

HARVARD CLIMATE ACTION PLAN



Commit – Act – Thrive

January 2022

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Introduction

Climate change is a challenge of sobering magnitude and urgency, which will require us to draw on our extraordinary capacity for resilience and innovation. Across the nation in 2021, we saw record heat, record drought, and super storms and fires that took significant economic and human tolls. In Harvard, we also saw record heat, record rainstorms and environmental impacts, such as algal blooms in Bare Hill Pond, the spread of invasive species, and forests under stress. What's more, the science of climate change indicates we should expect more of what we saw in 2021 in the years ahead. We can rise to the challenge by tapping into the creativity, volunteerism, and entrepreneurial spirit of Harvard. As a small town but with exceptional talent and experience of our people, we can be a model for how small towns address climate change and environmental sustainability.

Municipalities must play a vital role in addressing climate change. The design of cities and towns—how we use our land, how we design our buildings, how we get around—significantly impacts the amount of energy we use and greenhouse gas (GHG) emissions we produce. While large cities often get the most attention due to their scale and impact, small communities are more numerous and a model framework for climate change can and should be developed. Therefore, it is critical that towns like Harvard demonstrate that it is possible to dramatically reduce GHG emissions, while creating more vibrant and prosperous places to live, play, and work.

In October 2021, at a Special Town Meeting, Harvard residents approved a climate change resolution. The resolution asked that the Select Board commit to the following actions:

- 1 - Harvard affirms its support for the greenhouse gas reduction goals established by the Commonwealth of Massachusetts and for any subsequently adopted modifications of those goals, and affirms its willingness to change its practices, policies, and procedures in support of achieving the goals established by the Commonwealth in order to mitigate the impacts of climate change;
- 2 - Harvard commits to evaluating and mitigating the potential negative impacts of climate change associated with all purchases, public projects, planning processes, and policies;
- 3 - Harvard commits to developing and requiring an environmental assessment process to review all purchases, public projects, planning processes and policies and to make this information readily available to town residents specifically on warrants requiring citizen approval; and
- 4 - Harvard commits to addressing climate resiliency and adaptation by coordinating the work of Town boards, committees, commissions, and other entities to plan together how to respond to the threats climate change may have on the built environment, natural resources, and the health of its residents.

The Harvard Climate Action Plan is a roadmap to meet the commitments the Harvard Community made at 2021 Special Town Meeting to reduce Greenhouse Gas emissions in alignment with the Commonwealth of Massachusetts' goals and roadmap based on the Baker-Polito Administration "2050 Decarbonization Roadmap and Clean Energy and Climate Plan for 2030" and the 2020 legislative "Act Creating a Next Generation Roadmap for Massachusetts Climate Policy."

Vision

“The Town of Harvard will be a thriving, sustainable community that nurtures and enhances its forests, agricultural lands, and all its precious natural and cultural resources through active stewardship and partnering with all community stakeholders, as well as other external partners, to act on climate change in support of planetary health for a sustainable future.”

Plan at a Glance

To fulfill the vision, the town must address its local contributions to greenhouse gas emissions as well as be a player in the state, country and world to create a sustainable future for generations to come. We can no longer ignore the climate impacts we see and feel when we have the ability to make changes in our everyday lives to help lessen the extent of own impact. We have many of the tools now to reduce our greenhouse gas emissions if everyone agrees to take part. For our town, the specific actions we must take are summarized below in six broad categories: buildings, energy, transportation, natural resource, agriculture and preparedness. The entire plan explains in significant detail what these actions are and how we can measure our progress.



Buildings

Municipal Goal: Convert Harvard's municipal buildings from carbon-based fuel combustion to high efficiency electric heating

- Create a plan for replacement of municipal heating systems to fully electric options as part of the Capital Investment Planning Committee's plans to be approved yearly at annual town meeting.

Residential Goal: Increase the number of homes that reduce their fossil fuel energy consumption by converting their heating and cooling systems to electric heat pumps

- Pass a bylaw that requires all new residential homes be 100% fossil free for heating, cooling, and hot water.
- Assist homeowners to evaluate air source and ground source heating and cooling systems specific to their homes' design and needs.
- Implement incentives (?) for home conversions to electric heating and cooling systems.



Energy

Municipal Goal: Convert all electricity to renewable energy sources through solar installments and renewable energy supply contracts

- Negotiate a 100% renewable energy electricity supply contract for all municipal buildings.
- Increase the number solar installations on municipal buildings or surrounding grounds, either as ownership or PPA.
- Add battery back-up to buildings with PV solar.

Residential Goal: Increase the number of residential solar arrays and battery storage systems

- Provide education for residential installation of PV Solar and battery storage systems based on state and federal financial incentives.



Transportation

Municipal Goal: Convert 85% of Harvard's municipal vehicle fleet to electric by 2050

- Develop a capital budget and schedule to replace existing town vehicles with electric vehicles at a fiscally and operationally appropriate retirement date, beginning with lighter duty vehicles.
- Identify an approach or timeframe for electrifying heavier duty vehicles (including school buses) for which realistic solutions do not yet exist on the market.
- Build EV charging stations on municipal properties for town vehicles, backed by PV energy generation.

Residential Goal: Provide a convenient and attractive range of zero carbon transportation options for residents to get to work and around town

- Encourage the adoption of electric vehicles amongst residents and businesses through education on incentives and options, promotional events, and expediting permits.
- Develop a high quality, high frequency regional electric shuttle service to and from town center, commuter rail stations, and newly developed park-and-ride locations.
- Improve the reach of Harvard's bicycle and walking paths to provide a realistic, healthy, and zero carbon alternative to driving.
- Encourage the use of commuter rail to get to work.



Natural Resources

Municipal Goal: Increase the resilience of Harvard's ecosystems and community through the coordinated implementation of nature-based solutions

- Seek grant funds to implement key recommendations related to nature-based solutions from the 2021 Apple Country Report, prioritizing:
 - Invasive species management
 - Wetland restoration and expansion
 - Stormwater management and culvert improvements
 - Tree and vegetation enhancements to built environments for shade, improved buffer, bio-swale, etc.
- Develop forest management plan to enhance health and carbon sequestration opportunities for Harvard's forests.
- Prioritize efforts to improve partnership with the state, region, and neighboring communities on topics of sustainability, environmental justice, invasive species, and biodiversity.

- Pilot a green infrastructure project in town (what, specifically? Wait to identify with partner committee?).
- Engage town committees and community to identify additional focus areas for improving the resilience of the town's natural resources not already covered in Apple Country Report.

Land Use Goal: The town's policies and bylaws shall facilitate sustainable land use and development

- Include more zoning districts and development types that are sustainable, smart growth models and remove or replace provisions that are not in line with this framework.
- Educate and inform the public about sustainable land use patterns and why they have better environmental, social, and fiscal outcomes.
- Ensure that all open space acquisitions and set asides align with goals for open space and nature resource protection through updated Open Space bylaws and ongoing decision-making by the Planning Board and Open Space Committee.
- Enhance development and design review processes to enable low impact development and other nature-based solutions in land development and redevelopment.
- Ensure land use and transportation planning are coordinated as their consequent impacts are interlinked.

Residential Goal: Reduce the climate impact of our homes and yards on the local environment

- Significantly reduce food waste amongst residents through composting, "buy local," and changes to consumption practices.
- Provide residents with information on sustainable practices for lawn care, landscaping, tree care, and invasive species management.



Agriculture

Municipal Goal: Invest in the necessary shared infrastructure for the agricultural community to accelerate or deepen sustainable farming practices

- Explore options to reduce tax burden on farmers for their land, buildings, and equipment
- Revise Harvard's zoning bylaw to allow greater flexibility for farm-related uses.
- Pilot a collaborative purchasing initiative to take advantage of volume discounts which can enable wider use of organic fertilizer, biodegradable plant containers, and other farm supplies. Over time look for opportunities to formalize the initiative into a purchasing cooperative or grange model. This could also create a mechanism for collective purchasing of electric equipment.
- Identify opportunities for large scale composting of community-wide food and green waste to reincorporate into agricultural soils.
- Pursue a state grant to establish a centralized shared processing facility with energy star appliances to reduce food processing energy and decrease regulatory requirements amongst individual farms.

Residential Goal: Through outreach and community building, encourage innovative approaches to sustainable farming in Harvard

- Evaluate opportunities for “agrivoltaics” or community solar arrays on pasture land.
- Educate and encourage farmers to adopt soil, crop, and water management practices that will enhance resilience to climate change.
- Build a community forum for information sharing and best practices on regenerative farm practices.
- Partner with farmers, residents, and businesses to develop principles for a sustainable food system.
- Provide financial and logistical support for CSA’s in Harvard — both on supply and demand sides.



Preparedness

Municipal Goal: tbd

- Asdf

Residential Goal: tbd

- asdf

The Problem: Greenhouse Gas Emissions

Background:

Scientists know with virtual certainty that increasing greenhouse gas concentrations tend to warm the planet. In computer-based models, rising concentrations of greenhouse gases produce an increase in the average surface temperature of the earth over time. The imbalance between greenhouse gas emissions and the ability for natural processes to absorb those emissions has resulted in a continued increase in atmospheric concentrations of greenhouse gases. Rising temperatures may produce changes in precipitation patterns, storm severity, and sea level. Collectively, this is commonly referred to as *climate change*.

The Massachusetts 2050 Decarbonization Roadmap aims to reduce the state's production of greenhouse gases. As stated in their Roadmap: The climate crisis is a generational challenge that, without decisive action, leaves residents and communities across the state on the front lines. Recognizing the urgency of this crisis, the Baker-Polito Administration listened to the science, and set Massachusetts on an aggressive path to Net Zero greenhouse gas emissions by 2050. Reducing emissions to achieve Net Zero by 2050 is the Commonwealth's primary and most important line of defense in preventing the significant threats presented by a changing climate.

Harvard's Role:

In 2020, a report of Harvard's greenhouse gas (GHG) emissions was conducted based on community wide activities of residents, businesses and municipal operations in the year 2018. The findings also highlighted GHGs from agricultural activities as well as an estimate of the carbon sequestration benefit provided by forests, wetlands and other tree cover in the community.

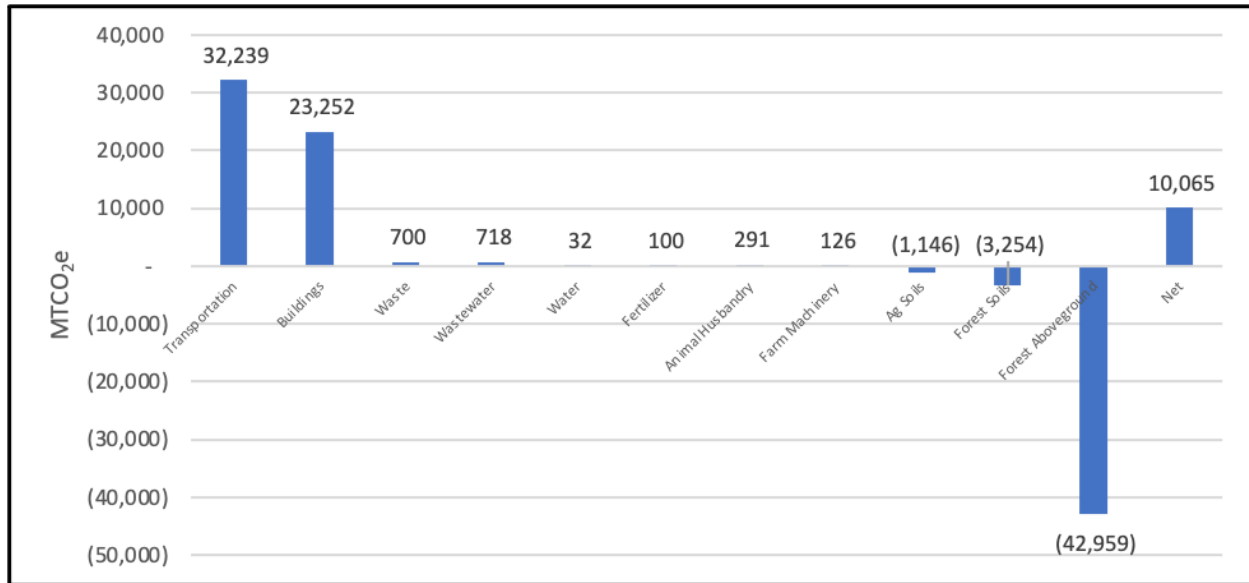
The inventory of GHG emissions for calendar year 2018 was the most recent year in which energy utility data was available. It considered three primary GHGs: carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) and are presented in terms of CO₂e or CO₂.

Total greenhouse gas emissions for the Harvard community total 57,453 metric tons carbon dioxide equivalent (MTCO₂e) in 2018, primarily from **on-road transportation and building energy use**. Approximately 3% of those emissions are attributable to municipal operations. Agricultural activities are relatively small (< 1%) contributors to the GHG footprint of the community and come from unique sources related to fertilizer use, animal husbandry, and farm machinery use.

With 1864 households, this is approximately 25-30 metric tons per household, given there are few commercial enterprises that account for much of the total. The average metric tons per

household in the United States from several sources puts it at 20 metric tons. The average worldwide is 4 metric tons.

The figure below identifies the sources of GHGs in Harvard as well as the offsets of carbon from our forested areas.



Harvard benefits greatly from its extensive forested areas and other tree cover. These forested areas along with wetlands capture carbon from the atmosphere and is upwards of 80% of the Town's annual emissions.

But as fortunate as Harvard is to be so well forested, maps over the years show that these areas are shrinking due to development. The significant positive impact provided by trees and undeveloped land represents significant potential for release of carbon should the land be developed. On a per acre basis, the release of GHGs from development would create a significant increase in emissions of 403 MTCO₂ that would need to be overcome but also would permanently reduce the rate at which tree cover in Harvard sequesters carbon by 4.26 MTCO₂ per year.

Harvard also needs to reflect on climate justice. It has the good fortune of its forests but it also has a responsibility to help the state, country, and world by doing its part to reduce its impact by protecting its forests and addressing the greenhouse gases produced by its homes and cars. Reducing GHGs from its sources will require action on the part of residents to improve the efficiency of their homes, electrify their heating systems, drive electric vehicles, care for the land and take other actions both big and small to reduce GHGs.

Climate Impacts from GHG's

Climate impacts can be addressed in two major ways:

- ✓ Adaptation (also called resilience): how to adapt to or withstand the negative impact of climate change
- ✓ Mitigation (also called sustainability): how to prevent or reduce the adverse impact of climate change, usually by taking actions to reduce GHGs

In order to address both adaptation and mitigation, the Town has sought input from residents, through workshops, surveys, and the establishment of several different committees who over time have been charged with developing plans to address climate change. These activities have led to the identification of what concerns residents: the problems brought on by climate change, now and foreseen, that need to be addressed.

Short History of Climate Action in Harvard

2018: With the establishment of Municipal Vulnerability Program (MVP) Subcommittee of the Energy Advisory Committee and state funding by the Executive Office of Environment and Energy Affairs (EOEEA), hazards and vulnerabilities of concern in the Town regarding climate change were identified. Thirteen (13) areas of concern were identified, with these being the top four:

1. Pests and Invasive Species
2. Extreme Precipitation
3. Extreme temperatures and Temperature Swings
4. Ice Storms

Other hazards included flooding, large storm events, wind, drought, sea level rise, extreme thunderstorms, tornadoes, extreme heat, and wildfires.

The conclusion of the MVP subcommittee's work was three recommendations to improve resilience to the changing climate:

1. Create an implementation committee to manage the process of creating and monitoring implementation of a comprehensive Climate Action Plan
2. Establish a Climate Vulnerability Liaison within Town government responsible for capital planning oversight
3. Create an emergency response network and a medical professional network to coordinate professional and volunteer-based emergency and medical response teams.

Additionally, there were eleven (11) High Priority recommendations, thirteen (13) Moderate Priority recommendations, and fourteen (14) Lower Priority recommendations. The full report can be found at:

2020: With additional funds from EOEEA, a new subcommittee, the Community Resilience Working Group, reporting to the Planning Board, was established. The Greenhouse Gas Inventory discussed above was one of the outcomes of the 2020 funding. This identified the areas that Harvard needs to address to reduce GHGs. A survey was also conducted that asked residents about their concerns regarding climate change and where actions should be focused.

Three hundred fifty-four residents took the survey. Residents were most concerned about the impacts of climate change on natural resources, energy, agriculture and infrastructure/buildings. Drought and intense storms were the climate impacts residents felt would do the most harm and this would affect the town's agricultural business, degrade the town's natural resources, increase disease and illnesses, and disrupt the energy grid.

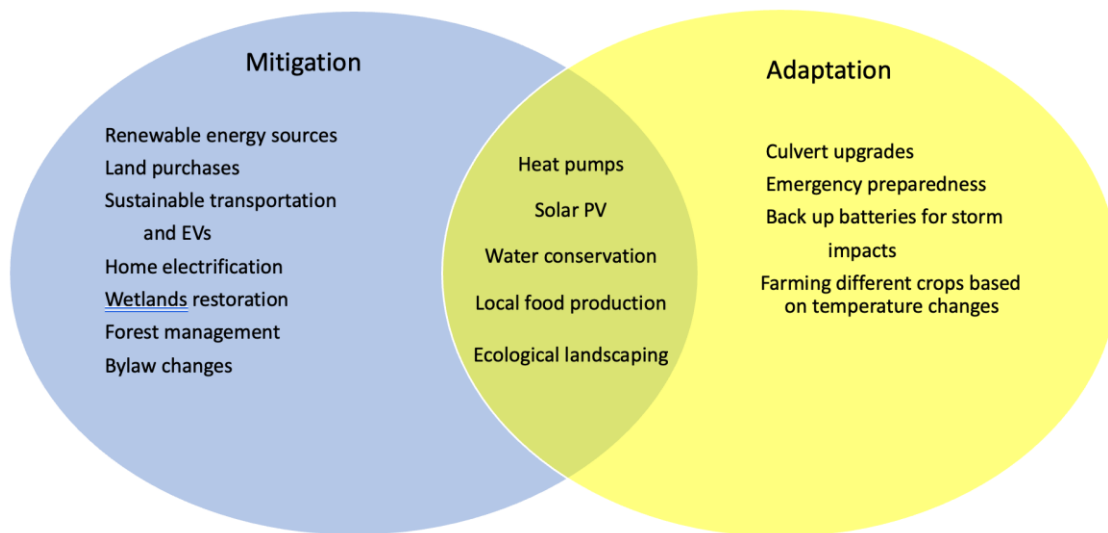
2021: The outcomes of the 2018 and 2020 committee work identified the problems facing Harvard in addressing climate change and the interest of its residents. The next section of this report outlines what has been done to date to address these problems and what is being put forth as the Town of Harvard's Climate Action Plan.

Climate Action Plan Overview

Introduction

At the special town meeting in October 2021, the residents voted to adopt a resolution on climate change and part of that resolution is to create a climate action plan. The Harvard Climate Initiative Committee (HCIC) was formed with the charge to create the plan that would help guide the Town in meeting the Commonwealth of Massachusetts greenhouse gas emissions goals by 2050. The HCIC has framed this climate action plan around mitigation and adaptation.

This chart, is an example of mitigation and adaptation scenarios and the overlaps as to how the two elements of the plan come together.



With state funding, some of the work began in 2020. An agricultural climate action plan was released and the outline or framework of a comprehensive climate action plan was prepared. This work has led to the development of this plan: a goal setting and action plan that is attainable, that can reach the town's goals as outlined in the town resolution, and that will require municipal and resident participation and commitment. We believe Harvard will thrive to commit and act on these actions. That it will be a collaborative process, that it will require commitments from all parts of our municipal government and that it is an iterative process that will be ever evolving.

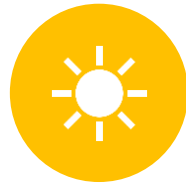
Organization of the Plan

There is much the town and residents can do, but the goals and actions have to be realistic, implementable, timely and focused. For this reason, the plan targets six areas that reflect the Commonwealth's goals, the data on GHGs, the input the community provided to date and the desire to address both sustainability and resilience.

The areas include:



BUILDINGS



ENERGY



TRANSPORTATION



NATURAL
RESOURCES



AGRICULTURE



PREPAREDNESS

These six areas have one goal for municipal operations and one goal for residents and typically two action items per goal. As actions are completed, new ones will be added, thus making this a living document. It reflects the ability of the plan to be realistic in what can be accomplished and timely as actions are completed and new ideas emerge.

The plan, though drafted by the HCIC is not the work of HCIC but the outcomes of discussions, interactions, input and feedback received from town committees, municipal operations, and residents. It is the ideas of many, those most knowledgeable of what can be accomplished and the commitments they can make to meet the goals.

Some of the work has already begun due to the commitment of a key group of stakeholders in town. These accomplishments are noted and celebrated. Much of this work relies on the many volunteers who are so devoted to this work and to giving back to the community.

The following pages contain the substance of the plan:

- Introduction of the climate consideration being addressed
- Municipal Goal, Actions to Date, and Priority Actions to undertake
- Residential Goal, Actions to Date and Priority Actions to undertake
- Measurements for success criteria

Buildings

Climate Consideration:

Forty-one percent of greenhouse gas emissions in Harvard are due to its buildings – both municipal and residential.

Town buildings utilize fossil fuels. Harvard has 12 facilities with about 337,648 square feet that burn natural gas, oil, and propane for heat and domestic hot water (DHW). With Green Communities funds, energy efficiencies, such as heating systems improvements and maintenance and weatherization have improved the buildings' performance. However, to reduce greenhouse gases to the levels in the Commonwealth's roadmap, the buildings would need to be converted to non-fossil fuel sources.

Most residential buildings are heated by oil; a small percentage by natural gas, propane or electricity. Harvard homes are larger than the state average and thus emit more greenhouse gasses.

The HeatSmart program in 2017 provided incentives for air source and ground source systems. State data (which is assumed to be undercounting) notes 15 ground source systems installed between 2015 - 9/2020 and 80 air source systems between 2015 - 10/2019. This is a growing but insignificant number of homes that have been converted to non-fossil fuel systems.

Therefore, the following goals and actions are designed to be the most relevant and applicable to achieving this in Harvard.

Municipal:

Goal: Convert Harvard's municipal buildings from carbon-based fuel combustion to high efficiency electric heating and power production.

Actions to Date:

- Green Communities funding has supported the following climate mitigation actions:
 - Bromfield School - Lighting LED Retrofit
 - Public Library - Lighting LED Retrofit
 - Replacement of transformers in Bromfield heating system to improve efficiency
 - Weatherization of Bromfield and Public Library

Priority Actions:

1. Create a 10 year plan for replacement of municipal heating systems to fully electric options as part of the Capital Investment Planning Committee's plans to be approved yearly at annual town meeting. [the time frame should probably follow the 85% decarbonization plan by 2050 timetable for budgetary reasons — 10 years probably too aggressive)

Residential:

Residential buildings make up X% of Harvard's building inventory and thus is the single largest area of focus for this plan and opportunity for carbon reduction.

Goal: Increase the number of homes that reduce their fossil fuel energy consumption by converting their heating and cooling systems to electric heat pumps

Actions to Date:

- HeatSmart program - A state grant program that provided incentives for home owners to convert to air source or ground source heat pumps with vetted contractors. 31 homes converted in 2018-19
- HarvardEnergize - a website has been developed that provides access to information and goal setting for households to undertake climate actions, including energy saving options. As of January 2022, a total of ___ Harvard households have joined HarvardEnergize.
- Harvard Climate Initiative website - events and resources(harvardsclimateinitiative.org)

Priority Actions:

1. Pass a general bylaw that requires all new residential homes be 100% fossil free for heating, cooling and hot water
1. Assist homeowners to evaluate air source and ground source heating and cooling systems specific to their homes' design and needs
2. Implement incentives (?) for home conversions to electric heating and cooling systems

Measuring Progress:

Energy:

Climate Consideration:

Electricity that Harvard purchases from National Grid includes electricity generated from fossil-fuel and renewable energy. National Grid's electricity generation sources in 2021 were 82% fossil fuel (mostly natural gas) and 18% renewable energy. State legislation requires National Grid to increase the percent of renewable energy generation 2% each year. The rate of conversion to renewable sources through National Grid will not meet the targets set by the state.

Harvard has 12 municipal facilities with about 337,648 square feet that burn natural gas, oil, and propane for heat and hot water. Total energy use for these facilities in fiscal year 2019 was: Natural Gas – 133,878 therms, Oil - and Propane -

Harvard's use of electricity for its buildings, other structures, streetlights, and other services in fiscal year 2019 was 1,936,032 kWh or about 6,606 MMBtu.

For residential buildings, in 2019, the Town signed a contract for town-wide electricity (excluding municipal buildings) to be 100% renewable wind renewable energy credits (REC's) thus converting most of the residential buildings in town to this supplier, unless a family opted out of the program. As of 2021, 86% of households participate. This significantly reduces fossil fuel use, and thus greenhouse gas emissions for home electricity and for those with electric vehicles who charge their cars at home. Local renewable sources of electricity would provide more stability as these contracts are renegotiated every few years. Conversion of heating systems to heat pumps would accelerate the positive impacts of this renewable energy source.

Municipal:

Goal: Convert all electricity to renewable energy sources through solar installments and renewable energy supply contracts

Actions to Date:

- Hildreth Elementary School - Solar Power Purchase Agreement for a 245 kW photovoltaic rooftop array

Priority Actions:

1. Negotiate a 100% renewable energy electricity supply contract for all municipal buildings.

2. Increase the number solar installations on municipal buildings or surrounding grounds, either as ownership or PPA.
3. Add battery back-up to buildings with PV solar.

Residential:

GOAL: Increase the number of residential solar arrays and battery storage systems

Actions to Date:

- Solarize Harvard, as state funded program for residents, added approximately 200 solar installations on homes since 2000 through mid-2021.
- Harvard developed the first Community Solar Garden in the state with homeowners purchasing shares to offset their electricity use. These homeowners did not have suitable placement of their homes to individually benefit from a solar installation. Two gardens now have 60 participants.
- Community Choice Aggregation (CCA) - Town residents electricity supply converted to 100% renewable wind recs. 86% of town residents receive electricity from CCA

Priority Actions:

1. Provide education for residential installation of PV Solar and battery storage systems based on state and federal financial incentives.

Background: These could be used for metrics

Harvard's municipal facilities and operations emit about 1,493 MTCO₂e of carbon per year. The three primary sources of carbon emissions for Harvard's municipal facilities and operations in 2019 were fuel combustion for heating and domestic hot water (DHW), town vehicles, and utility provided non-renewable energy electricity generation.

Harvard has 12 facilities with about 337,648 square feet that burn natural gas, oil, and propane for heat and domestic hot water (DHW). Total energy use for these facilities in fiscal year 2019 included:

- Natural Gas – 133,878 therms
- Gasoline – 14,995 gallons
- Diesel – 12,2002 gallons

This energy use is equivalent to 14,002 MMBtu. In addition, these facilities consumed about 1,667,351 kWh of electricity which is equivalent to about 5,689 MMBtu. (See additional electricity usage below)

Harvard has 48 vehicles and other equipment that have gasoline or diesel-powered internal combustion engines. Total energy use for these vehicles in fiscal year 2019 was:

- Gasoline – 14,995 gallons
- Diesel – 12,2002 gallons

Harvard uses electricity for its buildings, other structures, streetlights, and other services. Total municipal facility and operations electricity used in fiscal year 2019 was 1,936,032 kWh or about 6,606 MMBtu.

MassEnergize data or town data on:

- Number of solar installations
- Number of ground source and air source systems

Measuring Progress:

Transportation

Climate Consideration:

Transportation is the biggest producer of GHGs in Harvard. As a semi-rural community with limited commercial enterprises, particularly the most common needs, such as a full-service grocery store, a pharmacy, a hardware store, etc., most residents leave the area in their cars. There may be no change in services in town, but how residents get to these services can change. Electrification of vehicles would greatly reduce GHGs. Those who visit, as the town has a tourism base with its orchards, Fruitlands Museum, hiking and biking trails, adds to GHGs emissions.

Town residents have access to commuter rail to Boston in Littleton and Ayer. Use of public transportation reduces GHG emission impacts, yet the use of this means of transportation appears limited from the GHG inventory report. Public transportation is known to lessen the impact of GHG on the environment.

At for the municipal operations, Harvard has 48 vehicles and other equipment that have gasoline or diesel-powered internal combustion engines. Total energy use for these vehicles in fiscal year 2019 was:

·Gasoline – 14,995 gallons or $133,260 \times 10^{-3}$ metric tons of CO₂

·Diesel – 12,202 gallons or $124,216 \times 10^{-3}$ metric tons of CO₂

Replacement of municipal vehicles comes to town meeting for approval from the Capital Projects and Investment Committee each year. A few of the town vehicles have been replaced with hybrid versions. There has been an increasing interest in the type of vehicles being purchases at town meeting to reduce GHG emissions.

Lastly, the School Committee is responsible for the bus contract, of which 7 buses operate fully on diesel fuel. Many of these buses spend significant time idling. Not only does this add to GHG emissions, it also impacts the health of the riders given the toxic nature of the pollutants these vehicles add to the nearby air.

Municipal:

Goal: Convert 85% of Harvard's municipal vehicle fleet to electric by 2050.

Actions to date:

- Need data on number of hybrid police cars, other municipal vehicles

- School Committee has added language to its request for bus transportation proposals to include a schedule for bus conversion to electric vehicles

Priority Actions:

1. Develop a capital budget and schedule to replace existing town vehicles with electric vehicles at a fiscally and operationally appropriate retirement date, beginning with lighter duty vehicles.
2. Identify an approach or timeframe for electrifying heavier duty vehicles (including school buses) for which realistic solutions do not yet exist on the market.
3. Build EV charging stations on municipal properties for town vehicles, backed by PV energy generation.

Residential:

Goal: Provide a convenient and attractive range of zero carbon transportation options for residents to get to work and around town.

Actions to date:

- State incentives for the purchase of hybrid-electric or fully electric vehicles has increased the number of such vehicles in town. Data is not yet currently available on the number of such vehicles currently registered to residents in town

Transportation Advisory Committee --- established in 2021, this committee coordinates local transportation planning efforts and promotes collaboration in the development of collective transportation goals and priorities

Priority Actions:

1. Encourage the adoption of electric vehicles amongst residents and businesses through education on incentives and options, promotional events, and expediting permits.
2. Develop a high quality, high frequency regional electric shuttle service to and from town center, commuter rail stations, and newly developed park-and-ride locations.
3. Improve the reach of Harvard's bicycle and walking paths to provide a realistic, healthy, and zero carbon alternative to driving.
4. Encourage the use of commuter rail to get to work.

Measuring Progress:

Asdf

Natural Resources

Climate Consideration (Adam to write/re-write?)

Forests, native plants, meadows, soil, wetlands and waterways play a major role in reducing carbon in the atmosphere, by sequestering it. In 2020-2021, with a grant from the Commonwealth's Municipal Preparedness Program, and in conjunction with Bolton and Devens, The Apple Country project completed an assessment of the lands in all three towns with recommendations for lands to preserve, and how preserve them. To do so is to "ensure robust ecological climate resilience and continued ecosystem health." Preserving and restoring these lands and waterways helps slow climate change while also providing water retention, wildlife habitat and opportunities to continue to have agricultural lands to grow food . Despite the valuable natural resources, Harvard's location in the region of Massachusetts is experiencing some of the most significant development pressure which exacerbates the effects of climate change and highlights the urgency of protecting the natural resources that provide substantial climate related relief.

The key recommendations that emerged from The Apple Country Project are grouped into four Categories: 1. Protect, 2. Restore, 3. Manage Better, and, 4. Develop Better. Protect the natural environment that sequesters carbon. Restore areas that have the potential to be better carbon sinks. Manage well what is there. Manage development in areas that will not impact lands that benefit the ecosystem.

Municipal:

Goal: Increase the resilience of Harvard's ecosystems and community through the coordinated implementation of nature-based solutions.

Actions to date:

- MVP Prioritization Plans
- 2021 Apple Country Report
- 2017 Open Space and Recreation Plan
- 2016 Master Plan, Chapter 3
- The Conservation Commission, Harvard Conservation Trust, Sudbury Valley Trustees and other local partners have helped to protect over 1,900 acres of conservation land directly and an additional 523 acres under conservation restrictions and agricultures preservation programs. (Add Apple Country report map from page 155?

Priority Actions:

1. Seek grant funds to implement key recommendations related to nature-based solutions from the 2021 Apple Country Report, prioritizing:
 - Invasive species management
 - Wetland restoration and expansion
 - Stormwater management and culvert improvements
 - Tree and vegetation enhancements to built environments for shade, improved buffer, bio-swale, etc.
2. Develop forest management plan to enhance health and carbon sequestration opportunities for Harvard's forests.
3. Prioritize efforts to improve partnership with the state, region, and neighboring communities on topics of sustainability, environmental justice, invasive species, and biodiversity.
4. Pilot a green infrastructure project in town (what, specifically? Wait to identify with partner committee?)
5. Engage town committees and community to identify additional focus areas for improving the resilience of the town's natural resources not already covered in Apple Country Report

Land Use Goal: The Town's policies and bylaws shall facilitate sustainable land use and development.

Actions to date:

- Established an Open Space Residential Development Bylaw in response to 2002 Master Plan.
- Created a mixed-use overlay zoning district to facilitate smart growth.
- Land purchases by Conservation Commission, Harvard Conservation Trust and Sudbury Valley Trustees

Priority Actions:

1. Include more zoning districts and development types that are sustainable, smart growth models and remove or replace provisions that are not in line with this framework.
2. Educate and inform the public about sustainable land use patterns and why they have better environmental, social, and fiscal outcomes.
3. Ensure that all open space acquisitions and set asides align with goals for open space and nature resource protection through updated Open Space bylaws and ongoing decision-making by the Planning Board and Open Space Committee.
4. Enhance development and design review processes to enable low impact development and other nature-based solutions in land development and redevelopment.

5. Ensure land use and transportation planning are coordinated as their consequent impacts are interlinked.

Residential:

Goal: Reduce the climate impact of our homes and yards on the local environment.

Actions to date:

- HarvardEnergize information on native plantings
- Harvard Press Garden Column on environmentally friendly options

Priority Actions:

1. Significantly reduce food waste amongst residents through composting, “buy local,” and changes to consumption practices.
2. Provide residents with information on sustainable practices for lawn care, landscaping, tree care, and invasive species management.

Measuring Progress:

Agriculture

Climate Consideration:

In 2020, with a grant from the Municipal Preparedness Program, Harvard's Climate Resiliency Working Group used the resources to focus on the agricultural community. Harvard's farms and orchards have always been viewed in survey after survey of town residents as an important asset of the community. As stated in the introduction to the report, the process of creating the plan "brought awareness to the issue that while climate change impacts are a risk to the farmers, existing financial pressures are the greatest risk to Harvard's socio-economic resilience and will only further exacerbate climate-related impacts."

Climate change presents significant risks to the agricultural community as identified in the report:

- Rising Temperature Impacts:
 - New and more pests/pathogens
 - Unsafe outdoor working conditions
 - Change in crop viability
- Changes in Precipitation Impacts:
 - Flooding: soil erosion, fertilizer/pesticide/manure runoffs, plant disease
 - Drought: crop losses, irrigation demands
- Storm Impacts:
 - Crop losses
 - Damage to buildings and equipment

Although the number of farms in Harvard are estimated to be 100 or more, three are large and the remainder are small with approximately X acres in total. They do not produce a large amount of the town's GHGs but should they be sold for development, not only would it impact the feel of the community, it would substantially increase the GHG emissions.

Municipal:

Goal: Invest in the necessary shared infrastructure for the agricultural community to accelerate or deepen sustainable farming practices

Actions to date:

- Agricultural MVP Prioritization Plan (2019)
- 2020 Agricultural Climate Action Plan

Priority Actions:

1. Explore options to reduce tax burden on farmers for their land, buildings, and equipment
2. Revise Harvard's zoning bylaw to allow greater flexibility for farm-related uses
3. Pilot a collaborative purchasing initiative to take advantage of volume discounts which can enable wider use of organic fertilizer, biodegradable plant containers, and other farm supplies. Over time look for opportunities to formalize the initiative into a purchasing cooperative or grange model. This could also create a mechanism for collective purchasing of electric equipment.
4. Identify opportunities for large scale composting of community-wide food and green waste to reincorporate into agricultural soils.
5. Pursue a state grant to establish a centralized shared processing facility with energy star appliances to reduce food processing energy and decrease regulatory requirements amongst individual farms.

Residential:

Goal: Through outreach and community building, encourage innovative approaches to sustainable farming in Harvard

Actions to date:

- Adaadf
- Asdfasfd

Priority Actions:

1. Evaluate opportunities for "agrivoltaics" or community solar arrays on pasture land.
2. Educate and encourage farmers to adopt soil, crop, and water management practices that will enhance resilience to climate change.
3. Build a community forum for information sharing and best practices on regenerative farm practices.
4. Partner with farmers, residents, and businesses to develop principles for a sustainable food system.
5. Provide financial and logistical support for CSA's in Harvard — both on supply and demand sides.

Measuring Progress:

Preparedness:

Climate Consideration:

Municipal:

Goal:

Actions to date:

Priority Actions:

Residential:

Goal:

Actions to date:

Priority Actions:

Measuring Progress:

Acknowledgements (will need to refresh this)

The Harvard Climate Action Plan was developed through a collaborative process driven by the Community Resilience Working Group (CRWG), a subcommittee of the Harvard Planning Board. Major contributions were made from multiple consulting firms whose work was funded by generous grants from the Massachusetts Executive Office of Energy and Environmental Affairs Municipal Vulnerability Preparedness (MVP) program.

Municipal Participants

Christopher J. Ryan, AICP, Lead Staffer
Director of Community and Economic Development

Elizabeth Allard
Conservation Commission Agent

Richard Sicard
Fire Chief

Timothy Kilhart
DPW Director

Patricia Natoli
Public Safety Administrator

MVP Committee

Eric Broadbent, Chair
Kerri Green, Agriculture Advisory Commission
Sharon McCarthy, Board of Health
Kara McGuire Minar, Select Board
Justin Brown, Planning Board

Community Resilience Working Group Past Members

Peter Kelly-Joseph, Harvard Energy Advisory Committee, Chair
Christiane Turnheim, Agriculture Advisory Commission
Lucy Wallace, Select Board and Citizen Member
Sharon McCarthy, Board of Health
Stacia Donahue, Planning Board
Ellen Sachs Leicher, Citizen Member, HEAC and Acting Chair
Ron Ostberg, Citizen Member
Elizabeth Toll, Bromfield Green Team

Janet Waldron, Conservation Commission
Patricia Natoli, Public Safety
Adam Meier, Harvard Conservation Trust
Alexandra Cronin, Citizen Member
Arianna Thornton, Bromfield High School Member
Jefferson Burson, Planning Board Member
Catherine Warner, Citizen Member
Phoebe von Conta, Citizen Member
Deborah O'Rourke, Citizen Member

Consulting Teams

- Harriman
- Kim Lundgren Associates
- BSC Group
- Linnean Solutions
- Regenerative Design Group

Other Contributors

Appendix:

Background on Plan Development (should all of this just be an appendix?)

Climate action planning commenced in 2018 with the establishment of HEAC's MVP Subcommittee that was assembled to carry out the Prioritization Planning project which was funded by an MVP grant of \$35,000 awarded to the Town by EOEEA. Harvard retained the services of consulting firm Harriman Associates to develop the plan, resulting in two (2) reports. A summary of these Plans are as follows. See the full reports for detailed analysis:

General Prioritization Plan (2019)

Top Hazards Identified – A total of 13 hazards were identified by workshops. The top four (4) priority hazards were noted as:

1. Pests and Invasive Species
2. Extreme Precipitation
3. Extreme temperatures and Temperature Swings
4. Ice Storms

Other hazards included flooding, large storm events, wind, drought, migration from sea level rise, extreme thunderstorms, tornadoes, extreme heat, and wildfires.

Geographic Areas of Concern – Workshop participants also identified specific geographic or place-based areas of concern in Harvard. These are:

1. Environmental – All public byways and waterways, including trails, roadsides, and Bare Hill Pond.
2. Facilities – All municipal sites including the police station, DPW facility, schools, library, and the area behind Town Hall.
3. Infrastructure – Town Center sewer and various culverts.

Topical Areas of Concern – Workshops also identified specific categories of concern and challenge.

1. Infrastructure
 - a. Stormwater Management
 - b. Municipal Services

- c. Roads
 - d. Septic/Sewer Systems
 - e. Development Patterns
- 2. Societal
 - a. Emergency Response
 - b. Stewardship
 - c. Development Patterns
- 3. Environmental
 - a. Land Management
 - b. Insects
 - c. Plants
 - d. Trees

Current Strengths and Assets

During Workshop #1, participants identified strengths and assets within Harvard that could help the community mitigate or be more resilient to the impacts of hazards related to climate change and extreme weather events. Some of the strengths were also characterized as vulnerabilities, which were noted in the previous section, depending on the hazard or impact. A full listing of strengths and assets is found in the plan risk matrices in Appendix D: Harvard Agriculture and Community Resilience Building Workshop Matrices and Top Priority Actions.

- 1. Private Septic Systems and Town Sewer
- 2. Emergency Response System
- 3. Isolated Population
- 4. Trees and Forests
- 5. Conservation
- 6. Communication

These identified strengths and assets should be further elaborated on and used by this process to enhance local resilience.

Top Three (3) Recommendations to Improve Resilience

- 1. Create an implementation committee to manage the process of creating and monitor implementation of a comprehensive Climate Action Plan
- 2. Establish a Climate Vulnerability Liaison within Town government responsible for capital planning oversight

3. Create an emergency response network and a medical professional network to coordinate professional and volunteer-based emergency and medical response teams.

Additionally, there were eleven (11) High Priority recommendations, thirteen (13) Moderate Priority recommendations, and fourteen (14) Lower Priority recommendations. These are listed in the Plan document as part of Appendix D of this Plan and were highly informative of the final goals and actions in the Plan.

Agricultural Prioritization Plan (2019)

Two (2) workshops and interviews of operators were conducted to gather the information in this report. Key findings are as follows. Please see Appendix D for the full report and details.

Top Five (5) Potential Impacts

1. Extreme and Variable Weather
2. Land Use Regulations
3. Local Tax Structure
4. Crop Failure
5. Pest Control

Top Five (5) Concerns

1. More frequent or new pest pressures related to weather (e.g. insects, fungus, or disease)
2. Longer dry periods or drought
3. More frequent or new weed/invasives pressure related to weather
4. More frequent/unpredictable seasonal temperatures (early bud break, early or late frosts)
5. More frequent crop diseases related to weather

Top Five (5) Climate-Related Priorities

1. State regulations for grants for forestry management plans require a minimum of ten contiguous acres. That leaves many smaller parcels unmanaged, with the risk of invasive (pest and plant) and forest fires. Participants recommended that adjacent property owners with less than ten acres each but ten or more acres together work with the state to create a shared forestry management plan, including managing forests for CO₂ for the integration of carbon sequestration.
2. Projected impacts of climate change lead to increased threats to plant and animals from diseases. Participants noted that organic farms have greater difficulties addressing some of these threats. The first recommended action was a focus on soil health and inter-planting techniques.
3. Because some solutions to invasives create additional problems, such as the threat to pollinators from pesticides and herbicides, the third recommended action was to create a public education program, including recommendations for the timing of spraying and the spread of pollinator gardens.

4. ;Participants recommended education around systems (e.g., the link between deer, mice, bird feeders, and ticks) and comprehensive regional strategies for collective land stewardship.
5. Participants identified land use and settlement patterns (particularly those that allow greenfield development) as a threat to the continuity of agriculture in the state and recommended that the state coordinate strategies for small New England Towns to address the pressures of development on agricultural land.

Top Five (5) Non-Climate Priorities

1. Local property taxes contribute to financial stress for farms with small profit margins. In some cases, land is assessed at agricultural rates but buildings are assessed at commercial rates. Participants suggested several strategies, including land banks, preservation, and evaluating the property tax structure.
2. Participants recognized the promise of agritourism to help farms with additional income streams, educate residents and visitors about the importance of agriculture and local products, and contribute to the local economy and culture. Questions arose about whether agritourism would be regulated by the Commonwealth or locally, or both. Participants recommended support for agritourism locally and the creation of a strong information flow between the Commonwealth and municipalities about agritourism regulations and also recommended that communities lobby the state for their interests.
3. A common discussion was the general lack of awareness about agriculture and agricultural needs in Harvard. Participants recommended a robust outreach program to educate more people about the unique benefits afforded to the Town by its orchards and farming operations. Participants also identified a lack of a shared information base about agriculture for the entire community and recommended facilitation to connect the community to agriculture.
4. Considering how building codes should be applied to agricultural buildings was an issue under the regulatory discussion. The concern was that commercial standards were applied to agricultural buildings and that not all of these standards were appropriate. Participants recommended lobbying the Commonwealth for building codes specific to agricultural uses.
5. Another priority requiring state action were the regulations on farm stands that serve food, particularly food that had been grown and/or prepared on-site rather than brought in from an outside supplier. Participants recommended lobbying the Commonwealth for appropriate regulations for farm stands selling products produced on-site.
6. Tied for the fifth priority was the need to consider succession planning. Participants noted that Chapter 61A enhances the economics of succession planning by keeping land values lower, but that the Town should explore other strategies such as the transfer of development rights (TDR) and open space design development. A strategy for TDR would require a receiving zone, which could be the C District identified by the 2016 Master Plan as underutilized.

There were a number of other important recommendations in the agricultural prioritization report and there is too much detail to repeat here. It is recommended that for those interested specifically in agricultural priorities and actions, readers refer to the prioritization report [here](#) and the draft Agricultural Climate Action plan.

Agriculture Climate Action Plan

The KLA created Agriculture Climate Action Plan, completed in 2020, consists of 64 pages of detailed content directly targeted toward Harvard's agricultural community.

The KLA plan reiterated the climate change risks to the agricultural sector in Harvard (p. 8), discussed carbon emissions and sinks (p. 10), and develop four (4) elements to focus on including Economic Viability, Resource Efficiency and GHG Reduction, Nature-Based Resilient and Regenerative Practices, and Social Cohesion and Agricultural Character. Each of these is listed below with the associated goals. Specific actions are detailed in the full document linked above and [here](#).

1. Economic Viability Goals

- a. Minimize the cost of owning and operating a farm in Harvard (and minimize financial risks)
- b. Enhance ongoing revenue of farms
- c. Expand resource sharing opportunities to support farms in diversifying and/or scaling up operations
- d. Protect agricultural/agroforestry land from build-out scenarios

2. Resource Efficiency and GHG Reduction Goals

- a. Reduce energy consumption and/or GHG emissions in farm operations
- b. Increase utilization of renewable sources of energy
- c. Minimize water consumption in farm operations
- d. Manage waste through circular economy principles

3. Nature-Based Resilient and Regenerative Practices Goals

- a. Protect and enhance pollinator habitats
- b. Enhance soil health and maximize carbon sequestration
- c. Maintain biodiversity
- d. Encourage resilient and regenerative practices among farmers

4. Social Cohesion and Agricultural Character Goals

- a. Nurture a more cohesive agricultural community within Harvard
- b. Support local food and goods production at all scales

- c. Expand the availability and purchasing of agricultural products produced in Harvard
- d. Expand understanding among Harvard and surrounding community members of the public value of farms

Harvard Today

Harvard has made modest advances in local climate action and sustainability. The 2016 Master Plan refers to “long-term sustainability” in its Vision Statement. A key goal in the plan is that “Harvard is assured long-term sustainability” and this goal includes references to public infrastructure, public revenue, energy, and commercial development. It also includes a range of actions addressing the protection of natural resources and increasing the open space inventory. The plan is not specific enough regarding any metrics defining sustainability. But conversely, it is general enough to allow for flexible interpretation of actions in order to pursue sustainability goals.

Developing the Plan

The Harvard Climate Action Plan was developed through the contributions of many Harvard citizens in conjunction with key Town staff, Board and Commission members, and consulting firms that have been assisting Harvard since 2018. The origin of the Climate Action Plan process emanated from a key recommendation of the Prioritization Plan developed by Harriman in 2019. The Community Resilience Working Group (CRWG) was established in 2020 to take the recommendations of that plan and continue the work of climate change action in the Town.

Harvard, through the CRWG, received its first MVP Action Grant in February of 2020 and retained the firm of Kim Lundgren Associates (KLA) to develop a Climate Action Plan. A reduced funding award resulted in KLA developing the agricultural component of a climate plan and an outline and contributing materials toward a full climate plan.

In 2021, the CRWG established a Plan Development sub-group to create a detailed framework for a climate plan and this was completed in July 2021.

The Players – Plan Advisors and Stakeholders

[add here]

Plan Approach

Harvard recognizes that the issue of climate change is fundamentally existential and requires significant thought and effort to craft a plan that will, in detail, address those aspects of climate change that Harvard can influence. On the other hand, it is also clear that many plans and reports have been issued for the Town over the past half a century and while some of them were quite well done, few were fully implemented or significantly changed the community. Plans are often voluminous books that few people have the time or interest to read. Further, many such plans require a dedicated set of staff or volunteers to work to achieve goals, objectives, and actions. Harvard did not want that to be the fate of this plan.

Therefore, the approach taken for the Harvard Climate Action Plan was to acquire and catalog the necessary data and narrative to be able to fully implement the plan by leaders and stakeholders, but house this more extensive set of information in a set of appendices that could be mined by implementers who need it. The plan relies on graphics and charts that clearly state the goals, action steps and responsible entities to achieve the plan.

Engaging the Community

Public outreach and participation was a critical element in developing this Climate Action Plan. Without it, the Plan has no standing in the community, there is no buy-in from citizens, there is no foundation on which to gain consensus for action, to commit funding, to inspire leadership, and to develop partnerships. Below is a listing of the various ways in which the Community Resilience Working Group and then after 2022, the Sustainability Commission [\[EL6\]](#) , engaged the citizens of Harvard.

2019

- Prioritization Plan workshops and public meetings

2020

- Agricultural CAP public meetings
- Climate Action Survey conducted by KLA

2021

- Spring 2021 – Development of Website and Social Media Platforms
- September – Kick-Off Public Meeting
- September – Transportation Plan Public Meeting #1
- September – Kickoff for Mass Energize Website
- October – Stakeholder Group Meeting
- November – Hazard Mitigation Plan Kick-Off

- November – Transportation Plan Public Meeting #2

2022

- January – Nature-Based Solutions Workshop
- February – Economic Development Open House and Public Meeting
- March – Climate Action Plan Check In with Public
- July – Business Resilience Open House (w/ Chamber)

Definitions

MTCO_{2e} – some comparison to something folks will understand. Maybe add carbon footprint – average for household in US compared to other nations, etc.

ICLEI

MMBtu

Therms

Greenhouse Gases- define re. methane, etc.

Agriculture Report: Elements of Focus

1. Economic Viability Goals

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