery Center on Rumford Avenue. Greater detail will be included in the Sustainable Materials Management 5-Year Strategy, to be released in 2020. Waste diversion could be increased by expanding Swap Shop hours and modifying Resource Recovery Center hours to increase convenience.

- Examples: none
- Metric(s): Recycling tonnage, recycling contamination, amount of drop-off materials collected for recycling, traffic counts at the Resource Recovery Center
- Implementer: Department of Public Works, Solid Waste Commission

Newton's Consumption and Disposal Accomplishments and On-Going Efforts

- The City is developing a 5-year sustainable materials management strategy.
- The City undertook a successful educational campaign to reduce contamination in the recycling stream.
- The City ran a successful curbside organics collection pilot in 2018.
- The City is introducing an organics subscription program and organics drop off options.

[65] "History of Recycling in Newton," **City of Newton**. http://www.newtonma.gov/civicax/filebank/documents/83468

[66] The **Town of Natick** piloted curbside composting for 500 households, and is currently expanding the program with the goal of increasing to 1,500 households served. https://www.natickma.gov/1302/Curbside-Composting-Pilot

[67] After two pilot phases, the **City of Cambridge** expanded to provide curbside composting city-wide in 2018. https://www.cambridgema.gov/Services/curbsidecomposting

Appendix A: Climate Change Vulnerability Assessment and Action Plan (Summary)

The greater Boston regions is already experiencing warmer temperatures, increased precipitation, and rising seas. Precipitation in the Boston area has increased by 10% in the past fifty years. Recently released design storm figures (NOAA 14) for the 10-year, 24-hour storm are 15% higher than those issued in 1961. Climate projections for this century include increased frequency and intensity of rain storms, and more frequent days with extreme heat. The devastating effects of Hurricanes Harvey, Irma, and Maria highlight the imperative to plan now for future storms.

In Newton, the March 2010 rains caused millions of dollars in damages and disrupted service on the Green Line. Twenty-five of the City's seventy-eight facilities flooded. As rainfall amounts increase, rain events similar to 2010 will become more frequent. A one-thousand-year event would nearly double the rainfall experienced over three days in March 2010. As is evident from Hurricane Harvey, damage and suffering from such an extreme event is severe. Indeed, flooding or extreme heat, and the resultant potential for power outages can have devastating and cascading effects during far lesser storms than a one-in-one-thousand-year occurrence.

Yet we can take steps to increase Newton's resilience and limit future damages. Many of today's investments and decisions in the City of Newton have long legacies that will influence future vulnerabilities. Of particular concern are the impacts on vulnerable populations in Newton including seniors, individuals living alone, people with a disability, young children, people who are socially isolated, and people with limited English language proficiency. Advance planning can save money, while inaction, or actions that don't anticipate future conditions, may lead to higher costs in the future. An example of effective planning comes from the reports that Florida properties experienced much less damage from Hurricane Irma in 2017 than from Hurricane Andrew in 1992. This is attributed to critical improvements made to the building code because of lessons learned from Hurricane Andrew.

Newton's Climate Change Vulnerability Assessment and Action Plan identifies future climate vulnerabilities and suggests strategies for the City of Newton that can reduce the risk of harm to people, properties, and natural resources and help speed recovery when inevitable future storms occur. The recommendations span many areas and range from easy and quick to difficult and expensive. They include such areas as:

- Communicating with and supporting vulnerable populations
- Improving stormwater systems and restoring natural drainage
- Planting more trees
- Continuing and improving emergency preparedness
- Investing in critical infrastructure (e.g. bridges and culverts)
- Incorporating green infrastructure and stormwater management into the zoning ordinances as they are revised.

Appropriate Plan/Process	Recommended Action	Lead Department(s)	Possible Timing	Category* and Action #
• ALL	The Steering Committee, or a successor group, should continue to meet to establish priorities, incorporate new information, and monitor progress on climate goals. The City should expand the Steering Committee to include additional relevant departments, such as Senior Services, Inspectional Services, and Urban Forestry.	• Steering Committee	FY18-19 on	A3
• ALL	Establish relationships with state agency staff responsible for climate resilience. Communicate City concerns and priorities and stay abreast of agency planning (e.g. DCR and MWRA).	• Sustainability • Executive Office	On-going	G1
• Annual Departmental Budgets	Provide training to empower City staff to implement cutting edge techniques for green practices. [i]	• ALL	FY18-19 on	E2
• Capital Improvement Plan (**CIP**)	Place signage at popular park and recreation areas to inform residents about tick/mosquito protection measures.	• Parks and Rec • Planning • HHS	FY19	C3
• Capital Improvement Plan (**CIP**)	Assess municipal properties for opportunities for LID/GI retrofits. [ii]	• Public Facilities	On-going	E5
• Capital Improvement Plan (**CIP**)	Prioritize retrofits and emergency planning for City facilities vulnerable to flooding and heat impacts.	• Public Facilities	On-going	E15
• Capital Improvement Plan (**CIP**)	Target affordable housing sites and low-income residents for flood and heat protection upgrades.	• Planning	FY20	B3
• Capital Improvement Plan (**CIP**)	Prioritize public health education programs that address the illnesses and conditions forecast to be exacerbated by climate change (e.g., extreme heat). [iii] [iv]	• HHS	FY20	C1
• Capital Improvement Plan (**CIP**)	Publicize hot spot and potential flooding areas to current residents, businesses, and to permit applicants. Direct them to educational materials.	• Planning • ISD	FY22	E14
• Capital Improvement Plan (**CIP**)	Develop and distribute education and outreach materials on climate related technologies and practices including, for example, elevating utilities, preventing backflow, protecting basements, and weatherization. Consider targeting flooding areas outside of flood zones, including areas with older housing stock, and properties with chronic mold issues. [v]	• ISD	FY20	E13
• Capital Improvement Plan (**CIP**) • Stormwater Infrastructure Improvement Plan (**SIIP**)	Prioritize energy efficiency and stormwater management in capital planning.	• Sustainability • DPW • Executive Office	FY18-19 on	E8

Appropriate Plan/Process	Recommended Action	Lead Department(s)	Possible Timing	Category* and Action #
• Stormwater Infrastructure Improvement Plan (**SIIP**)	Utilize flood claim (losses) mapping to target stormwater improvements.	• DPW	On-going	E7
• Stormwater Infrastructure Improvement Plan (**SIIP**)	Look for stream daylighting or re-naturalizing opportunities to restore natural habitat as part of stormwater or other infrastructure projects. [vi]	• DPW • Planning	As needed	D3
• Stormwater Infrastructure Improvement Plan (**SIIP**)	Reach out to property owners in a specific catchment area (as a pilot project) about ways to improve conditions through Green Infrastructure and stormwater projects. Locations could include an area prone to chronic flooding or an important resource area such as the Crystal Lake watershed.	• DPW • Planning	FY20	E6
• Comprehensive Emergency Management Plan (**CEMP**)	Identify gaps in services to vulnerable populations and prioritize: developing strategies to address gaps, coordinating with community partners to strengthen relations, and considering staff/Medical Reserve Corps involvement in emergency plans.	• Emergency Management • Steering Committee	On-going	B1
• Comprehensive Emergency Management Plan (**CEMP**)	Update the Comprehensive Emergency Management Plan to incorporate changes in emergency situations and response activities that may result from climate impacts.	• Emergency Management	At next cycle	C4
• Comprehensive Emergency Management Plan (**CEMP**)	Develop advance shelter-in-place and communication strategies for residents who may not be able to evacuate during emergencies.	• Emergency Management	On-going	B6
• Comprehensive Emergency Management Plan (**CEMP**)	Assist local businesses in developing emergency preparedness plans. [vii]	• Sustainability • Planning	On-going	F1
• Comprehensive Emergency Management Plan (**CEMP**)	Identify and support vulnerable households most in need of air conditioning. Encourage use of efficient air conditioning.	• HHS	FY20	C5
• Comprehensive Emergency Management Plan (**CEMP**)	Ensure redundancy in the City's emergency communications infrastructure.	• Emergency Management	On-going	H2
• Comprehensive Emergency Management Plan (**CEMP**) • Hazard Mitigation Plan (**HMP**) • Emergency Support Functions (**ESF**) Model	Review climate projections and revise and update climate resilience priorities every five years.	• Sustainability	FY23	A1
• Comprehensive Emergency Management Plan (**CEMP**) • Hazard Mitigation Plan (**HMP**)	Communicate emergency preparedness information to linguistically isolated households.	• Emergency Management	On-going	B4

Appropriate Plan/Process	Recommended Action	Lead Department(s)	Possible Timing	Category* and Action #
• Comprehensive Emergency Management Plan (**CEMP**) • Hazard Mitigation Plan (**HMP**)	Incorporate and prioritize climate resilience and energy efficiency, stormwater management into all City planning documents and activities.	• Executive Office • Planning	On-going	A4
• Comprehensive Emergency Management Plan (**CEMP**) • Hazard Mitigation Plan (**HMP**)	City departments should review the projections and reevaluate climate vulnerabilities relevant to their assets and mission and identify potential and current activities that bolster resilience.	• All	FY18-19	A2
• Hazard Mitigation Plan (**HMP**)	Explore joint procurement opportunities with MAPC to purchase emergency generators and pumps.	• Facilities • Emergency Management	As needed	E12
• Hazard Mitigation Plan (**HMP**)	Evaluate readiness of facilities that serve vulnerable populations (e.g. group homes). Assess retrofit needs and evacuation plans. Assess air conditioning and back-up generators. Encourage sign-up for the emergency notification system.	• Emergency Management	On-going	B2
• Hazard Mitigation Plan (**HMP**)	Work with local health providers to provide emergency preparedness information to clients with physical and mental disabilities.	• Health and Human Services	On-going	B5
• Street Tree Planting Plan (**STPP**)	Increase funding for increased street-tree planting and landscaping at public facilities in "hot spot" areas. Continue to increase tree diversity and consider trees well-adapted to warming temperatures to boost climate resilience. [viii]	• Parks and Rec/Forestry	On-going	C2
• Zoning Redesign	Ensure that the zoning ordinance requires Green Infrastructure/Low Impact Development/Renewable Energy through, e.g., green buildings, creative approaches to parking, driveways, street width, stormwater, and site plan review in all development and redevelopment. Include incentives to increase green landscaping, reflective pavements, and cool or green roofs to lessen heat island impacts. [ix] [x]	• Planning	FY18-19	E1
• Zoning Ordinance	Establish green building requirements. [xi]	• Planning • ISD	FY19-20	E9
• Floodplain Ordinance	Expand the floodplain ordinance to include documented areas of flooding. [xii]	• Planning	FY21	E3
• Floodplain Ordinance	Develop plans to address flooding outside of FEMA flood zones (e.g., expand wetlands protection jurisdiction, restrict basements, or require flood proofing for basements).	• Planning • ISD	FY20	5E4

Appropriate Plan/Process	Recommended Action	Lead Department(s)	Possible Timing	Category* and Action #
• Open Space and Recreation Plan (**OSRP**) • Conservation Restrictions (**CR**s)	In open space planning include: 1) protecting large, connected or buffering green spaces to foster ecological resilience and biodiversity; 2) removing asphalt; 3) planting trees; and 4) identifying locations where soil will support stormwater infiltration. .[xiii]	• Planning	FY18-19 (plan due in 2020)	D1
• DPW evaluation of specific bridge and culvert projects	Ensure that bridge and culvert repairs take into account future precipitation projections. [xiv]	• DPW	As needed	D2
• DPW review of special permits, administrative site plans, and proposed subdivisions. • Zoning Ordinance or LID Ordinance. • Complete Streets Policy	Incorporate depaving permeable concrete, and GI/LID stormwater management guidelines into street design for construction and reconstruction. Use GIS to prioritize areas where such activities will address flooding.	• DPW • Planning	FY20	E10
• DPW monthly meetings with Eversource (electrical distribution), National Grid (gas distribution), and Verizon (communication distribution).	Work with Eversource to address vulnerabilities and coordinate work, including capital improvements and vegetation management, to ensure protection of Newton assets.	• Sustainability • DPW	On-going	H1
• Newton North High School microgrid plan. • Newton Wellesley Hospital microgrid plan.	Encourage use of microgrids, district energy, and battery storage to keep critical facilities functioning in the event of power loss. [xv]	• Sustainability	FY19-20	E11

*Category

A. Implementation Recommendations
B. Socio-Economic Recommendations
C. Public Health Recommendations
D. Natural Resources Recommendations
E. Built Environment
F. Economic Recommendations
G. State-owned Infrastructure Recommendations

[i] The University of New Hampshire Stormwater Center conducts research and offers technical training on innovative stormwater treatments.

[ii] Possible project with MAPC.

[iii] The Bureau of Environmental Health of the Massachusetts Department of Public Health has online resources, including a conceptual pathways matrix that identifies hazards, exposures, vulnerable groups, and health risks https://matracking.ehs.state.ma.us/Climate-Change/conceptual-pathways.html.

[iv] Center for Disease Control Extreme heat guidebook: https://www.cdc.gov/climateandhealth/pubs/extreme-heat-guidebook.pdf MAPC's Keep Cool App. MAPC's Keep Cool App.

[v] Example: Basement protection materials from Kingston, Ontario, Canada (https://utilitieskingston.com/Wastewater/BasementFlooding/Protect).

[vi] Example: The Muddy River project in Brookline and Boston has restored natural habitat and reduced flooding risk.

[vii] Example: The City of Cambridge and MAPC partnered in providing workshops to small business owners. The City of Cambridge maintains a Business Emergency Preparedness website: https://www.cambridgema.gov/CDD/econdev/resourcesforbusinesses/smallbusiness/emergencypreparednessforbusinesses

[viii] The U.S. Forest Service has developed a comprehensive manual, "Forest Adaptation Resources: Climate Tools and Approaches for Land Managers," available at https://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs87-2.pdf.

[ix] MAPC Low Impact Development Toolkit, ex. Town of Littleton Low Impact Development Manual.

[x] Examples: Seattle Green Factor establishes green landscaping requirements for projects of a certain size. Sacramento Parking Lot Shading Requirement mitigates urban heat island impacts.

[xi] The Boston Planning and Development Agency has a climate resiliency checklist that could be modified for use in Newton. LEED resources include climate resilience screening tools. Example: The City of Cambridge has developed sustainable building requirements.

[xii] The Town of Braintree floodplain by-law includes documented areas of flooding outside FEMA flood zones.

[xiii] The Metro Mayors Climate-Smart Region (CSR) Decision Support Tool is a new GIS-based program developed to prioritize locations for green infrastructure. The CSR program analyzes spatial data in four climate strategies: Connect (carbon-free transportation links), Cool (shade areas to reduce heat), Absorb (innovative stormwater management), and Protect (natural land buffers for sea level rise). MAPC can provide training on use of the tool.

[xiv] Massachusetts Stream Crossing Handbook: http://www.mass.gov/eea/docs/dfg/der/pdf/stream-crossings-handbook.pdf and State grant program for replacement of high ecological value culverts.

[xv] The state's Advancing Commonwealth Energy Storage (ACES) program, and the Mass Clean Energy Center Community Micro grids program. Examples: The City of Northampton is building a microgrid to power its DPW, emergency shelter, and local hospital.

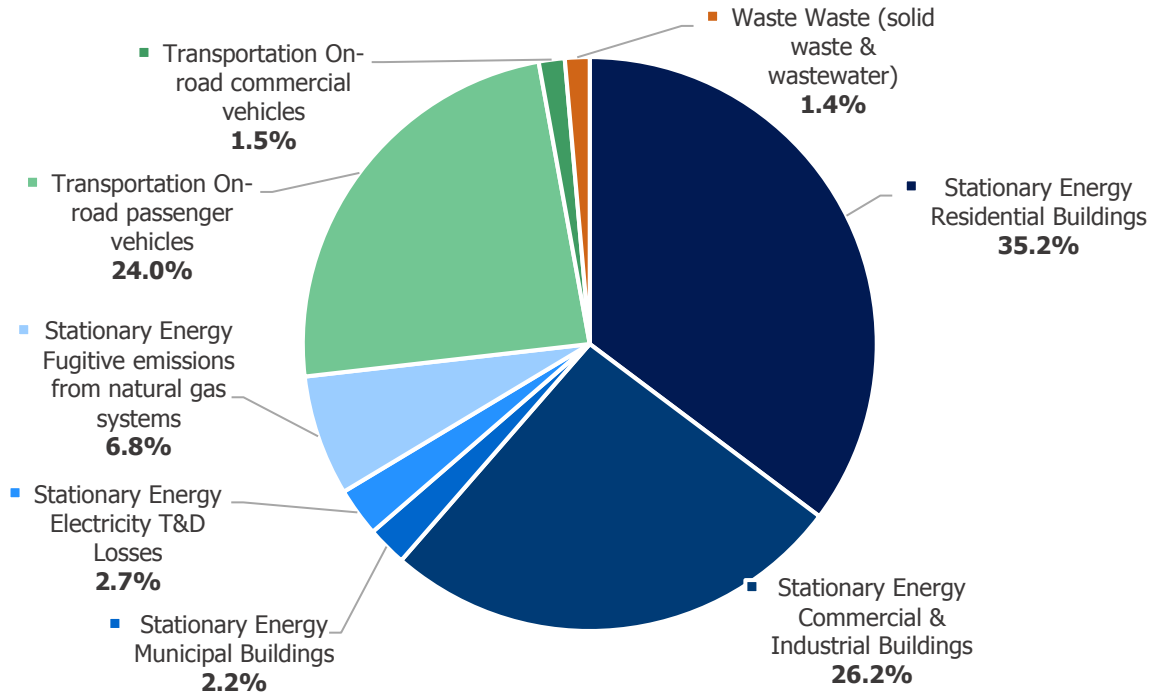
Appendix B: Greenhouse Gas Inventory Methodology

Greenhouse Gas Inventory Overview

The City established a baseline year of 2013 based on the availability of data and prior work completed by the Newton Citizens' Commission on Energy ("NCCE"). The Metropolitan Area Planning Council ("MAPC") expanded on the work completed by the NCCE to provide the City with a methodology that would be simple to update on a regular basis and to track progress towards the City's climate action goals. This appendix provides all supporting documentation on the methodology and data used to develop the City's GHG inventory to accompany the GHG Inventory worksheet provided in **Appendix E**.

In the baseline year of 2013, the City of Newton emitted **785,068 metric tons of carbon dioxide equivalent** (CO_2e) from the residential, commercial, industrial, transportation, and waste sectors. Residential buildings in the City are responsible for the largest portion of GHG emissions (35.2%), with commercial and industrial buildings (26.2%) and on-road transportation (25.5%) following closely behind. **Figure B1** below provides a summary of the GHG emissions accounted for by sector in the City's 2013 GHG inventory.

FIGURE B1: CITY OF NEWTON GREENHOUSE GAS INVENTORY (2013)



Scopes and Boundaries

The City's GHG Inventory uses the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories ("GPC") for sources of emissions where data is reasonably available to the City.[68] With some limitations in resources and data, the City's GHG Inventory adheres most closely to the BASIC level reporting under the GPC framework. This includes emissions from Scopes 1 and 2 for Stationary Energy and Transportation, and Scopes 1 and 3 for Waste (**Table F1**). The inventory uses the GPC's definitions for scopes 1, 2, and 3. **Scope 1** GHG emissions are those from sources located within the City's boundary. **Scope 2** GHG emissions occur from the use of grid-supplied electricity, heat, steam, and cooling within the City's boundary. **Scope 3** represents all other GHG emissions that occur outside of the City's boundary as a result of any activities within the City's boundary.

TABLE F1: NEWTON GHG INVENTORY SECTORS AND SCOPES INCLUDED

GHG Emissions Source (by sector and subsector)	Scope 1	Scope 2	Scope 3
Stationary Energy			
Residential buildings – electricity		•	•
Residential buildings – natural gas and heating oil	•		
Commercial and industrial buildings – electricity		•	•
Commercial and industrial buildings – natural gas and heating oil	•		
Fugitive emissions from natural gas systems	•		
Transportation			
On-road transportation – Fuel combustion	•		
On-road transportation – Electricity		•	
Waste			
Solid waste disposed at landfills			
Biological treatment of waste	•		•
Incineration and open burning	•		•
Wastewater treatment and discharge	•		•

**Blue cells in Figure B1 note all scopes required for GPC BASIC reporting. Green cells indicate scopes only required for BASIC+ reporting. "•" indicates data points that are included in the City's GHG inventory.*

[68] Global Protocol for Community-Scale Greenhouse Gas Emission Inventories, https://ghgprotocol.org/sites/default/files/standards/GHGP_GPC_0.pdf

Data Limitations

The City's GHG Inventory is limited to those emissions sources included in the BASIC level of the GPC framework. The City's inventory also does not include transportation emissions from railways, aviation, or off-road vehicles, or stationary energy emissions from manufacturing industries or construction, agriculture, forestry, and fishing.

The GHG emissions associated with heating oil for residential, commercial, and industrial buildings are limited by the static estimation methodology used to approximate total gallons of heating oil consumed by each sector. A consistent and complete local data set for fuel oil consumption has yet to be identified for cities and towns in Massachusetts.

The transportation sector GHG emissions are limited to those associated with on-road vehicles. Additional data and analysis are also required for estimation of emissions from public transportation. In Newton, this would include data on fossil fuels combusted and grid-supplied electricity consumed by the portions of the MBTA Green line and Commuter Rail within Newton and local MBTA bus routes.

Sector-Specific Methods, Data Sources, and Emissions Factors

Activity Data Calculations

Stationary Energy

The stationary energy sector includes all GHG emissions from combustion of natural gas and heating oil and use of grid-supplied electricity. A majority of stationary emissions result from existing buildings. A smaller subset of stationary energy emissions results from electricity transmission and distribution losses and fugitive emissions from the natural gas system. The electricity and natural gas data used in the inventory are from MassSaveData (with the exception of municipal energy consumption, which was sourced from MassEnergyInsight).

Heating fuel oil consumption for residential, commercial, and industrial buildings was estimated using public national, state, and local datasets to calculate average fuel consumption by building type. Residential heating oil consumption is estimated based on American Community Survey (ACS) data for heating fuel type and housing unit types and U.S. Energy Information Administration (EIA) data for average fuel oil consumption by housing type to calculate a localized estimate that takes into account the housing portfolio in Newton and energy use profiles of these buildings. Commercial and industrial heating oil consumption is estimated based on U.S. EIA data for average fuel oil consumption by business and industry type and MA Executive Office of Wages and Labor Division data on local businesses and industries. Local businesses and industries are mapped by their three-digit NAICS code to the appropriate Principal Building Activity (PBA). Emissions from these facilities are then calculated using data from U.S. EIA on average fuel oil consumption by PBA.

Electricity losses are estimated using a grid-supplied transmission and distribution loss factor, multiplied by the cumulative activity data reported on grid-supplied energy consumption by the U.S. Energy Information Administration. Fugitive emissions from the natural gas distribution system are estimated based on the Boston-specific average loss factor produced in a 2015 Harvard Proceedings of the Natural Academy of Sciences (PNAS) study.[69]

[69] K. McKain, et al., "Methane emissions from natural gas infrastructure and use in the urban region of Boston, Massachusetts," *Proceedings of the National Academy of Sciences*, February 2015, www.pnas.org/cgi/doi/10.1073/pnas.1416261112

Transportation

The transportation sector uses a resident-activity model to calculate GHG emissions from on-road vehicles. The emissions calculated represent all trip miles travelled inside and outside of Newton carried out by passenger and commercial vehicles registered in the City of Newton. This includes vehicles of all fuel types registered in Newton (gasoline, diesel, hybrid, and battery electric). Data from the Massachusetts Vehicle Census (MAVC) on average daily emissions from registered passenger and commercial vehicles in Newton was used to calculate emissions for the GHG inventory. The MAVC combines information from the MA Registry of Motor Vehicles on vehicle registrations, inspection records, mileage ratings, and other sources to document the ownership and mileage history of each vehicle. MAPC uses the actual vehicle miles traveled (VMT) of registered vehicles and the adjusted miles per gallon (MPG) to generate daily fuel consumption and associated greenhouse gas emissions based on the greenhouse gas density of the associated fuel type.

Waste

The waste sector includes GHG emissions from the disposal of municipal solid waste and treatment of wastewater generated by residents and commercial entities in the City. All the municipal solid waste generated in Newton that is not recycled or composted is disposed of by incineration. GHG emissions are calculated for the tons of waste in Newton that is either composted (i.e., biologically treated) or incinerated. All of the wastewater generated by the City is delivered by the Massachusetts Water Resources Authority (MWRA) to the Deer Island Wastewater Treatment Plant. On Deer Island, no methane is released from the treatment process at the facility. Nearly all of the facility's methane is used for heating the digester tanks according to MWRA records. The excess is diverted to a cogeneration system where it is used to heat buildings and generate electricity via steam turbine generators. As such, only nitrous oxide emissions are calculated for the wastewater generated in the City.

TABLE F2: PRIMARY SOURCES FOR ACTIVITY DATA

Source	Data Type	Sector/Subsector
MassSaveData[70]	Statewide	Residential and commercial/industrial buildings – electricity and natural gas
MassEnergyInsight[71]	Local	Municipal buildings and vehicles – all fuels
EIA RECS, CBECS, MECS[72]	Regional	Residential and commercial/industrial buildings – heating oil estimation
American Community Survey[73]	National	Residential and commercial/industrial buildings – heating oil estimation
EOLWD Wages and Labor Survey[74]	Statewide	Residential and commercial/industrial buildings – heating oil estimation

[70] http://masssavedata.com/public/home
[71] https://massenergyinsight.net/home
[72] https://www.eia.gov/consumption/
[73] https://datacommon.mapc.org/browser/Housing/Household%20Tenure
[74] http://lmi2.detma.org/lmi/lmi_oes_a.asp

Massachusetts Vehicle Census[75]	Statewide	Passenger and commercial vehicles
City of Newton, DPW	Local	Municipal solid waste

Emissions Factors

Emissions factors are applied to all activity data to calculate emissions for a greenhouse gas inventory. The greenhouse gases included in this inventory are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The best practice guidance for developing GHG inventories is to apply emissions factors that are most relevant to the inventory boundary. In most cases, city-specific emissions factors are unavailable unless additional data collection and analysis has been performed. For Newton's GHG inventory, a range of local, regional, and national factors were applied. Where relevant emissions factors were unavailable, the inventory uses the default factors provided by either IPCC or ICLEI guidance on GHG inventories (as is recommended in the GPC method).

TABLE F3: PRIMARY SOURCES FOR EMISSIONS FACTORS

Source	Factor Type	Factor Application
2016 ISO New England Electric Generator Air Emissions Report[76]	Regional	CO_2 emissions from consumption of grid-supplied electricity
2018 EPA Emissions Factors for Greenhouse Gas Inventories[77]	National	CH_4 and N_2O emissions from consumption of grid-supplied electricity and all emissions from combustion of natural gas, fuel oil #2 (heating oil), propane, diesel, and gasoline
2006 IPCC Guidelines for National Greenhouse Gas Inventories[78]	Default guidance	CH_4 and N_2O emissions from composting and N_2O emissions from wastewater
2003 ICLEI US Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions[79]	Default guidance	All emissions from incineration of municipal solid waste
2015 Harvard Study published in the Proceedings of the National Academy of Sciences[80]	Local	CH_4 emissions from non-combusted natural gas losses from the distribution system (i.e. gas leaks)

75 https://datacommon.mapc.org/browser/Transportation/Massachusetts%20Vehicle%20Census%20(2009-14)

76 https://www.iso-ne.com/static-assets/documents/2018/01/2016_emissions_report.pdf

77 https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

78 https://www.ipcc.ch/report/2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/

79 http://icleiusa.org/publications/us-community-protocol/

80 K. McKain, et al.

The "REFERENCES" sheet of **Appendix E** provides complete documentation of the specific emissions factor values used in the City's GHG inventory. This section of **Appendix E** also documents all other conversion factors applied in the inventory.

Emissions from Grid-Supplied Electricity

The GHG inventory applies the locational marginal unit (LMU) heat rates and emissions factors produced by ISO New England to calculate emissions from grid-generated electricity. The heat rates and emissions factors provided by ISO New England provide a higher level of local accuracy than the eGRID factors calculated by the U.S. Environmental Protection Agency (EPA). The LMU methodology bases the emissions factor on the last unit dispatched to balance the system, rather than a fuel type assumption method that places assumptions based on the overall composition of energy sources. Additionally, ISO New England provides updated factors by year – allowing for adjustments as the energy portfolio of the regional electricity grid changes in composition.

Fugitive Emissions from Natural Gas Systems

The GHG inventory applies the 2.7 % loss factor reported in the Harvard Proceedings of the Natural Academy of Sciences (PNAS) study to the total amount of natural gas combusted by buildings in Newton. This application of the factor is likely an underestimation of total fugitive emissions, because the study examined the average fractional loss rate of all downstream components of the natural gas system, including gas lost along transmission and distribution. The GHG inventory assumes that 90 % of the total amount of natural gas lost is released as methane into the atmosphere.

Updating the GHG Inventory for Future Years

MAPC produced the workbook in the **Appendix E** Excel spreadsheet to support the City in updating the GHG inventory as more recent years of activity data become available. The City intends to update the GHG inventory every two to three years to benchmark progress toward the City's climate goals.

Using the Inventory Workbook

All of the sheets in the workbook link back to the "INPUTS" tab. To calculate the City's GHG inventory for a new year, save a copy of the entire workbook and update all the INPUTS cells highlighted in yellow below with the respective data for the updated year of the inventory. No changes should be made within the "REFERENCES" or sector-specific sheets, unless a revision to the methodology is being implemented. All of the linked calculations will update for the new year of data and auto populate in the "GHG SUMMARY" and "FIGURES" tabs for immediate use.

Appendix C: 2013 Greenhouse Gas Inventory

The information contained in this Appendix is available as a separate excel spreadsheet for ease of updating and is shown here.

City of Newton Greenhouse Gas Emissions Inventory SUMMARY (2013)

The following inputs are for the calendar year 2014

The City of Newton's Greenhouse Gas Inventory ("GHG Inventory") uses the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories ("GPC") for sources of emissions for which data is reasonably available to the City. With some limitations in resources and data, the City's GHG Inventory adheres most closely to the BASIC level reporting under the GPC framework. This includes emissions from Scopes 1 and 2 for Stationary Energy and Transportation, and Scopes 1 and 3 for Waste.

How to use the City's GHG Inventory Tool: All of the sheets in this workbook link back to the INPUTS tab. To calculate the City's GHG inventory for a new year, save a copy of the entire workbook and update all the INPUTS cells highlighted in yellow below with the respective data for the new year. No changes should be made within the REFERENCES or sector-specific sheets (STATIONARY ENERGY, TRANSPORTATION, and WASTE), unless a revision to the methodology is being implemented. All of the linked calculations will update with the new year of data and auto-populate in the GHG SUMMARY and FIGURES tabs for immediate use.

Current limitations and methodology details: As stated above, the City's GHG Inventory is limited to those emissions sources included in the BASIC level of the GPC framework. The City's inventory also does not include Transportation Emissions from railways, aviation, or off-road vehicles or Stationary Energy Emissions from manufacturing industries or construction, agriculture, forestry, or fishing activities. See **Appendix F** of the City's Climate Action Plan for further documentation on the limitations of the current methodology and background on the sources supporting the calculations made.

STATIONARY ENERGY

The following inputs are being used to calculate emissions in the stationary energy sector for Newton's Greenhouse Gas Inventory.

Residential Buildings	**Input**	**Source**
Electricity (MWh)	226,802.00	MassSaveData
Natural gas (Therms)	25,081,856.00	MassSaveData
Heating oil (Gallons)	4,610,351.49	MAPC Estimate Methodology

Commercial & Industrial Buildings	**Input**	**Source**
Electricity (MWh)	330,418.00	MassSaveData
Natural gas (Therms)	13,919,189.00	MassSaveData
Heating oil (Gallons)	859,372.50	MAPC Estimate Methodology

Municipal Buildings	**Input**	**Source**
Electricity (MWh)	22,578.52	MassEnergyInsight
Natural gas (Therms)	1,263,525.00	MassEnergyInsight
Heating oil (Gallons)	128,924.00	MassEnergyInsight
Propane (Gallons)	755.00	MassEnergyInsight

Electricity Transmission & Distribution Losses	**Input**	**Source**
Estimated losses (MWh)	3,009,923	US EIA
Total disposition (MWh)	34,159,686	US EIA
Direct use electricity (MWh)	1,123,088	US EIA

Fugitive Emissions from Natural Gas Systems	**Input**	**Source**
Fractional loss rate from all downstream components of the natural gas system	2.7%	Harvard PNAS (2015)

TRANSPORTATION

The following inputs are being used to calculate emissions in the transportation sector for Newton's Greenhouse Gas Inventory.

Passenger Vehicles	**Input**	**Source**
Average Daily Emissions Q1 (lbs CO_2e)	513.52	MA Vehicle Census
Average Daily Emissions Q2 (lbs CO_2e)	513.87	MA Vehicle Census
Average Daily Emissions Q3 (lbs CO_2e)	521.36	MA Vehicle Census
Average Daily Emissions Q4 (lbs CO_2e)	512.32	MA Vehicle Census

Commercial Vehicles	**Input**	**Source**
Average Daily Emissions Q1 (lbs CO_2e)	32.53	MA Vehicle Census
Average Daily Emissions Q2 (lbs CO_2e)	31.60	MA Vehicle Census
Average Daily Emissions Q3 (lbs CO_2e)	31.44	MA Vehicle Census
Average Daily Emissions Q4 (lbs CO_2e)	30.04	MA Vehicle Census

Municipal Vehicles	**Input**	**Source**
Gasoline (Gallons)	191,907	MassEnergyInsight
Diesel (Gallons)	71,348	MassEnergyInsight

WASTE

The following inputs are being used to calculate emissions in the waste sector for Newton's Greenhouse Gas Inventory.

Municipal Solid Waste Treatment	**Input**	**Source**
Landfill (US tons)	-	City of Newton, DPW
Incineration (US tons)	18,719.65	City of Newton, DPW
Composting (US tons)	7,106.62	City of Newton, DPW
Recycling (US tons)	10,411.30	City of Newton, DPW

Wastewater Treatment	**Input**	**Source**
City population	87,636	US Census, MAPC Population Estimates
Per capita protein consumption (kg/pers/yr)	31.9	US EPA, 2013 GHG Inventory

City of Newton Greenhouse Gas Emissions Inventory SUMMARY (2013)

GHG Emissions Source (by sector and subsector)	Scope	Notation Key*	Emissions (MT)				Data Quality**	
			CO_2	CH_4	N_2O	CO_2e	Activity Data	Emissions Factor
Stationary Energy								
Residential buildings			275,830.49	12.18	2.05	276,713.70		
Electricity	2		95,674.47	7.79	1.43	96,270.32	High	High
Natural gas	1		133,084.33	2.51	0.25	133,221.02	High	Medium
Heating oil	1		47,071.69	1.89	0.37	47,222.35	Medium	Medium
Commercial & industrial buildings			222,013.40	13.09	2.29	222,985.42		
Electricity	2		139,383.99	11.34	2.08	140,252.06	High	High
Natural gas	1		73,855.22	1.39	0.14	73,931.08	High	Medium
Heating oil	1		8,774.19	0.35	0.07	8,802.28	Low	Medium
Manufacturing and construction		NE						
Electricity	2	NE						
Natural gas	1	NE						
Heating oil	1	NE						
Energy Industries	1, 2, 3	NO	-	-	-	-	N/A	N/A
Transmission & distribution losses from grid-supplied electricity consumption	3		21,416	2	0	21,549	Medium	High
Fugitive emissions from natural gas systems	1		-	1,905	-	53,335	Low	High
Transportation								
On-road transportation						**199,535**		
Fuel combustion - passenger	1					188,072.84	Medium	Medium
Fuel combustion - commercial	2					11,462.54	Medium	Medium
Waste								
Solid waste disposal								
Disposed at landfills in-city boundary	1	NO					N/A	N/A

Disposed at landfills outside city boundary	3	NO						
Biological treatment of waste			-	**64**	**4**	**2,830**		
Treated within city boundary	1		-	64	4	2,830	High	Low
Treated outside city boundary	3	NE						
Incineration and open burning			**6,112**	**6**	**1**	**6,488**		
Treated within city boundary	1		6,112	6	1	6,488	High	Low
Treated outside city boundary	3	NE						
Wastewater treatment and discharge			**-**	**-**	**6**	**1,630**		
Treated within city boundary	1	NO						
Treated outside city boundary	3		-	-	6	1,630	High	Medium

**Notation keys from GPC used (IE = Included Elsewhere, NE = Not Estimated, NO = Not Occurring, C = Confidential)*
***Data quality assessment applies GPC standards for High, Medium and Low quality ratings for the data used.*

STATIONARY ENERGY EMISSIONS CALCULATIONS

Cells highlighted in yellow are data points sourced from the inputs tab. Included in the current calculations for stationary energy are: Residential Buildings (Starts Row 4), Commercial & Industrial Buildings (Starts Row 16), Municipal Buildings (Starts Row 28), Electricity Transmission & Distribution Losses (Starts Row 40), and Fugitive Emissions from Natural Gas Systems (Starts Row 59).

Residential Buildings

	Natural Gas		Oil		Electricity	
Units	**Therms**	**MMTBU**	**Gallons**	**MMBTU**	**MWh**	**MMBTU**
Consumption	25,081,856.00	2,508,185.60	4,610,351.49	636,228.51	226,802.00	1,551,552.48

	Natural Gas	**Oil**	**Electricity**	**All Fuels**
	Metric Tons	**Metric Tons**	**Metric Tons**	**Metric Tons**
CO_2	133,084.33	47,071.69	95,674.47	275,830.49
CH4	2.51	1.89	7.79	12.18
N2O	0.25	0.37	1.43	2.05
CO_2e	133,221.02	47,222.35	96,270.32	**276,713.70**

Commercial & Industrial Buildings

	Natural Gas		Oil		Electricity	
Units	**Therms**	**MMTBU**	**Gallons**	**MMBTU**	**MWh**	**MMBTU**
Consumption	13,919,189.00	1,391,918.90	859,372.50	118,593.40	330,418.00	2,260,389.54

	NaturalGas	**Oil**	**Electricity**	**AllFuels**
	MetricTons	**MetricTons**	**MetricTons**	**MetricTons**
CO_2	73,855.22	8,774.19	139,383.99	222,013.40
CH4	1.39	0.35	11.34	13.09
N2O	0.14	0.07	2.08	2.29
CO_2e	73,931.08	8,802.28	140,252.06	**222,985.42**

Municipal Buildings (Subset of Commercial & Industrial - do not include in GHG SUMMARY tab)

	Natural Gas		Oil		Electricity		Propane	
Units	**Therms**	**MMTBU**	**Gallons**	**MMBTU**	**MWh**	**MMBTU**	**Gallons**	**MMBTU**
Consumption	1,263,525.00	126,352.50	128,924.00	17,791.51	22,578.52	154,459.66	755.00	

	Natural Gas	**Oil**	**Electricity**	**Propane**	**All Fuels**
	Metric Tons	**Metric Tons**	**Metric Tons**	**Metric Tons**	**Metric Tons**
CO_2	6,704.26	1,316.31	9,524.55	4.32	17,549.45
CH4	0.13	0.05	0.78	0.00	0.95
N2O	0.01	0.01	0.14	0.00	0.16
CO_2e	6,711.15	1,320.53	9,583.87	4.33	**17,619.88**

TRANSPORTATION EMISSIONS CALCULATIONS

Cells highlighted in yellow are data points sourced from the INPUTS tab. Included in the current calculations for Transportation are on-road emissions from passenger vehicles and commercial vehicles. Emissions from the municipal vehicle fleet are calculated separately - but are accounted for in the GHG inventory in the Commercial Vehicle Emissions.

Passenger Vehicle Emissions

	Average Daily Emissions Q1	**Average Daily Emissions Q2**	**Average Daily Emissions Q3**	**Average Daily Emissions Q4**	**Average Daily Emissions - All Quarters**	**Total Annual Emissions**
	Metric Tons	**Metric Tons**	**Metric Tons**	**Metric Tons**	**Metric Tons**	**Metric Tons**
CO_2e	513.52	513.87	521.36	512.32	515.27	**188,072.84**

Commercial Vehicle Emissions

	Average Daily Emissions Q1	**Average Daily Emissions Q2**	**Average Daily Emissions Q3**	**Average Daily Emissions Q4**	**Average Daily Emissions - All Quarters**	**Total Annual Emissions**
	Metric Tons	**Metric Tons**	**Metric Tons**	**Metric Tons**	**Metric Tons**	**Metric Tons**
CO_2e	32.53	31.60	31.44	30.04	31.40	**11,462.54**

Municipal Vehicle Emissions (Subset of commercial vehicles - do not include in GHG SUMMARY tab)

	Gasoline		Diesel	
Units	**Gallons**	**MMBTU**	**Gallons**	**MMBTU**
Consumption	191,907	23,111.17	71,348	9,801.86

	Gasoline	Diesel	All Fuels
	Metric Tons	**Metric Tons**	**Metric Tons**
CO_2	1,684.94	724.18	2,409.13
CH4	0.07		0.07
N2O	0.02		0.02
CO_2e	1,691.05	724.18	**2,415.24**

WASTE EMISSIONS CALCULATIONS

Cells highlighted in yellow are data points sourced from the INPUTS tab. Current calculations for the Waste sector of the GHG inventory area treatment of municipal solid waste by incineration and biological treatment (composting) and wastewater treatment. The emissions equations used for incineration and composting are from ICLEI's U.S. Community Protocol for Accounting and Reporting GHG Emissions. The data collected for this inventory does not support use of either the first order of decay or methane commitment models recommended in the GPC method.

Municipal Solid Waste Treatment

	Landfill		Incineration		Composting (Yard Waste)		Recycling	
Units	**US Tons**	**kg**	**US Tons**	**kg**	**US Tons**	**kg**	**US Tons**	**kg**
Waste Generated	-	-	18,719	16,982,185	7,106	6,447,019	10,411	9,444,975

	Landfill	**Incineration**	**Composting (Yard Waste)**	**Recycling**	**All Methods**
	Metric Tons	Metric Tons	Metric Tons	Metric Tons	Metric Tons
CO_2	-	6,112.34	-	-	6,112.34
CH4	-	5.99	64.47	-	70.46
N2O	-	0.79	3.87	-	4.65
CO_2e	-	6,488.42	2,830.24	-	**9,318.66**

Wastewater Treatment

	City Population	**Protein per Capita**
Units	**Persons**	**kg/person/year**
Inputs	87,636	31.9

	Domestic& Industrial Metric Tons
CO_2*	-
CH4**	-
N2O	6.15
CO_2e	1,629.83

**CO_2 from wastewater treatment is considered to be of biogenic origin and reported outside the scope.*
***For Deer Island, no methane is released from the treatment process. The facility utilizes nearly all of its methane for heating the digester tanks according to MWRA records. The excess is diverted to a cogeneration system where it is used to heat buildings and generate electricity via steam turbine generators.*

Appendix D: Newton's 2020-2025 Climate Action Plan Strategies

A. Newton's Implementation Leadership Strategies

A.1. Create a City implementation team, develop appropriate municipal planning and budgeting processes, and ensure regular Plan evaluations and updates

A.2. Work with partners to build awareness and drive action

B. Newton's Clean and Renewable Energy Strategies

B.1. Increase the amount of electricity provided by New England renewable energy resources

B.2. Support the installation of residential and commercial solar

B.3. Support advocacy groups' efforts to transition from natural gas to renewable energy systems

C. Newton's Green Transportation Strategies

C.1. Ensure that municipal infrastructure and operations are as "green" as possible

C.2. Incentivize residents to switch to EVs with a goal of having 10% of all vehicles on the road be EV, BHEV, ZEM, PHEV+ by 2025

C.3. Engage with third party partners to promote EVs and encourage biking walking, public transit and shared transportation.

C.4. Increase the rate of biking, walking, telecommuting, shared rides, and use of shuttles and public transit, while reducing single-occupancy vehicle trips

D. Newton's New Construction and Major Renovations Strategies

D.1. Advocate for a more energy-efficient and climate-smart building code

D.2. Ensure that new and renovated municipal buildings meet the highest energy efficiency standards possible

D.3. Work with City Council to adopt Zoning Ordinance amendments that require and/or incentivize high-efficiency performance, such as Passive House and/or net-zero new construction – within the next 12 months

D.4. Develop and provide to residents, developers, and businesses educational resources about clean heating and cooling and renewable technologies

E. Newton's Existing Building Strategies

E.1. Advance energy efficiency and weatherization in existing homes and businesses by helping homeowners and contractors understand options

E.2. Transition to electric and thermal heating and cooling in residential and commercial buildings

E.3. Work with City Council to adopt zoning ordinances for energy efficiency and clean energy technologies

F. Newton's Consumption and Disposal Strategies

F.1. Consider initiatives to engage businesses and residents in reducing GHG emissions resulting from corporate operations and individual activities

F.2. Evaluate strategies to improve waste reduction and diversion among residents, businesses, and municipal operations in Newton

Appendix E: Proposed Actions by Action Number

A. Implementing Newton's Climate Action Plan	
A.1.1.	Transform the existing Major Projects and Infrastructure Cluster into the Major Projects, Infrastructure, and Climate Change Cluster to oversee implementation and track the progress of this Plan.
A.1.2.	Develop more concrete estimates of costs and fiscal benefits for each municipal action recommended in this plan and incorporate funding categories or appropriate metrics in the FY 2021 CIP prioritization process to reflect the priorities of this plan and other related plans (such as the Climate Change Vulnerability Assessment and Transportation Plan).
A.1.3.	Evaluate the success of initiatives in this plan -- collect data on immediate and measurable results
A.1.4.	Update the Greenhouse Gas Inventory every 3 to 5 years.
A.1.5.	Incorporate action items (and milestones) from this Plan into annual departmental work plans.
A.1.6.	Review the Climate Action Plan regularly and update the plan as needed, but at least every 5 years.
A.1.7.	Provide annual updates to the City Council and the public.
A.2.1	Promote energy efficiency and GHG emission reduction in the Newton community through a Memorandum of Understanding with Eversource and National Grid.
A.2.2.	Develop an Energy Coach role.
A.2.3.	In collaboration with the Utilities, work with the largest energy users in the City to reduce their GHG emissions.
A.2.4.	Work with the Newton-Needham Chamber of Commerce and the NCCE to explore possible structures for a "Green Ribbon Commission" and implement the preferred model.
B. Promoting Clean and Renewable Energy	
B.1.1.	Encourage residents and businesses to opt up to 100% renewable energy through Newton Power Choice.
B.1.2.	Explore increasing the percentage of MA Class 1 RECS in the City's next Newton Power Choice contract.
B.1.3.	Explore increasing the percentage of MA Class 1 RECS in the City's next municipal electricity contract.
B.2.1.	Work with City Council to adopt a zoning requirement that all new buildings with a certain roof area require solar PV where technically feasible, and other "eco-roof" treatment where appropriate. (See D.3.4.)
B.2.2.	Support Green Newton's efforts to implement the Newton Solar Challenge for residents and businesses which encourages the installation of rooftop solar.
B.2.2.	Work with the Housing Authority to install solar PV on their buildings under the state's SMART incentives.
B.3.1.	Support HEET in its efforts to pilot neighborhood-scale conversion to all-electric heating and cooling systems for neighborhoods in which there is a high prevalence of leak-prone gas infrastructure.
C. Greening Newton's Transportation and Streetscapes	
C.1.1.	Replace 100% of the City's own passenger vehicles with EVs or other zero-emission vehicles.
C.1.2.	Reduce GHG emissions from all municipal non-passenger vehicles.
C.1.3.	Install EV charging stations in village centers, school facilities, and other priority municipal sites, primarily through the Make Ready and GreenSpot programs.

C.1.4.	Initiate small, medium, and large Green Infrastructure and Complete Streets projects specifically aimed at supporting bike/pedestrian travel, reducing GHG emission, increasing tree and shrub installations.
C.1.5.	Facilitate municipal employees use of alternate modes of transportation.
C.1.6.	Prioritize street tree preservation, tree planting, and landscaping, with special consideration given to hot spot areas identified in the Climate Vulnerability Assessment.
C.2.1.	Incorporate electric vehicle charging station requirements into the Zoning Ordinance and a criterion for large multi-family, commercial, and mixed-use developments.
C.2.2.	Provide preferential parking for electric vehicles to make it easier to park.
C.2.3.	Continue to work with partners (such as Make Ready) to install EV charging stations on private properties throughout the City.
C.3.1.	Support local non-profits, for-profits, and advisory groups such as Green Newton, the NCCE, and Newton-Needham Chamber of Commerce, the Transportation Advisory Group (TAG), Safe Routes to School, the utilities, and local businesses efforts in education, events (such as test drives and Tour du Newton), and literature dissemination.
C.3.2.	Support local environmental organizations and car dealerships in implementing group purchasing discounts and other incentivization efforts.
C.3.3.	Engage the transportation network companies (TNCs) and private shuttle operators to increase adoption of electric vehicles, primarily in partnership with other metro Boston communities.
C.4.1.	Work with the City Council to develop a TDM program to reduce single-occupancy vehicle trips through amendments to the Zoning Ordinance.
C.4.2.	Work with the City Council to explore reducing or eliminating the minimum parking requirement in the Zoning Ordinance and instead setting a maximum on parking allotments.
C.4.3.	Create and encourage the use of safe bicycle and pedestrian facilities for commuters and residents.
C.4.4.	Support local transportation partners, such as Safe Routes to School, MassRides, and others in allowing Newton residents to reduce single-occupancy vehicle trips.
C.4.5.	Explore public-private partnerships to develop shared and electric shuttles to support first- and last-mile connections.
C.4.6	Explore opportunities to contract with companies that supply electric school buses.
C.4.7.	Advocate for Newton's transit service needs, including: frequent and accessible service, expanded routes and service hours, station and bus stop upgrades, dedicated lanes for buses and zero-emission vehicles on the MassPike, and other measures during planning processes at the MBTA and MassDOT.
D. Improving New Construction and Major Renovations	
D.1.1.	Register and educate all eligible representatives to ensure strong City participation in the vote on the 2021 International Energy Conservation Code (IECC) to improve the state base building code (with regard to energy efficiency, electrification, and other carbon reduction strategies), and advocate to the Board of Building Regulations and Standards (BBRS) for a net zero Stretch Code.
D.2.1.	Require that all new and renovated municipal buildings continue to meet the City's Sustainability Guidelines for Public Buildings (see **Appendix G**): (1) Minimize Energy Use Intensity (EUI), (2) Transition away from fossil fuel use, (3) Have solar photovoltaics (PV) panels or are solar-ready, and (4) Have EV chargers and/or are charger-ready. Ensure that such goals are reflected in the CIP.
D.3.1.	Work with City Council to amend the Zoning Ordinance to require new construction and major renovations seeking a Special Permit maximize energy efficiency, maximize the use of renewable energy including thermal energy, and use electricity for heating and cooling.
D.3.2.	Work with City Council to require that all new construction and major renovations analyze the costs, benefits, and GHG impacts of maximizing energy efficiency; utilizing electric heating, cooling, and hot water; and using renewable energy, including thermal energy.

D.3.3.	Work with City Council to adopt a zoning requirement that all new parking lots above a certain size require EV charging stations.
D.3.4.	Work with City Council to adopt a zoning requirement that all new buildings with a certain roof area require solar PV where technically feasible, and other "eco-roof" treatment where appropriate.
D.3.5.	Work with the City Council to adopt Zoning Ordinances that encourage additional, appropriate low-carbon housing near public transportation.
D.4.1.	Provide educational resources to developers, residents, and businesses applying for municipal permits about the financial and lifestyle benefits of clean heating and cooling and renewable technologies.
E. Improving Existing Buildings	
E.2.1.	Implement a Solarize Plus, HeatSmart, or similar outreach program for residents and businesses to encourage adoption of electric and clean heating and cooling technologies such as air-source heat pumps, ground-source heat pumps, and thermal options.
E.3.1.	Work with City Council to allow by right the installation of GHG-reducing building improvements.
E.3.2.	Explore opportunities for requiring a standardized, broadly accepted, building energy performance scorecard, to be obtained by a potential seller and disclosed to potential buyers.
F. Reducing GHG Emissions Associated with Consumption and Disposal	
F.1.1.	Work with the Economic Development Director and the Newton-Needham Chamber of Commerce to explore incentive programs for businesses to reduce GHG emissions associated with consumption and disposal.
F.1.2.	Explore adoption of a voluntary program that would allow contributions to a municipal program to help offset GHGs produced by air travel.
F.1.3.	Make available to residents and business information about the GHG impacts of different habits of consumption, including travel, appliances, food, and vehicles.
F.2.1.	Consider citywide mandatory commercial recycling.
F.2.2.	Solicit ideas for a consumption/waste reduction campaign.
F.2.3.	Work to implement organics diversion programs for Newton residents.
F.2.4.	Increase waste diversion through recycling and household hazardous waste efforts.

Appendix F: Proposed Actions by Type of Action (listing implementers)

Action by type of action	Implementers
Working with Commercial Property Owners	
A.2.3. In collaboration with the Utilities, work with the largest energy users in the City to reduce their GHG emissions.	Mayor's Office, Sustainability Dept., Planning Dept., and Partners
A.2.4. Work with the Newton-Needham Chamber of Commerce and the NCCE to explore possible structures for a "Green Ribbon Commission" and implement the preferred model.	Mayor's Office, Sustainability Dept., Planning Dept., Economic Development Commission, N-N Chamber of Commerce, Green Newton
F.1.1. Work with the Economic Development Director and the Newton-Needham Chamber of Commerce to explore incentive programs for businesses to reduce GHG emissions associated with consumption and disposal.	Planning Dept., Sustainability Dept.
F.1.2. Explore adoption of a voluntary program that would allow contributions to a municipal program to help offset GHGs produced by air travel.	Parks, Recreation, and Culture Dept., Sustainability Dept.
Educating Others about and Marketing Climate-Friendly Actions	
A.2.2. Develop an Energy Coach role.	Sustainability Dept.(with support from, the Newton Citizens Commission on Energy, and local environmental groups), Utility Providers
B.2.2. Support Green Newton's efforts to implement the Newton Solar Challenge for residents and businesses which encourages the installation of rooftop solar.	Green Newton, Sustainability Dept.
D.4.1. Provide educational resources to developers, residents, and businesses applying for municipal permits about the financial and lifestyle benefits of clean heating and cooling and renewable technologies.	Sustainability Dept., Planning Dept.
E.2.1. Implement a Solarize Plus, HeatSmart, or similar outreach program for residents and businesses to encourage adoption of electric and clean heating and cooling technologies such as air-source heat pumps, ground-source heat pumps, and thermal options.	Local Environmental Organizations
F.1.3. Make available to residents and business information about the GHG impacts of different habits of consumption, including travel, appliances, food, and vehicles.	Sustainability Department
F.2.2. Solicit ideas for a consumption/waste reduction campaign.	Dept. of Public Works, Solid Waste Commission
F.2.4. Increase waste diversion through recycling and household hazardous waste efforts.	Dept. of Public Works, Solid Waste Commission
Promoting Electric Vehicles	
C.2.2. Provide preferential parking for electric vehicles to make it easier to park.	Planning Dept., Sustainability Dept., Dept. of Public Works
C.2.3. Continue to work with partners (such as Make Ready) to install EV charging stations on private properties throughout the City.	Sustainability Dept., Planning Dept.

Action by type of action	Implementers
Promoting Electric Vehicles (cont'd)	
C.3.1. Support local non-profits, for-profits, and advisory groups such as Green Newton, the NCCE, and Newton-Needham Chamber of Commerce, the Transportation Advisory Group (TAG), Safe Routes to School, the utilities, and local businesses efforts in education, events (such as test drives and Tour du Newton), and literature dissemination.	Local Environmental Organizations, with support from the Sustainability Department
C.3.2. Support local environmental organizations and car dealerships in implementing group purchasing discounts and other incentivization efforts.	Local Environmental Organizations, Car Dealerships, with support from the Sustainability Department
C.3.3. Engage the transportation network companies (TNCs) and private shuttle operators to increase adoption of electric vehicles, primarily in partnership with other metro Boston communities.	Planning Dept., Mayor's Office, TNCs, shuttle operators, City Council Public Safety and Transportation Committee
C.4.6 Explore opportunities to contract with companies that supply electric school buses.	School Dept., Mayor's Office
Adapting Municipal Operations	
A.1.1. Transform the existing Major Projects and Infrastructure Cluster into the Major Projects, Infrastructure, and Climate Change Cluster to oversee implementation and track the progress of this Plan.	Major Projects, Infrastructure, and Climate Change Cluster, Sustainability Department
A.1.2. Develop more concrete estimates of costs and fiscal benefits for each municipal action recommended in this plan and incorporate funding categories or appropriate metrics in the FY 2021 CIP prioritization process to reflect the priorities of this plan and other related plans (such as the Climate Change Vulnerability Assessment and Transportation Plan).	Major Projects, Infrastructure, and Climate Change Cluster, Sustainability Department
A.1.3. Evaluate the success of initiatives in this plan -- collect data on immediate and measurable results	Major Projects, Infrastructure, and Climate Change Cluster, Sustainability Department
A.1.4. Update the Greenhouse Gas Inventory every 3 to 5 years.	Major Projects, Infrastructure, and Climate Change Cluster, Sustainability Department
A.1.5. Incorporate action items (and milestones) from this Plan into annual departmental work plans.	Major Projects, Infrastructure, and Climate Change Cluster, with municipal, volunteer, and private partners
A.1.6. Review the Climate Action Plan regularly and update the plan as needed, but at least every 5 years.	Major Projects, Infrastructure, and Climate Change Cluster
A.1.7. Provide annual updates to the City Council and the public.	Major Projects, Infrastructure, and Climate Change Cluster
A.2.1 Promote energy efficiency and GHG emission reduction in the Newton community through a Memorandum of Understanding with Eversource and National Grid.	Sustainability Dept., Mayor's Office
B.1.3. Explore increasing the percentage of MA Class 1 RECS in the City's next municipal electricity contract.	Sustainability Dept., Mayor's Office
C.1.1. Replace 100% of the City's own passenger vehicles with EVs or other zero-emission vehicles.	Public Works Dept.

Action by type of action	Implementers
Adapting Municipal Operations (cont'd)	
C.1.3. Install EV charging stations in village centers, school facilities, and other priority municipal sites, primarily through the Make Ready and GreenSpot programs.	Dept. of Public Works, Planning Dept., Newton Public School Dept.
C.1.4. Initiate small, medium, and large Green Infrastructure and Complete Streets projects specifically aimed at supporting bike/pedestrian travel, reducing GHG emission, increasing tree and shrub installations.	Dept. of Public Works, Planning Dept.
C.1.2. Reduce GHG emissions from all municipal non-passenger vehicles.	Dept. of Public Works, School Department
C.1.5. Facilitate municipal employees use of alternate modes of transportation.	Watertown TMA with support from the City
C.1.6. Prioritize street tree preservation, tree planting, and landscaping, with special consideration given to hot spot areas identified in the Climate Vulnerability Assessment.	Parks, Recreation, and Culture Dept.
D.2.1. Require that all new and renovated municipal buildings continue to meet the City's Sustainability Guidelines for Public Buildings: (1) Minimize Energy Use Intensity (EUI), (2) Transition away from fossil fuel use, (3) Have solar photovoltaics (PV) panels or are solar-ready, and (4) Have EV chargers and/or are charger-ready. Ensure that such goals are reflected in the CIP.	Public Buildings Dept.
F.2.1. Consider citywide mandatory commercial recycling.	Dept. of Public Works, Health and Human Services Dept.
F.2.3. Work to implement organics diversion programs for Newton residents.	Dept. of Public Works
Promoting Clean Energy Production and Utilization	
B.1.1. Encourage residents and businesses to opt up to 100% renewable energy through Newton Power Choice.	Sustainability Dept., Local Environmental Organizations
B.1.2. Explore increasing the percentage of MA Class 1 RECS in the City's next Newton Power Choice contract.	Sustainability Dept., Mayor's Office
B.2.2. Work with the Housing Authority to install solar PV on their buildings under the state's SMART incentives.	Sustainability Dept., Planning Dept., Newton Housing Authority
B.3.1. Support HEET in its efforts to pilot neighborhood-scale conversion to all-electric heating and cooling systems for neighborhoods in which there is a high prevalence of leak-prone gas infrastructure.	Sustainability Dept., Planning Dept., Dept. of Public Works
Enhancing Transportation Options	
C.4.3. Create and encourage the use of safe bicycle and pedestrian facilities for commuters and residents.	Planning Dept., Dept. of Public Works
C.4.4. Support local transportation partners, such as Safe Routes to School, MassRides, and others in allowing Newton residents to reduce single-occupancy vehicle trips.	Planning Dept., Sustainability Dept., Newton Public School Dept., Local Environmental Organizations
C.4.5. Explore public-private partnerships to develop shared and electric shuttles to support first- and last-mile connections.	Planning Dept., Mayor's Office
C.4.7. Advocate for Newton's transit service needs, including: frequent and accessible service, expanded routes and service hours, station and bus stop upgrades, dedicated lanes for buses and zero-emission vehicles on the MassPike, and other measures during planning processes at the MBTA and MassDOT.	Mayor's Office, Planning Dept.

Action by type of action	Implementers
Improving Newton's Zoning Ordinance and Permitting Processes	
C.2.1. Incorporate electric vehicle charging station requirements into the Zoning Ordinance and a criterion for large multi-family, commercial, and mixed-use developments.	City Council, Planning Dept.
C.4.1. Work with the City Council to develop a TDM program to reduce single-occupancy vehicle trips through amendments to the Zoning Ordinance.	City Council, Planning Dept.
C.4.2. Work with the City Council to explore reducing or eliminating the minimum parking requirement in the Zoning Ordinance and instead setting a maximum on parking allotments.	City Council, Planning Dept.
D.1.1. Register and educate all eligible representatives to ensure strong City participation in the vote on the 2021 International Energy Conservation Code (IECC) to improve the state base building code (with regard to energy efficiency, electrification, and other carbon reduction strategies), and advocate to the Board of Building Regulations and Standards (BBRS) for a net zero Stretch Code.	Sustainability Dept.
D.3.1. Work with City Council to amend the Zoning Ordinance to require new construction and major renovations seeking a Special Permit maximize energy efficiency, maximize the use of renewable energy including thermal energy, and use electricity for heating and cooling.	City Council, Planning Dept., Sustainability Dept.
D.3.2. Work with City Council to require that all new construction and major renovations analyze the costs, benefits, and GHG impacts of maximizing energy efficiency; utilizing electric heating, cooling, and hot water; and using renewable energy, including thermal energy.	City Council, Planning Dept., Sustainability Dept., Inspectional Services Dept.
D.3.3. Work with City Council to adopt a zoning requirement that all new parking lots above a certain size require EV charging stations.	City Council, Planning Dept.
D.3.4. Work with City Council to adopt a zoning requirement that all new buildings with a certain roof area require solar PV where technically feasible, and other "eco-roof" treatment where appropriate.	City Council, Planning Dept., Sustainability Dept.
D.3.5. Work with the City Council to adopt Zoning Ordinances that encourage additional, appropriate low-carbon, housing near public transportation.	City Council, Planning Dept.
E.3.1. Work with City Council to allow by right the installation of GHG-reducing building improvements.	City Council, Sustainability Dept., Planning Dept., Inspectional Services Dept.
E.3.2. Explore opportunities for requiring a standardized, broadly accepted, building energy performance scorecard, to be obtained by a potential seller and disclosed to potential buyers.	Planning Dept., Sustainability Dept.

Appendix G: Acronyms, Terms, and Definitions

Term	Abbreviation	Definition
Air-source heat pump	ASHP	An energy-efficient heating system which uses electricity to transfer heat from outside to inside a building, or vice versa
British thermal unit	Btu	The amount of heat needed to raise one pound of water at maximum density through one-degree Fahrenheit
Battery Hybrid Electric Vehicle	BHEV	Vehicles powered by both gasoline and electricity. The electric energy is generated by the car's own braking system to recharge the battery
Capital improvement plan	CIP	The City of Newton's Capital Improvement Plan is a multi-year plan designed to create a logical, data-driven, comprehensive, integrated and transparent capital investment strategy that addresses infrastructure needs, reflects community values, supports City operations, programs and services, and exemplifies financial and environmental best practices
Carbon dioxide equivalent	CO_2e	A measure for describing how much global warming a given type and amount of greenhouse gas may cause, expressed as the equivalent amount of carbon dioxide
Carbon neutrality		Emitting no net carbon dioxide through reducing and/or offsetting emissions
Carbon sequestration		The process of removing carbon dioxide from the atmosphere and storing it long-term to mitigate global warming
Clean heating and cooling		Refers to a number of heating and cooling technologies that do not require fossil fuel combustion, including air-source heat pumps, geothermal heat pumps, modern wood heating systems, and solar thermal systems
Community choice aggregation	CCA	Also known as municipal electricity aggregation, CCA allows municipalities to use bulk purchasing power to negotiate electricity supply contracts on behalf of their electricity customers
Community shared solar	CSS	A solar-electric system that provides power and/or financial benefit to multiple community members
Distributed energy resources	DER	Distributed generation is electrical generation and/or storage performed by a variety of small, grid-connected or distribution system connected devices such as renewable energy systems and battery storage
District Energy		Networks of hot and cold-water pipes, typically buried underground, that are used to efficiently heat and cool buildings using less energy than if the individual buildings were to each have their own boilers and chillers.
Eco roof		A term used to describe a number of roof types including solar (photovoltaic or thermal), white roofs, blue roofs, and green roofs, which have multiple benefits. These benefits include reducing greenhouse gas emissions, reducing the heat island effect, and lowering temperatures during hot days

EV	Electric vehicle	A vehicle that uses one or more electric motors or traction motors for propulsion
Electrification		The conversion of a machine or system to the use of electrical power
Embodied energy		The amount of greenhouse gases emitted in the production of materials consumed, from building materials to clothing
Energy use intensity	EUI	A measure used to express a building's energy use as a function of its size or other characteristics. A building's EUI is generally expressed as energy consumed in one year (measured in Btu) per square foot
Fossil fuels		Natural fuels such as coal, oil, and gas formed in the geological past from the remains of living organisms
Green infrastructure		Vegetation, soils, and other elements and practices used to restore natural processes required to manage water and create healthier urban environments, including green roofs, rainwater harvesting, bioswales, permeable pavement, and more
Greenhouse gas	GHG	Gases in the atmosphere that absorb and re-emit heat, and thereby keep the planet's atmosphere warmer than it otherwise would be. Those most commonly accounted for are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O)
Heat Pumps		Heating and cooling systems that use electricity to move heat from a cool space to a warm space, making the cool space cooler and the warm space warmer
Intergovernmental Panel on Climate Change	IPCC	An intergovernmental body of the United Nations dedicated to providing the world with an objective, scientific view of climate change, its natural, political and economic impacts and risks, and possible response options
International Energy Conservation Code	IECC	A building code created by the International Code Council adopted by many states and municipal governments in the United States (including Massachusetts) for the establishment of minimum design and construction requirements for energy efficiency
Key performance indicator	KPI	A quantifiable measure used to evaluate the success of an organization, employee, etc. in meeting objectives for performance
Leadership in Energy and Environmental Design	LEED	Leadership in Energy and Environmental Design (LEED) is a green building rating system developed by the US Green Building Council
Life cycle impacts		Impacts (environmental or otherwise) of a given product, process, or service through production, usage, and disposal
Light-emitting diode	LED	A semiconductor that glows when a voltage is applied. LED lights are up to 80% more efficient than traditional lighting technologies such as incandescent light bulbs
Massachusetts Class I Renewable Energy Certificate	MA Class I REC	Renewable energy certificates (RECs) generated by qualified renewable energy facilities (including solar photovoltaic, wind, small hydropower, etc.) that began operation after 1997. RECs are purchased by electricity suppliers to comply with the state's Renewable Energy Portfolio Standard (RPS)

Microgrid		A small network of electricity users with a local source of supply that is usually attached to a centralized national grid but is able to function independently
Mode shift		Changing the mode of transportation, e.g., shifting from driving to bicycling
Net Zero Municipality		A municipality that produces zero net carbon pollution and/or gets as much electricity from renewable sources as it uses, achieved through a combination of energy efficiency improvements, local clean energy production, and purchasing renewable energy
Passive House		A rigorous, voluntary standard for energy efficiency in a building, which reduces the building's ecological footprint and results in ultra-low energy buildings that require little energy for space heating and cooling
Plug-in Hybrid Electric Vehicle	PHEV	Vehicles that can recharge their battery through both regenerative braking and "plugging in" to an external source of electrical power
Plug-in Hybrid Electric Vehicle +	PHEV+	PHEVs that have a greater battery capacity than the standard, usually greater by 10+kwH
Renewable energy		Energy that is collected from resources that are naturally replenished on a human timescale, such as sunlight, wind, and geothermal heat
Renewable energy certificate	REC	A market-based instrument that represents the property rights to the environmental, social and other non-power attributes of renewable electricity generation. RECs are issued when one megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid from a qualifying renewable energy resource
Renewable portfolio standard	RPS	A Massachusetts law requiring the increased production of energy from renewable energy sources such as wind, solar, and geothermal
Solar Thermal		Technologies that capture the energy from the sun for either heating (e.g., hot water or space heating) or the production of electricity
Transportation network companies	TNCs	A company that matches passengers with drivers via websites and mobile apps such as Lyft or Uber
Vehicle Miles Travelled	VMT	Number of miles travelled by a vehicle
Zero Emissions Motorcycle	ZEM	An electric powered motorcycle

Appendix H: Climate Action Best Practices

As Newton joins the ranks of communities around the world planning for significant action on climate, it has looked to learn from others' best practices and innovative approaches. The City researched climate action plans from a range of cities leading in climate action in North America to identify effective strategies and relevant case studies to inform this plan.

Emerging Best Practices

As the scientific consensus about the urgency of the climate crisis becomes clearer, communities are developing increasingly bold and ambitious plans. One example of the increasing ambitiousness of climate action plans is the recent shift from long-term goals focused on 80% GHG reductions by 2050 to plans targeting *carbon neutrality* or *net zero* emissions by 2050 (or sooner). This shift reflects the IPCC's recent findings that global emissions must be reduced to net zero by 2050 to limit global warming to 1.5ºC.[81] Similarly, communities have shifted the focus of their climate planning efforts from accounting solely for GHG emissions generated by municipal operations to those that account for community-wide GHG emissions.

Most Prevalent Climate Actions

Across the ten climate action plans reviewed, some of the most commonly included actions were:

- Bike share
- Green municipal fleet
- Mixed zoning and high-density planning
- Energy benchmarking and mandates
- High-performance mandates for new construction
- Retrofitting incentives for businesses and residents
- Municipal building upgrades, retrofitting
- Investment in renewable energy development and/or procurement
- Home energy performance rating mandates at the point of sale

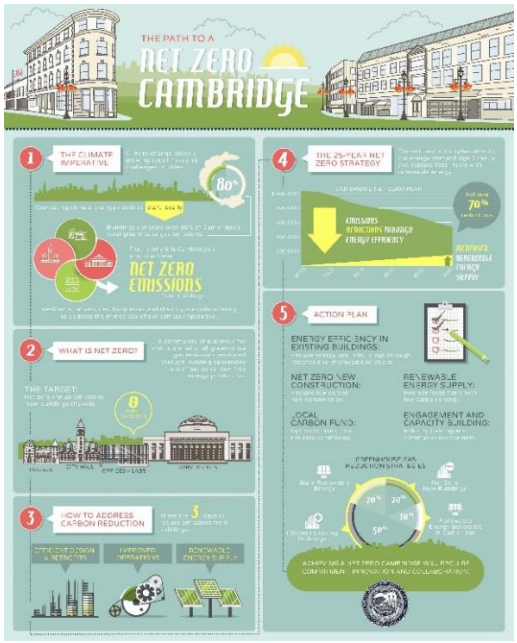
Our analysis of local climate action plans found that many municipalities used a combination of capital investment projects, ordinances, zoning, and municipal "lead by example" initiatives to reduce greenhouse gas emissions. The more aggressive actions and reductions in greenhouse gas emissions were represented in plans from larger cities that were able to mobilize stakeholders and leverage public-private partnerships. For many communities, the transportation sector and existing buildings were the hardest to address successfully and it has proven difficult to demonstrate significant progress after years of targeted policies and investments. Cities and towns are also seeking to address co-benefits associated with climate action, such as workforce development, health and wellbeing, natural resource preservation, and affordability.

Case Studies

Among the climate action plans reviewed were five that stood out as exemplary and informed the City's development for its Climate Action Plan. See **Appendix J** for a list of other resources and plans that were used to develop the City's Climate Action Plan.

[81] IPCC, 2018: Summary for Policymakers. https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers/

CAMBRIDGE, MA: NET ZERO ACTION PLAN



The City of Cambridge released the Net Zero Action Plan for the building sector in 2015. Within the plan, City created an **adaptable** Net Zero process and plan and established a **process for tracking** the City's progress toward meeting the goals set in the Plan. This plan is also an example of how climate plans can and should align with existing and future plans across City departments.

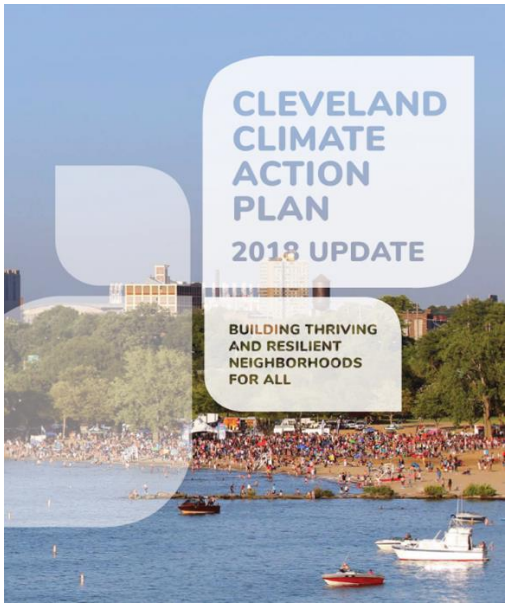
Climate Goal	Focus Areas
80% by 2050, and Net zero annual emissions for buildings citywide by 2040	Energy Efficiency in Existing Buildings, Net Zero New Construction, Local Carbon Fund, Renewable Energy Supply, Engagement and Capacity Building

SOMERVILLE, MA: SOMERVILLE CLIMATE FORWARD

Released in 2018, the City of Somerville's Plan identifies 13 priority areas and 22 key supporting actions across all of the priority areas. By **narrowing to 22 priority actions**, the City provides comprehensive details on the implementation approach and the necessary steps to achieve success.

Climate Goal	Focus Areas
Carbon Neutral by 2050	Buildings and Energy, Mobility, Environment, Community, Leadership

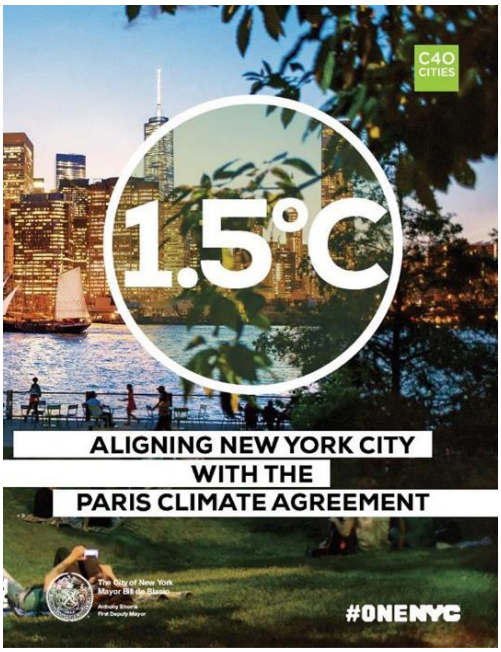
CLEVELAND, OH: CLIMATE ACTION PLAN 2018 UPDATE



The City of Cleveland's Plan divides into focus areas, each with a set of objectives and actions. For each action, the Plan identifies the appropriate implementers and indicators. An aspect of this plan that is unique is the **cross cutting priorities** identified in the plan of Social and Racial Equity, Good Jobs, Green Jobs, Climate Resilience, and Business Leadership.

Climate Goal	Focus Areas
80% below 2010 emissions by 2050	Energy Efficiency and Green Building, Clean Energy, Sustainable Transportation, Clean Water and Vibrant Green Spaces, More Local Food, Less Waste, and Cross-Cutting Priorities

NEW YORK, NY: 1.5°C PLAN



In 2017, the City released a second climate action plan with near term actions to align with the Paris climate agreement and achieve carbon neutral by 2050. Along with GHG impact and financial feasibility, the Plan analyzes the **associated benefits** for growth, equity, sustainability, and resiliency. By considering all of these factors – and providing the **associated implementer** responsible for each action – the City provides a clear picture of how these actions will move forward.

Climate Goal	Focus Areas
Carbon neutral by 2050	Buildings, Energy, Transportation, Waste, and All Sectors

VANCOUVER, BC: GREENEST CITY 2020 ACTION PLAN

Vancouver's Plan establishes a **holistic framework** to achieve zero carbon, zero waste, and healthy ecosystems. The Plan aligns with economic and public health plans for the City. Additional components of the plan are detailed targets, indicators, and **five-year priority actions**.

Climate Goal	Focus Areas
80% below 2007 emissions by 2050	Climate and Renewables, Green Buildings, Green Transportation, Zero Waste, Access to Nature, Clean Water, Local Good, Clean Air, Green Economy, Lighter Footprint

Appendix I: Public Buildings Department, Building Design and Construction Sustainability Guidelines (Approved by DRC 5/10/2017)

A. Introduction and Summary

In its decisions regarding the design and construction of new municipal buildings and the major renovation of existing municipal buildings, the City of Newton strives to reach the best balance among many goals. Key goals include building function, construction budget, operating costs, siting, appearance, maintenance requirements, longevity, and flexibility for future needs. This document is intended to better guide decision-makers who seek to achieve the best balance among these objectives. They are recommendations and do not alter the existing jurisdiction or authority of the City Council.

1) These guidelines will be reviewed at least every three years by the Public Buildings Commissioner as technology developments and experience warrant.

2) Newton is a leader in the pursuit of a sustainable built environment. As it plans the construction and major renovation of buildings, it will look beyond minimum regulatory standards and consider intelligent building strategies that will contribute to substantial long-term conservation of natural resources and operational economies. For each building design project, in addition to meeting code requirements, the City will evaluate all cost-effective features that reduce energy and other operational costs and minimize environmental impacts through the use of sustainable building materials and other strategies. This document will guide building siting, design, construction, and operations.

3) Newton's goal of a sustainable built environment is, to the extent possible, to

   a. minimize the use of energy, water, and other resources

   b. maximize the use of renewable sources to provide electricity and heat

   c. maximize building longevity through rigorous design processes and quality-controlled construction

   d. minimize environmental impacts of construction materials and methods

   e. institute building operations and maintenance practices to minimize environmental impacts, achieve optimal performance and maximize occupant health and well-being.

4) In all new buildings and in the renovation of existing buildings the City strives to minimize building energy use. To attain that goal, the City has a building design and operation approach that will reduce life cycle costs, demonstrate significant improvements over previous designs, help define a path to net zero, and educate the community regarding feasibility and value. The path to net zero includes reducing building energy use as much possible and maximizing the use of on-site renewable power and heat.

5) Per Sec 5-54 of the City of Newton Ordinances, a Design Review Committee (DRC) has been established to coordinate the design review process, examine specifications and study the feasibility of any proposed public facility as submitted to it by the Mayor, City Council, or other public agency (e.g., the Public Buildings Department), and shall make recommendations on a range of solutions

within realistic budgetary limits. The DRC may recommend that components of these guidelines be relaxed or modified to accommodate projects whose size or inherent nature make the component inapplicable.

B. Guidelines for Design Teams

1) Design Process Requirements

a. Newton requires its design teams to use an integrated design approach at all phases of the design process, especially in schematics and design development. Because reduction in energy consuming features and HVAC loads may also reduce the size and cost of other parts of the project, and because choice of building materials may impact durability of construction, Newton requires its consultants to identify all building features that can be affected, when making energy efficiency related decisions. (See the attached commentary by Josh Morse, Newton's Buildings Commissioner, regarding "Integrated Design Approach".)

b. During all phases of design

1. Refer to "lessons learned" list from Public Buildings Department
2. Evaluate Value Engineering options using life cycle cost analysis with full consideration of the impact on other building systems and components.
3. Value Engineering options that increase energy use require recommendation by the DRC
4. Continuously consider, propose and evaluate sustainability options
5. All budget estimates to include air infiltration testing

c. During Conceptual Design Phase

Provide a minimum of three options before completion of Conceptual Development Phase. These options will require creative interactive discussions among the design consultants. These analyses will address onsite alternative energy source options and consider funding sources beyond the established building budget. The City will explore budget sources for Options 2 and 3 before completion of Conceptual Design.

Option 1. Meets all codes and budget

Option 2. Reduces energy use to 30% below code requirements, with any budget implications

Option 3. Reduces energy use to net zero. If net zero is not feasible, show an option that reduces net energy use to the minimum feasible. Estimate budget implications.

d. During Schematic Design Phase

1. At the start of Schematics, the City will direct the design team regarding the major options developed in Conceptual Design.
2. The design team will develop options to improve sustainability within the parameters accepted in Conceptual Design. Evaluate life cycle costs of each option.

e. During Design Development Phase

1. The design team will develop options to improve sustainability within the parameters accepted in Schematic Design. Evaluate life cycle costs of each option.
2. Make provisions that enable future building modifications to improve sustainability.

f. During Completion of Construction Drawings

1. Develop options for commissioning building envelope construction
2. Develop options for air infiltration testing

g. Modeling for Large Projects. For projects of 20,000 square feet or more of gross floor area the design team is responsible for Building Energy Use Modeling using the following approach:

1. Establish expected schedule of building use before completion of schematics
2. As the design progresses, refine the model and complete energy model runs at Schematics, Design Development, and near completion of Construction Drawings. These models will be used to guide designers on how to achieve better energy conservation results and the impact of sustainability options being considered.
3. For schools, evaluate the feasibility of reducing energy use by 5%, 10%, and 15% compared to the models of three recently completed Newton schools.

2) Certification and Ratings system requirements

a. Design teams are responsible to meet the following requirements. While LEED is presently the preferred benchmarking system the DRC/ Public Buildings Department may consider alternative indices.

b. Projects of less than 20,000 sf shall meet the requirements of the most current applicable US Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) Building Design and Construction (BD+C) building rating system at the level 'Certified' or better.

c. Projects of 20,000 square feet or more of gross floor area shall meet the requirements of either:

1. The most current applicable LEED BD+C building rating system at the level "Gold" or better. For twelve months from the time of adoption of a new version of LEED projects shall have the option to file under either the old or newly adopted version.

OR

2. For schools, energy efficiency standards acceptable by the Massachusetts School Building Authority (MSBA) for additional reimbursement.

d. To further support the design, construction, and operation of a project that meets Newton's requirements for energy, water, indoor environmental quality, and durability, provide for implementing the LEED BD+C Enhanced Commissioning requirements.

e. The Design Review Committee may recommend any project conform to the certification system without actual participation in the formal process.

C. Guidelines for Designer Selection Committee

Consider the comparative capabilities and experience of design teams, including sub-consultants, to respond to these Guidelines as part of the designer selection criteria. Compare design teams' familiarity with recent sustainability achievements of similar buildings.

D. Guidelines for Public Buildings Department

1) Include these Guidelines in RFQs and contracts with Design Teams.

2) For all design projects, identify means to fund Life Cycle Cost-effective options that raise the cost higher than the established budget.

3) Maintain "lessons learned" list for use by design teams. Update this list after construction of each project and after one year of its occupancy. Semi-annually provide this list to the DRC. Among many other considerations, "lessons learned" shall include:

   a. Evaluation of high performing windows used on recent projects

   b. Evaluation of air barrier and insulating wall and roof assemblies used on recent projects

   c. Evaluation of constructability of thermal break strategies in foundations and structural components on recent projects

   d. Evaluation of HVAC and lighting approaches used on recent projects

   e. Evaluation of building controls, management, monitoring and display functions

   f. Evaluation of durability and performance of building materials

   g. Evaluation of educational opportunities for users and the community

4) Two years after completion of projects larger than 20,000 sf, compare actual energy use to the building model, and include reasonable explanations for significant deviations, recommendations for performance improvements, and a plan to implement such improvements. Require re-measurement and review one year after substantial completion of any significant improvements.

   Establish a formal "recommissioning" process to be completed by the third year of occupancy of buildings, and repeated every three years as follows:

   a. Projects of at least 10,000 sf of floor area but less than 20,000 sf shall meet the requirements of the most current applicable LEED Operations and Maintenance (O+M) building rating system at the level 'Certified' or better.
   b. Projects 20,000 sf or more shall meet the requirements of the most current applicable LEED O+M building rating system at the level 'Silver' or better.

Appendix J: Planning Process and Public Input

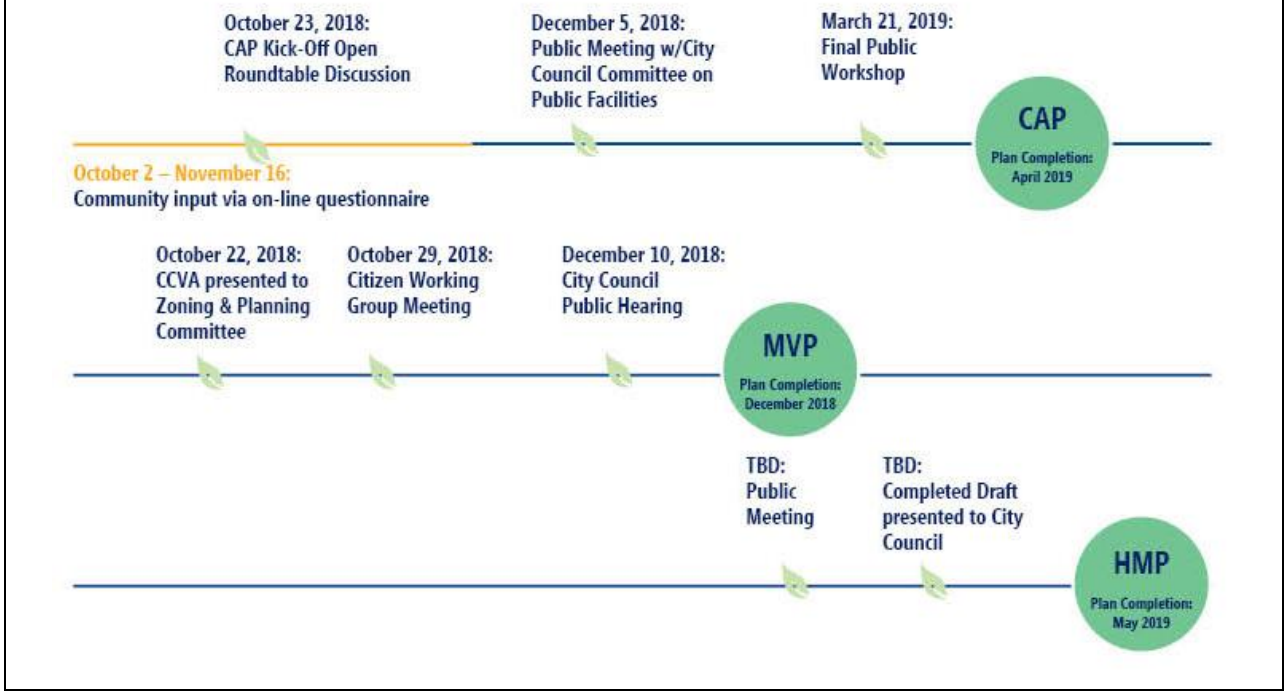
Plan Development Process

In her inaugural address, on January 1, 2018, Mayor Ruthanne Fuller committed to the development of a Climate Action Plan for the City of Newton. In August 2018, the City contracted with the Metropolitan Area Planning Council (MAPC) to revise the City's Greenhouse Gas Inventory and develop a Five-Year Climate Action Plan. The plan development process included continuous engagement of city staff and volunteer stakeholders and several points of public engagement to collect input and feedback from city residents, businesses, and climate organizations.

At the same time, Newton's Citizens Commission on Energy (NCCE) has prepared its own 30-year Climate Action Plan. The City is extremely grateful for the NCCE members' tremendous contributions, advocacy, and long-term vision that provided valuable context to the development of this five-year action plan.

As a part of this process, the Climate Action Plan Working Group ("Working Group") was assembled to guide and assist with the development of the City's Climate Action Plan. The Working Group included representatives from the City's Planning Department, other City departments, NCCE, and MAPC. The Working Group convened regularly over the nine months of the plan's development. In addition, MAPC staff and NCCE members held a series of coordination meetings at the close of 2018 and the beginning of 2019 to incorporate the recommendations and expertise of the volunteers as the action sections of the plan were developed.

Figure J1. Public Engagement Process



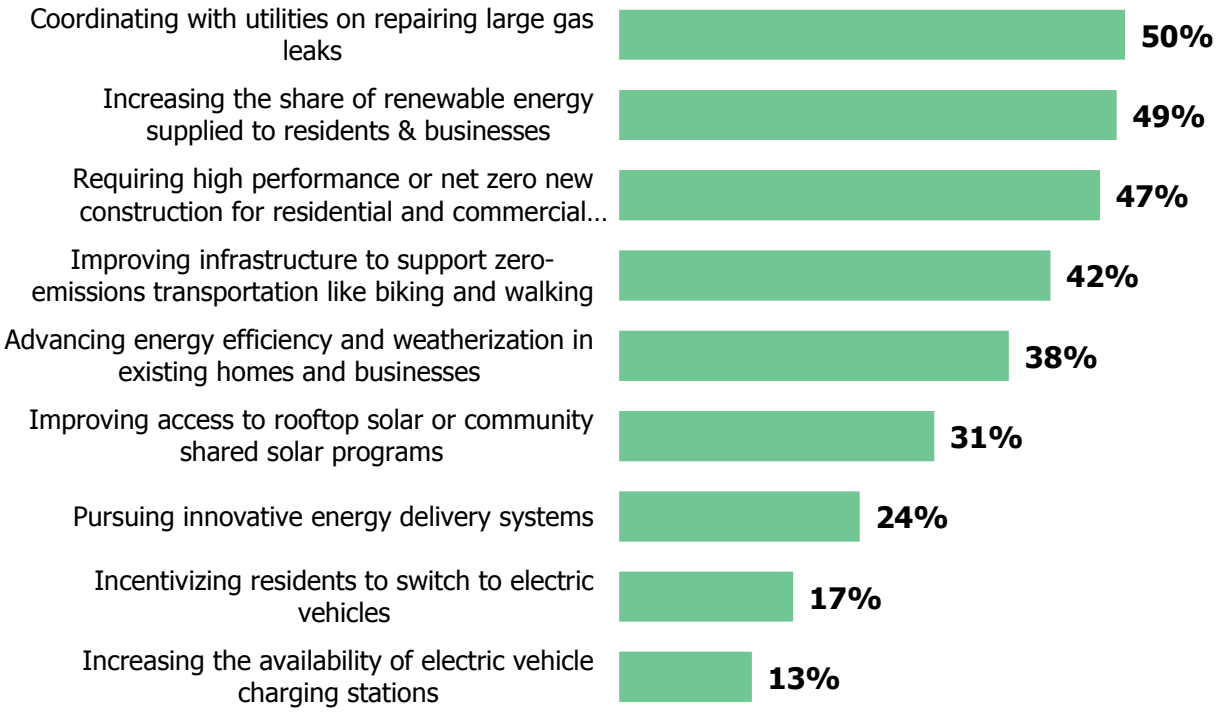
Public Input and Engagement

The City sought input from residents and businesses to inform the priorities and actions identified in the Climate Action Plan. At the beginning of October 2018, the City opened an online community input form that asked community members about their priorities for climate action in Newton and the ideas they would like to contribute to inform the plan's development.

The City received more than 125 responses from the public. While more than 90% of respondents identified as living in Newton, only 28% identified as working in Newton and even fewer identified as owning a business in Newton (approx. 13 %). A smaller subset of respondents identified as being either an elected official or working for the City of Newton (3% and 5%, respectively).

When asked to prioritize from a list of 9 possible climate actions the City could take, respondents gave these as the top 3 actions: (1) coordinating with utilities on repairing large gas leaks, (2) increasing the share of renewable energy supplied to residents and businesses, and (3) requiring high performance or net zero new construction for residential and commercial buildings.

Figure J2. Online Questionnaire Responses to, "What is most important to you? Please select the three actions that you find the most important."

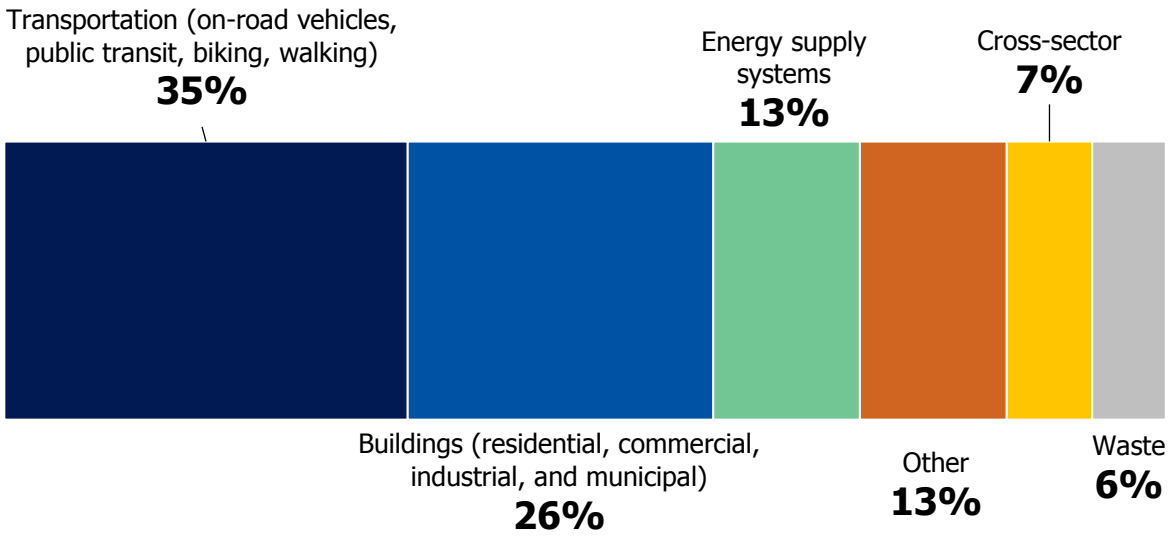


The second part of the questionnaire allowed respondents to submit their own ideas about climate actions to include in the plan. Respondents were asked to identify the sector their idea related to and who they felt should be responsible for implementing their idea (City Council, Municipal Staff, Community organizations/non-profits, Local businesses, Residents, or Other).

Overwhelmingly, the ideas submitted by the public had to do with the transportation and building sectors, which are also the two sectors responsible for a majority of the City's community-wide GHG emissions. Of

the 35% of ideas submitted that related to transportation, improvements to the bike lane network and frequency of MBTA service in Newton were most frequently mentioned. These ideas also highlighted the need for bike and transit options to reduce traffic congestion and improve public health. Ideas submitted about building emissions ran the gamut from installation of solar panels and heating electrification to increased housing density and availability of affordable housing in proximity to public transportation.

Figure J3. Online Questionnaire Responses to, "What sector does your idea relate to?"



The ideas submitted provided the City and MAPC with both new action areas to investigate and validation of community support for the draft action areas that were in the process of being formulated for inclusion in the final Climate Action Plan.

Table H1: Sampling of Ideas Submitted Through the Online Questionnaire

Sector	Quoted Idea
Buildings	*More affordable family homes and apartments need to be built in the area.*
Buildings	*We need to increase housing density in Newton. Higher density decreases environmental impact. We border Boston, which is only going to thrive economically and attract workers in the next century. Why should they drive 50 miles to get to work instead of take public transportation from Newton? We need to plan forward to build the infrastructure to support an increased population - better public transit, more schools, more businesses/services.*

Energy Supply	*Partner with businesses esp. warehouses e.g., along Needham at, and malls (e.g., the Street, Chestnut Hill Mall, Wegmans) to use their very large and flat roofs that receive tremendous amounts of sun that just reflects off of it for SOLAR installations. Provide incentives for these same businesses to utilize solar for their own purposes.*
Energy Supply	*Run a HeatSmart Plus campaign for PV solar and heat pumps to get lower costs for both. Advertise the availability of the MassSolar Loan program- especially to those with incomes below 80% State median income (provides a 30% principal buy-down and 1.5% interest rate buy-down). Target seniors - almost every retired person qualifies. Give all roofing permit applications information about the mass solar loan program.*
Energy Supply	*In order to reduce fossil fuel use, the City should maximize its use of electricity obtained from solar panels installed on municipal parking lots, and on city buildings, including schools.*
Transportation	*Increase use of bicycles (and walking) for everyday activities. And improving public transportation to get out of automobiles.*
Transportation	*Improve the quality (i.e., frequency, efficiency) of public transport services to and from major Newton T stations to promote use of public transports and help lower carbon emissions.*
Waste	*Improve education programs, signage and labeling for residents to learn about productive recycling. Better labeling will ensure residents understand the importance and do not contribute to contamination.*

Public Workshops

On **October 23, 2018,** more than 60 people gathered at the Newton War Memorial for the Kick-Off Roundtable Discussion for the City of Newton's Climate Action Plan. MAPC presented on the climate action planning process, greenhouse gas emissions in Newton, and best practices from national and international climate action plans. Ann Berwick, Co-Director of Sustainability for the City, provided an update on ongoing climate projects and initiatives. Mayor Ruthanne Fuller provided remarks to open up the table discussions where attendees had the opportunity to discuss priority actions and sectors they would like to see the Climate Action Plan address and why these were important to them.

Table H2: Summary of Kick-Off Roundtable Discussion Notes

Sector	# of Actions Identified	Percentage of Total
Buildings	21	25%
Energy Supply	20	24%
Transportation	15	18%
Education and Outreach	14	17%
Waste	3	4%
Other	10	12%

The nine small group discussions, led by members of the Working Group and City Staff, produced more than 80 priority actions that covered recommendations related to buildings, energy supply, transportation, education and outreach, waste, and other topic areas.

Table H3: Themes from Discussions at the October 23 Kick-Off

Buildings	Within the building sector, workshop attendee priorities demonstrate a depth of knowledge of the topic area. Overwhelmingly, the table discussion notes highlighted electrification of the heating and cooling systems for all buildings in Newton as a priority action area to address in the Climate Action Plan. Some tables included discussion of how the City could lead by example in its own municipal buildings through energy efficiency and electrification. Residential and commercial energy efficiency also rose to the top of discussions at the workshop. Attendees prioritized regulation, zoning, requirements for new construction through efficiency standards, and support for rooftop solar PV as actions to take in support of building energy efficiency.
Energy Supply	There was overwhelming support for and prioritization of the City's Newton Power Choice initiative as a strategy to increase the renewable energy supply for residents and businesses. The table discussions emphasized the importance of increasing renewable energy supply in tandem with their prioritization of electrification of heating and cooling and transportation. Several recommendations referenced specific targets for the percentage of renewable energy purchased through Newton Power Choice, such as committing to 100% renewable by different time frames (2021 and 2050 were proposed at some of the tables). Other actions prioritized by some of the groups in this sector included co-generation, community shared solar, district energy, gas leak repair, rooftop solar, and municipal solar.
Transportation	While there was less specificity in the priority actions identified by the workshop attendees in the transportation sector, there was a clear emphasis on several overarching categories of action. This included improved bike infrastructure, increased public transportation options, complete streets, electrification of transportation, and first and last mile connections.
Education & Outreach / Waste	Many of the tables prioritized actions that would increase education and outreach by the City to support resident and business behavior changes and decision-making. Many of these actions focused on raising public awareness and understanding of high efficiency options through targeted training and programs in schools. There was also a focus on ways that outreach could be implemented to support a comprehensive lifestyle change for Newton residents around food choices and waste. There was less emphasis on specific actions related to waste.
Other	Several of the actions noted during the discussions did not cleanly fit into the categories above, but still merit mention. Some of the table discussions prioritized overarching concepts the attendees would like to see the City's Climate Action Plan address, such as providing incentives, leading by example, setting short and long term goals, and support for state policies such as carbon pricing. Two of the table discussions also raised the carbon benefits of green infrastructure through creation of tree canopies or tree planting in general.

On **March 21, 2019,** the City held an implementation prioritization open house which was attended by 30 people. At the open house, the City released the first draft of the actions and goals included in the City's Five-Year Climate Action Plan. Mayor Ruthanne Fuller provided opening remarks to attendees, and

staff from the Metropolitan Area Planning Council presented on the research and analysis that guided the actions with the six priority focus areas included in the draft plan.

After the opening presentations, attendees were able to peruse the actions in each focus area of the plan and provide feedback for the City and MAPC. Attendees were asked to place dots next to their top three priorities in each focus area and to provide additional qualitative input. While the statistical significance of the input collected is limited for a number of reasons, there were several actions that clearly rose to the top for those in attendance.

Table H4: Top Ranked Actions and Associated Comments from the March 21 Open House

Rank	Focus Area	Action	Associated Comments
1	Mobility	C.2.1. Advocate for community transit service needs and bus stop upgrades during MBTA's Phase II Better Bus Project, Bus Network Redesign, Commuter Rail Upgrades, and Urban Rail Vision projects	*"Make the bus cool again"* *"Get Mayor on bus for press event"* *"Promote amenities associated with public transit to increase peoples' feelings for reliability, comfortability, and safety"*
2	Existing Buildings	E.3.3. Adopt an ordinance requiring that residential building energy use be assessed and disclosed through an energy efficiency scorecard at the point of listing	*"Annual reporting not just at transaction points"*
3	Clean Energy Supply	B.4.1. Explore the opportunity to pilot neighborhood-scale conversion to neighborhoods that are all-electric heating and cooling systems, neighborhoods that are all-oil heat, or neighborhoods in which there is a high prevalence of leak-prone infrastructure	*"Good idea but very challenging"*
4	Clean Energy Supply	B.3.1. Adopt requirements within the City's site plan and special permit review process for large-scale developments and major retrofits to consider the feasibility of rooftop solar, clean heating and cooling alternatives, and district energy or microgrid systems	*"Too broad"* *"Needs to be stronger than this with strong standards"*
5	New Construction and Major Renovations	D.2.2. Adopt zoning changes that allow appropriate housing density and ready access to public transportation to encourage low-impact development and mode shift	*"This action is critical"* *"Public outreach with need to increase to get Newton residents to buy into higher density neighborhoods, which is important!"* *"Especially near the Green Line"*
6	New Construction and Major Renovations	D.1.1. Adopt ordinance and/or special permit requirements that all new construction and major renovations meet certain sustainability standards and demonstrate that they have analyzed the	*"We need to [be] Passive House and net zero/fossil fuel free"* *"No natural gas – heat pumps instead"* *"Low embodied energy!"*

		costs and benefits of high-efficiency or renewable energy systems	*"Require much higher energy efficiency like Passive House"*

City Staff and Council Engagement

On December 5, 2018, MAPC presented to the Public Facilities Committee of the Newton City Council. The primary focus of the presentation and discussion was to solicit feedback from the Councilors on their priorities for the Climate Action Plan and identify any gaps or areas for additional focus as work on the Climate Action Plan progressed. Overall, the Councilors' recommendations supported a plan that sets ambitious targets for the City, focuses on points of municipal leverage, and aligns with other planning processes and project work. In particular, there were several suggestions about incorporating specific zoning recommendations and aligning the current zoning reform process with the recommendations being made in the Climate Action Plan. Councilors also emphasized the importance of the City keeping apprised of broader policy conversations at the state level as a way to advance the City's Climate Action goals and objectives.

On January 28, 2019, City planning staff presented the City Council's Zoning and Planning Committee the key assumptions guiding the development of the Climate Action Plan. The Committee discussed the matter of adopting the Climate Action Plan as an amendment to the City's 2007 Comprehensive Plan. The City also worked with MAPC staff to ensure that the recommendations in the Climate Action Plan related to zoning changes were considered in the redrafting of the Zoning Ordinance which coincided with the development of this plan.

MAPC interviewed many City staff from five departments. City staff identified many opportunities for Newton to reduce GHG throughout the community and provided valuable input about ongoing projects and processes related to the Climate Action Plan.

TABLE H5: CITY STAFF INTERVIEWED BY MAPC

Name	Title	Department
Amanda Berman	Director of Housing and Community Development	Planning and Development Department
Ann Berwick	Co-Director of Sustainability	Public Buildings Department
Bill Ferguson	Co-Director of Sustainability	Public Buildings Department
Dave Stickney	School Facility Manager	School Department
James Freas	Deputy Director of Planning and Development	Planning and Development Department
Josh Morse	Commissioner of Public Buildings	Public Buildings Department
Kathryn Ellis	Economic Development Director	Planning and Development Department
Linda Walsh	Deputy Commissioner of Health and Human Services	Health and Human Services Department
Marc Welch	Director of Urban Forestry	Parks and Recreation Department
Nicole Freedman	Director of Transportation Planning	Planning and Development Department

Appendix K: Climate Action Resources and Bibliography

1.5C: Aligning New York City with the Paris Climate Agreement (New York, NY)
https://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5-AligningNYCwithParisAgrmt-02282018_web.pdf
The City of New York's CAP includes other metrics besides reduction of GHGs. Its CAP includes other benefits, such as workforce development, health and wellbeing impacts, natural capital preservation, affordability, etc. Design and presentation of initiatives in the CAP are exceptionally well-done, making navigation of the document available for research and quick references. CAP also outlines the progress of CAP initiatives and responsible agencies for each initiative, promoting accountability and transparency of the CAP.

Carbon Free Boston Report (Boston, MA)
https://www.greenribboncommission.org/wp-content/uploads/2019/01/Carbon-Free-Boston-Report-web.pdf
This report was produced by the Boston Green Ribbon Commission and the research and analysis efforts were led by Boston University's Institute for Sustainable Energy. The report covers emissions reduction pathways out to 2050 for the city of Boston across the energy, buildings, transportation, and waste sectors.

The Carbon-Free City Handbook
https://www.rmi.org/insight/the-carbon-free-city-handbook/
Produced by the Rocky Mountain Institute, this handbook provides "22 recommendations for no-regrets actions that will help cities become carbon free," along with resources and vignettes from cities that have implemented the actions and policies highlighted in the handbook.

Climate of Opportunity: A Climate Action Plan for the District of Columbia
https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/ClimateOfOpportunity_web.pdf
Washington D.C.'s CAP suggests using a separate entity for community engagement strategies (monthly workshops, educational and outreach programs). Additionally, the CAP discusses the importance of the funding to update infrastructure and perform retrofitting initiatives around the city. The CAP suggests intertwining city's development priorities with climate action plan action items, bundling CAP initiatives with general District initiatives. Frequent GHG inventory adjustments were highlighted as meaningful factors in measuring the impacts of CAP and suggested as a good practice along the way of measuring impacts.

A Community Climate and Energy Action Plan for Eugene (Eugene, OR)
https://www.eugene-or.gov/Archive/ViewFile/Item/80
Eugene's CAP contains many innovative policies such as 20-minute neighborhoods plan that was developed where 90 % of Eugene residents can safely walk or bicycle to meet most basic, daily, non-work needs, and have safe pedestrian and bicycle routes that connect to mass transit. Another relevant and interesting suggestion that stood out during the time of research was an initiative to evaluate and remove financial, infrastructural, regulatory, and perceptual barriers to increase the use of on-site renewable energy systems.

Consumption-based GHG Emissions of C40 Cities
https://www.c40.org/researches/consumption-based-emissions
This report presents the methodology and results of a study investigating the consumption-based greenhouse gas emissions (GHG) from 79 cities, carried out by the C40 Cities Climate Leadership Group (C40). Consumption-based GHG accounting is an alternative to the sector-based approach to measuring city GHG emissions which focuses on the consumption of goods and services (such as food, clothing, electronic equipment, etc.) by residents of a city, and GHG emissions are reported by consumption category rather than GHG emission source category.

Copenhagen Climate Plan
https://www.energycommunity.org/documents/copenhagen.pdf
Copenhagen's 2009 CAP includes many initiatives, but not many clearly outline measurement indicators to evaluate initiatives. A more recent CAP update (below) was found to research more recent initiatives and lessons learned.

CPH 2025 Climate Plan. Roadmap 2017–2020. (2016)
https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=1586
While implementing the CAP, some of the challenges that arose were tackling traffic congestion, converting vehicles to new types of fuel, reducing energy consumption in the city and achieving the targets for sorting plastic and organic waste. The City of Copenhagen's CAP mentions that the transition has been slower than expected, with national measures such as the congestion zone and changes to energy taxes failing to materialize, which hindered some of the local initiatives. Most of the updated plan focuses on incentives for individual and businesses to engage more actively with the CAP initiatives.

Fourth National Climate Assessment
https://nca2018.globalchange.gov/
This report from the U.S. Global Research Program assesses the science of climate change and variability and its impacts across the United States, now and throughout this century. The report concludes that climate change is *already* having negative impacts on our communities and our economy and that those impacts will increase significantly in the future if we do not act. It also concludes that, "global action to significantly cut greenhouse gas emissions can substantially reduce climate-related risks and increase opportunities for [vulnerable] populations in the longer term."

The Getting to Net Zero Framework (Cambridge, MA)
https://www.cambridgema.gov/CDD/Projects/Climate/~/media/D74193AF8DAC4A57AC96E2A53946B96B.ashx
This report, produced collaboratively by a task force of representatives from the City of Cambridge, Harvard, and MIT, lays out recommendations for reducing emissions from buildings by 70%.

Global Warming of 1.5°C: IPCC Special Report - Summary for Policymakers
https://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf
The latest major report from the United Nations Intergovernmental Panel on Climate Change provides a summary of the latest climate science and the emissions pathways for limiting global warming to 1.5°C. The report states we have already caused about 1°C of warming and that that climate models show that global emissions must decline by about 45% by 2030 and 100% by 2050 to limit warming to 1.5°C.

GPS Case Study: City of Columbus, OH
http://my.assetworks.com/rs/153-QDM-861/images/GPS_City_of_Columbus.pdf

This case study highlights the City of Columbus, Ohio's efforts to reduce fuel consumption through the use of anti-idling technology, a project which saved the city an estimated $1.2 million per year.

Greenest City: 2020 Action Plan (Vancouver, BC)
https://vancouver.ca/files/cov/greenest-city-2020-action-plan-2015-2020.pdf
Vancouver's CAP includes plans for initiatives around the specific locations and already established programs. With ambitious goals (100% of energy from renewable sources by 2020), Vancouver's CAP heavily focuses on restructuring and changing the composition of the public transit system and municipal fleet that requires heavy GHG fuel. Vancouver's CAP, similarly to New York City's, includes status updates on the ongoing initiatives and highlights responsible parties and departments as a means to promote transparency to stakeholders and the general public.

Greenovate Boston: 2014 Climate Action Plan Update // Summary Report
https://www.cityofboston.gov/images_documents/Greenovate%20Boston%202014%20CAP%20Update_Summary_tcm3-49733.pdf
Boston's CAP update builds on seven years of GHG reduction initiatives. Citywide, GHG emissions are down 17% than they were in 2005. Emissions from City government operations have been reduced by almost 25% since 2005. Update highlights the urgency to prioritize comprehensive climate preparedness strategies, cross-cutting means of measuring effects of CAP (social equity, economic development, and public health and safety), extensive and inclusive community engagement, more rigorous greenhouse gas inventory and emission projections. The update focuses on a public as well as private initiatives, offering suggestions and initiatives for both sectors to engage in order to reduce GHG. A new update will be published in 2019.

Lessons Learned: Creating the Chicago Climate Action Plan
http://www.chicagoclimateaction.org/filebin/pdf/LessonsLearned.pdf
Chicago's Lessons Learned document highlights successes and failures while implementing the CAP. Particularly, a commitment to staffing (at least 2 people and project manager per initiative) has been suggested as a measure to ensure initiatives of the CAP are implemented to the best of their abilities. Additionally, the Lessons Learned document observes that it was helpful to have an outside person facilitating the community engagement processes. As a result, CAP initiatives have been accompanied by a strong presence and participation of non-profits and community leaders which ensures support and quick turn-around of initiated projects.

Local Action Plan for Climate Protection (Alameda, CA)
http://www.ca-ilg.org/sites/main/files/file-attachments/local_action_plan_for_climate_protection.pdf
The City of Alameda's CAP highlights various initiatives for transportation, energy, and others, and includes a dedicated chapter for implementation and monitoring strategies. This section discusses the need to distinguish between quantifiable and non-quantifiable initiatives and prioritize both in evaluating initiatives. Allocating dedicated staff to guide initiatives in public and private sectors was highlighted similarly to Chicago's CAP. Stakeholder engagement strategies and participatory methods of engaging private and public sectors have been identified as a means of successful implementation of CAP.

London Environment Strategy
https://www.london.gov.uk/sites/default/files/london_environment_strategy-_draft_for_public_consultation.pdf
London's CAP highlights an Economic Development Strategy as a means to influence carbon economy and move the needle in the direction of a global transition to a low carbon circular economy. Other initiatives - RE:NEW and RE:FIT – were highlighted by many other sources as the cornerstone of

London's public building retrofit activities. These programs are some of the most effective initiatives in helping public buildings to get an energy makeover and save energy costs. The initiative incorporates an energy service company (ESCo) to undertake energy efficiency works in buildings.

Municipal Climate Action Plan (Portland, ME)
https://www.portlandmaine.gov/DocumentCenter/View/6274/Municipal-Climate-Action-Plan
Portland's CAP is focuses exclusively on municipal operations. Policies like changing behavior of municipal staff to conserve energy were prioritized over ordinances or private sector engagement.

One City: Built to Last (New York, NY)
https://www1.nyc.gov/assets/builttolast/downloads/OneCity.pdf
A supplement to the city's CAP, this report charts a path for reducing GHG emissions from buildings 80% by 2050.

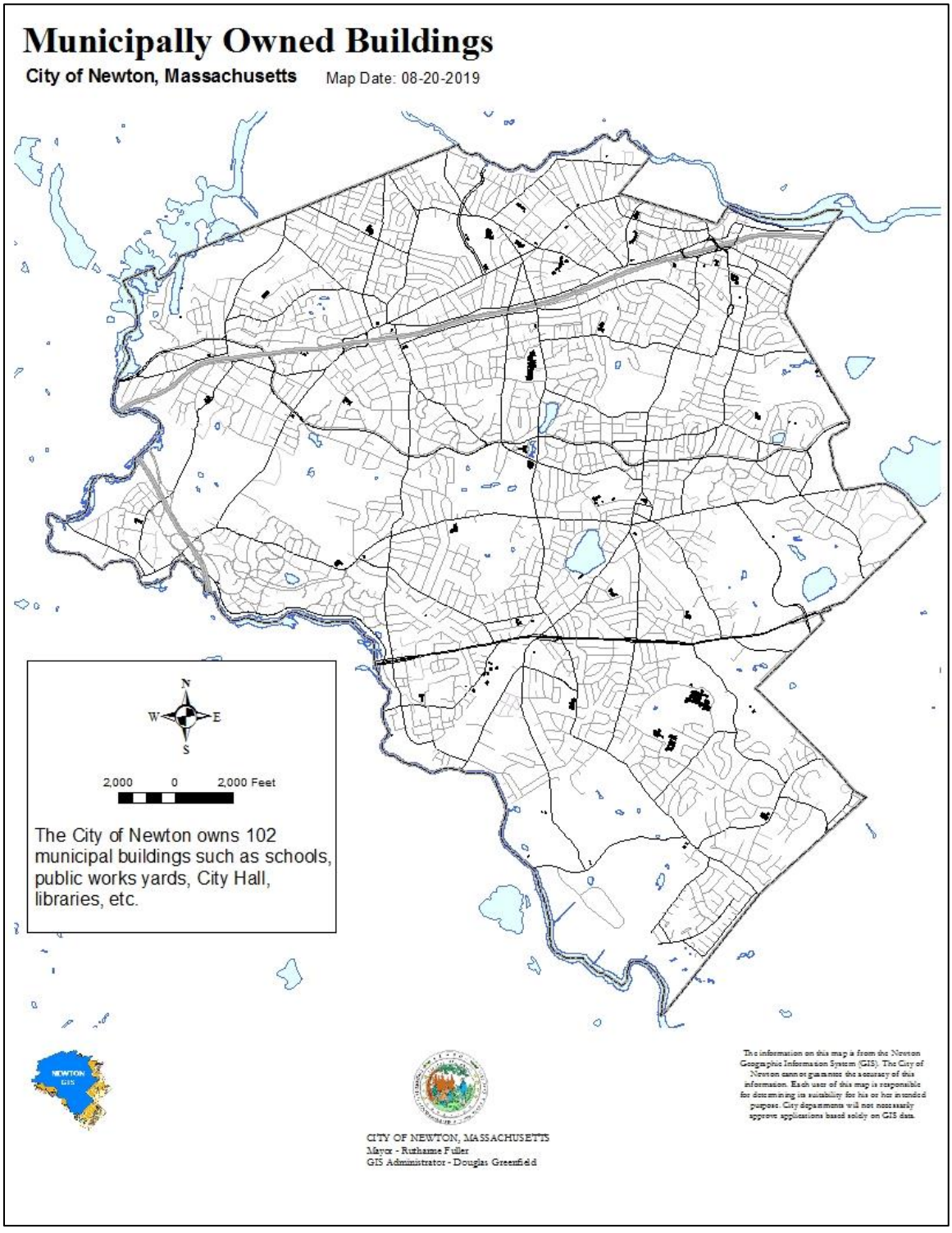
Paris Climate Partnership Agreement: Climate action partnership agreement
http://parisactionclimat.paris.fr/en/p/charte
The city of Paris engages stakeholders in a creative way by providing an opportunity to become "Partners" in the Paris Climate and Energy Action Plan by signing dedicated partnership agreement which gave stakeholders status of "Sustainable Paris Doers". This created network, led by the City of Paris, acts as a social network and lists all eco-actions and showcases Doers; encourages an exchange of sustainable ideas, offers practical tools, and hosts monthly free events that are open to the public.

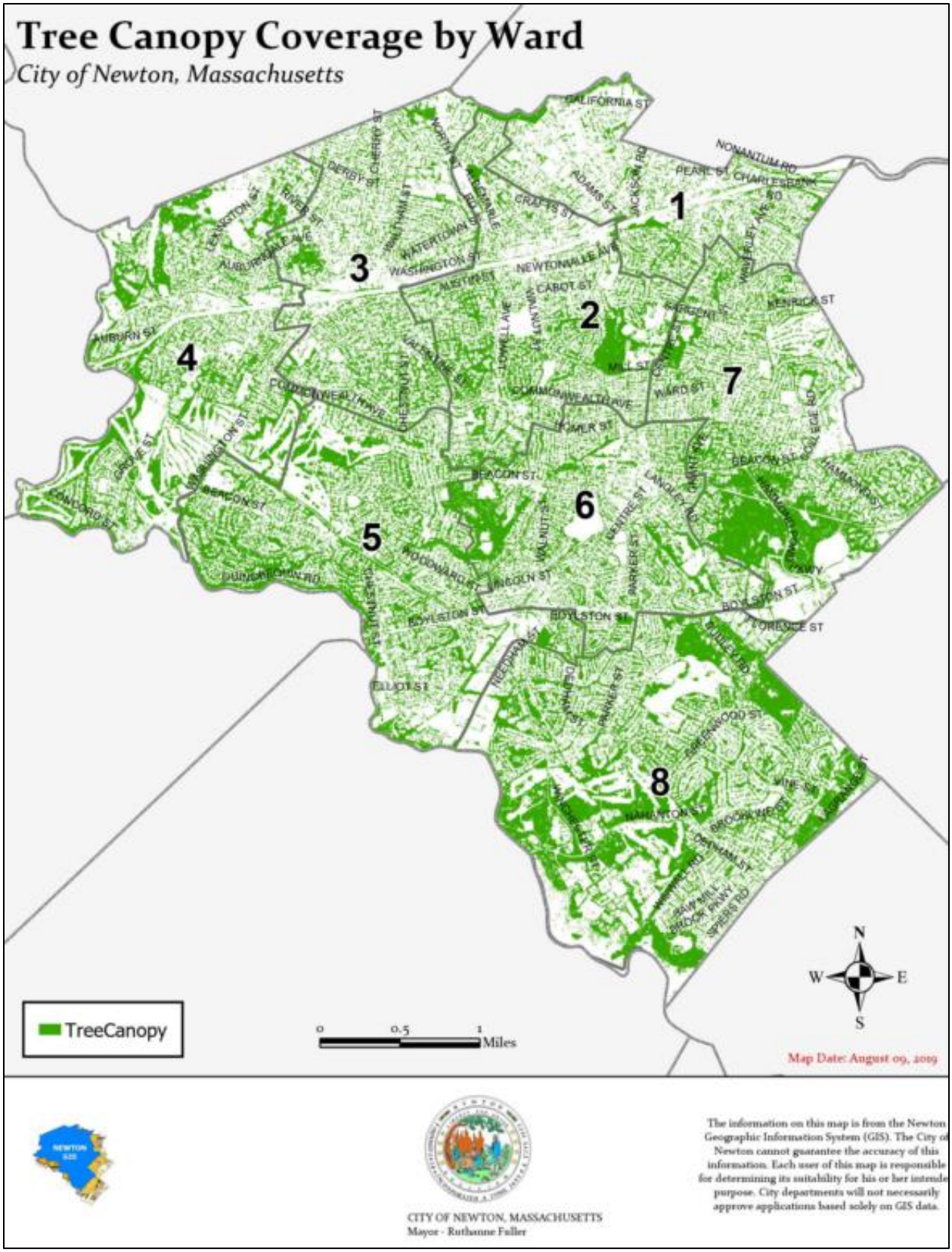
The Portland Plan: Progress Report (Portland, OR)
https://www.portlandonline.com/portlandplan/index.cfm?a=632343&c=45722
This progress report discusses the accomplishment of Portland to pass 10-cents per gallon gas tax that helped the city to secure funds for expansion of preventive maintenance that saved the city money, prevented future development of potholes, improved sidewalks, street crossings, and bike routes. Moreover, Portland's bike share system installed in 2016 demonstrated 26 percent auto trip replacement rate. Biking infrastructure has many action items and goals in the progress report.

Seattle Climate Action
http://durkan.seattle.gov/wp-content/uploads/2018/04/SeaClimateAction_April2018.pdf
Seattle's CAP was the most recent CAP that was researched and includes commentary on the withdrawal from the Paris Agreement as well as a message of encouragement for other cities to take initiatives on the CAPs. The CAP is an exception amongst researched CAPs as it is highlighting goals as a specific percentage change in each sector. The plan outlines pilot programs for initiatives in every sector. Piloting is viewed as a reliable way to collect data on the effectiveness of the CAP's initiative without heavy financial commitment. The CAP lists actionable items for the private sector to engage in GHG reduction initiatives.

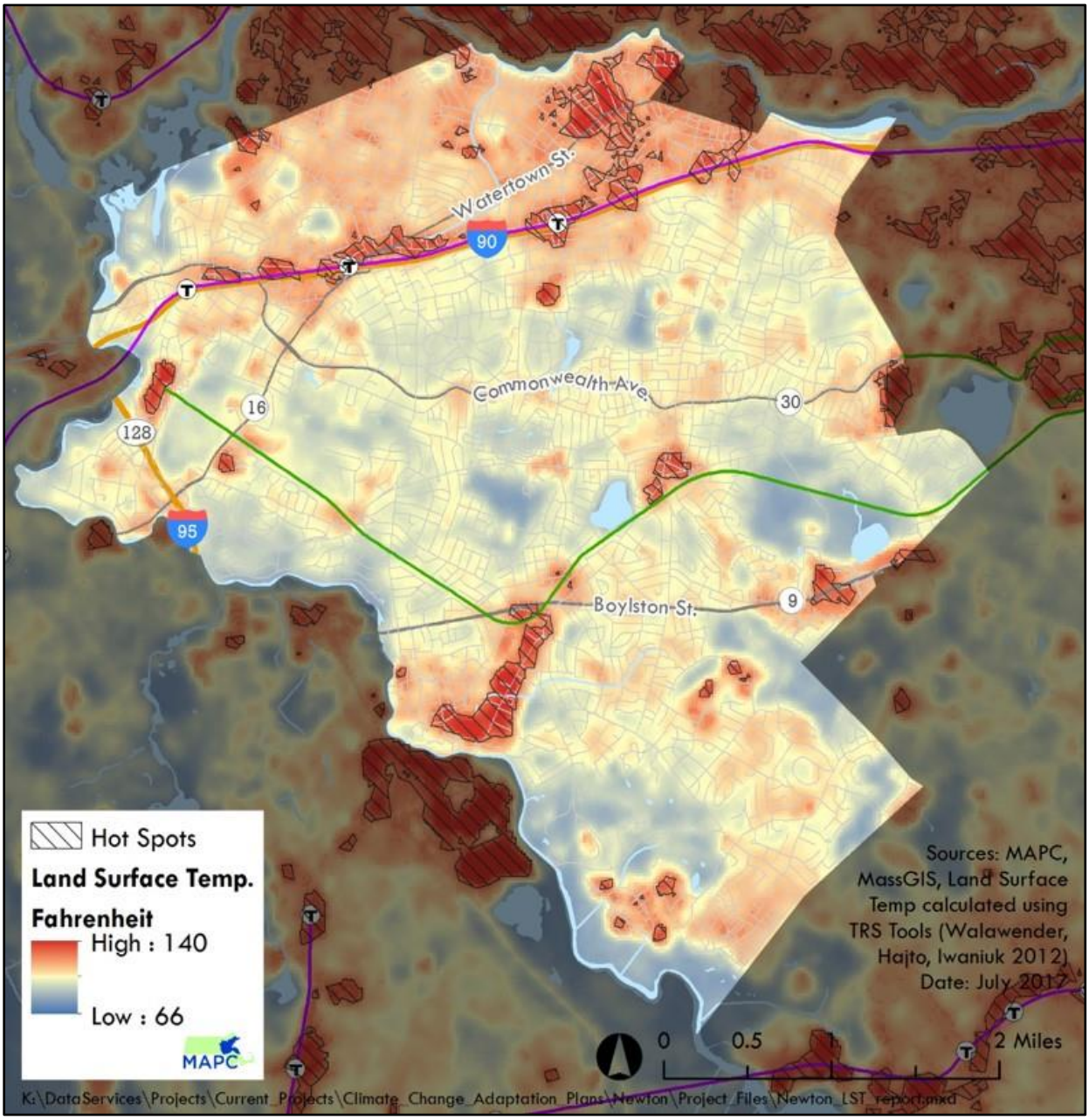
Somerville Climate Forward
https://www.somervillema.gov/sites/default/files/somerville-climate-forward-plan.pdf
Somerville's CAP, the Climate Forward plan lays out a vision to start the city on a path to meeting its 2050 carbon neutrality goal, though the actions outlined in the plan only account for a 79% reduction in emissions. The plan sets out to create a city that is *thriving, equitable, carbon neutral,* and *resilient*. The plan was completed with consulting support from Kleinfelder and AECOM and was the result of a 17-month process. For reference, Somerville's annual budget in Fiscal Year 2018 was approximately $233 million, compared to Newton's budget of $395 million.

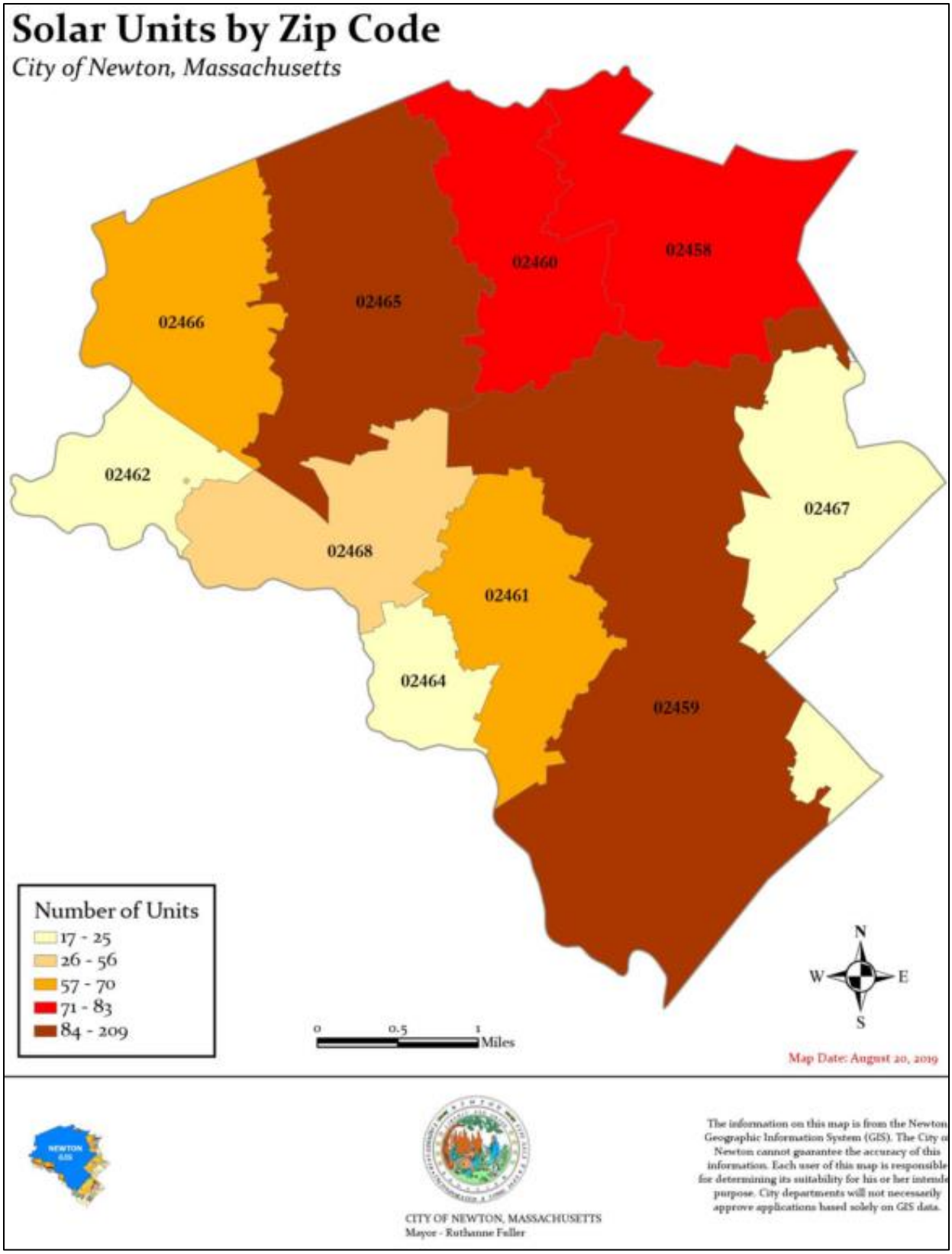
Appendix L: Relevant Maps and Illustrations




Tree Canopy Coverage by Ward
City of Newton, Massachusetts
1
2
3
4
5
6
7
8
TreeCanopy
0
0.5
1
Miles
N
W
E
S
Map Date: August 09, 2019
CITY OF NEWTON, MASSACHUSETTS
Mayor - Ruthanne Fuller
The information on this map is from the Newton Geographic Information System (GIS). The City of Newton cannot guarantee the accuracy of this information. Each user of this map is responsible for determining its suitability for his or her intended purpose. City departments will not necessarily approve applications based solely on GIS data.

Hot Spots in Newton




Solar Units by Zip Code
City of Newton, Massachusetts
02458
02460
02465
02466
02462
02467
02468
02461
02464
02459
Number of Units
17 - 25
26 - 56
57 - 70
71 - 83
84 - 209
0
0.5
1
Miles
N
W
E
S
Map Date: August 20, 2019
CITY OF NEWTON, MASSACHUSETTS
Mayor - Ruthanne Fuller
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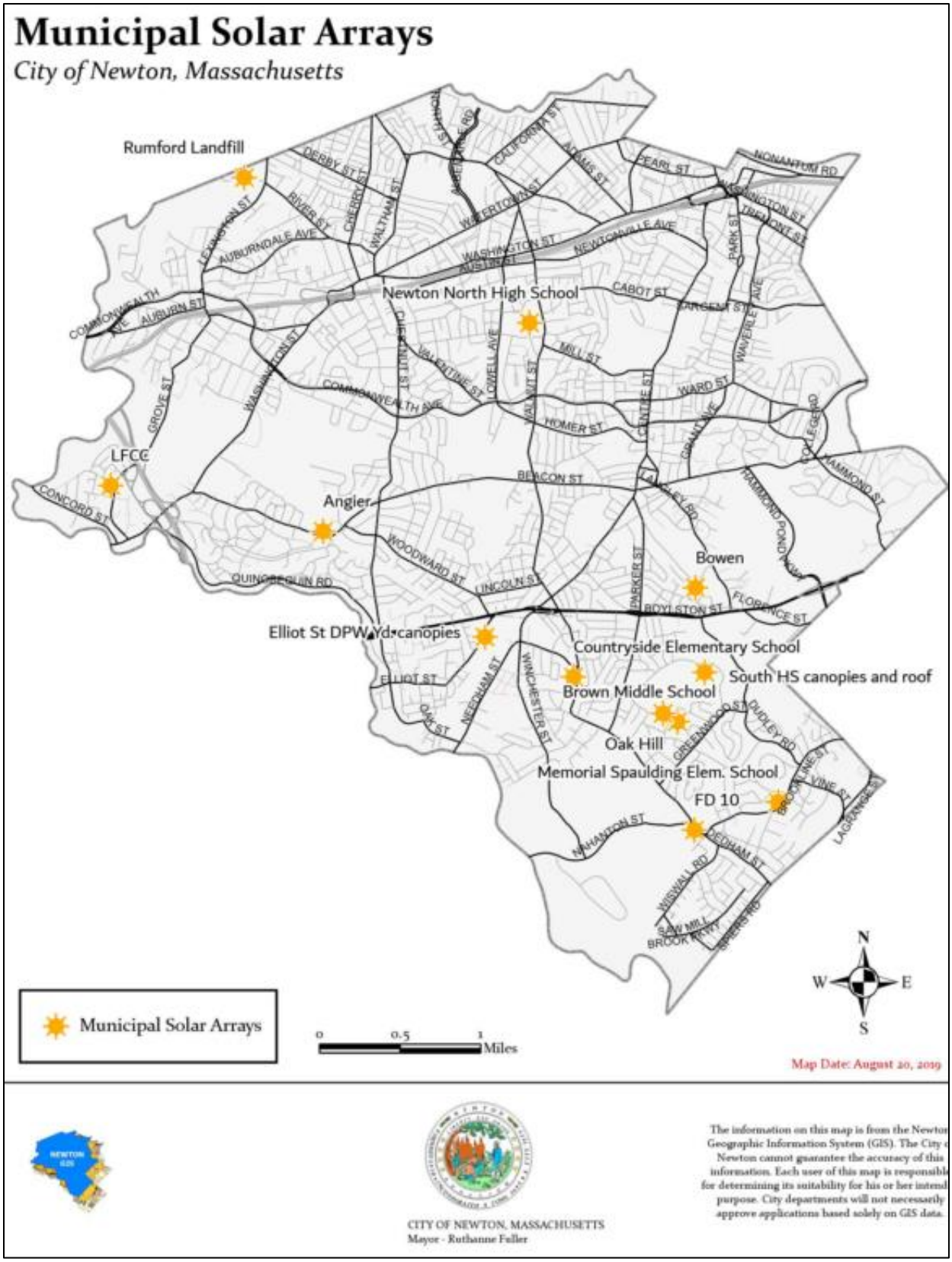
Municipal Solar Arrays
City of Newton, Massachusetts
Rumford Landfill
Newton North High School
LFCC
Angier
Bowen
Elliot St DPW Yd canopies
Countryside Elementary School
South HS canopies and roof
Brown Middle School
Oak Hill
Memorial Spaulding Elem. School
FD 10
Municipal Solar Arrays
0
0.5
1
Miles
N
W
E
S
Map Date: August 20, 2019
CITY OF NEWTON, MASSACHUSETTS
Mayor - Ruthanne Fuller
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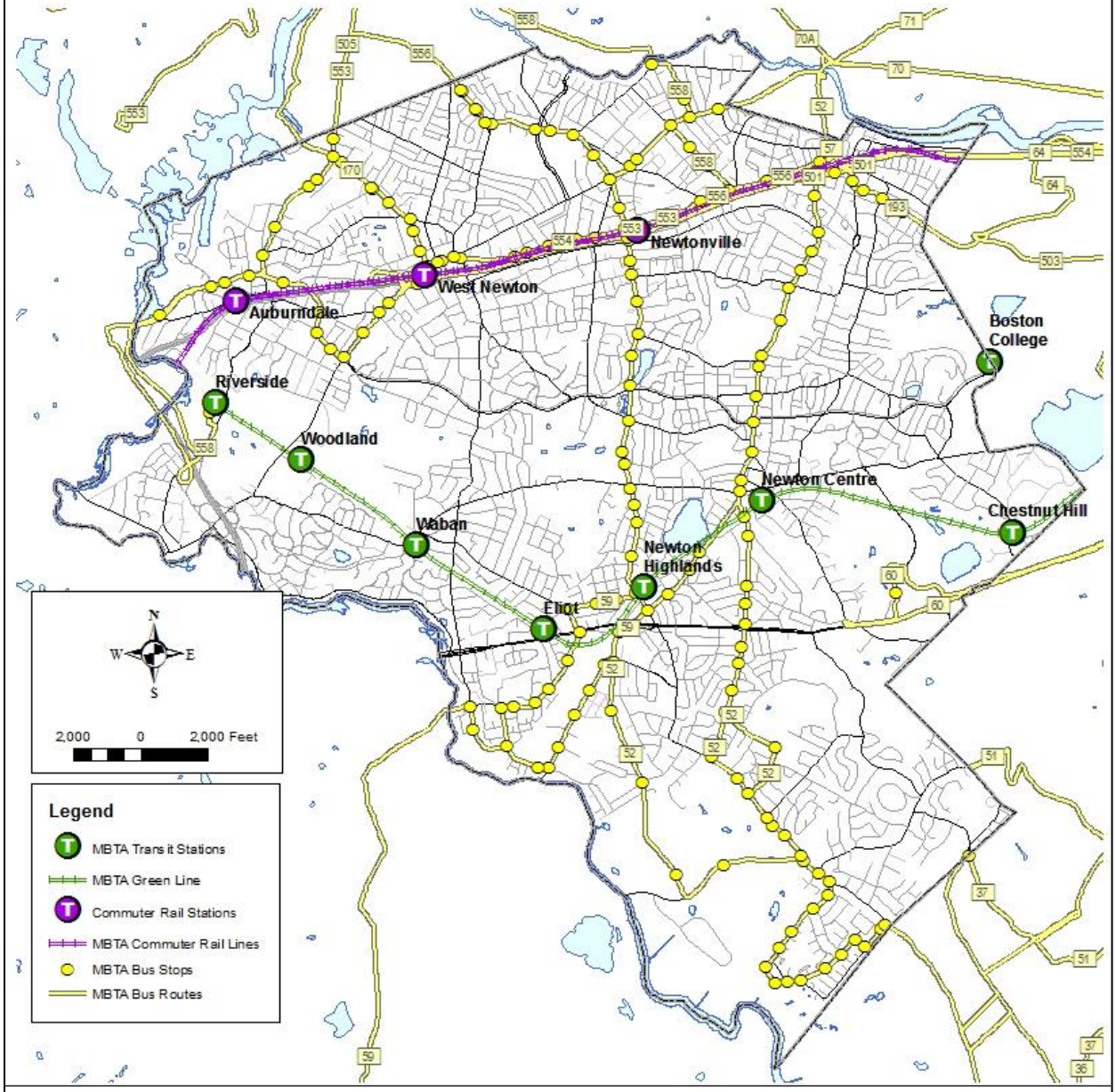
MBTA Public Transit System

City of Newton, Massachusetts Map Date: 08-20-2019



CITY OF NEWTON, MASSACHUSETTS
Mayor - Ruthanne Fuller
GIS Administrator - Douglas Greenfield

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