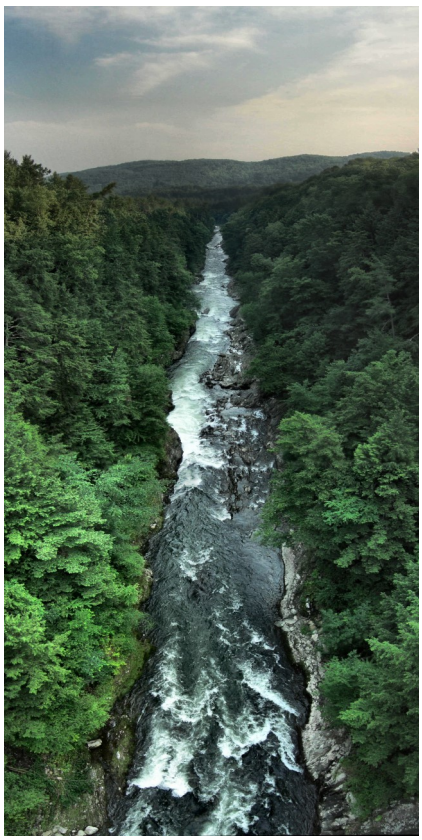
Town of Hartford

Climate Action Plan



Hartford Vermont

Selectboard Adopted:
August 24, 2021

Prepared by:

making change personal
paleBLUEdot LLC

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Hartford's Future Climate

By 2050, Hartford's climate can be expected to be:

+3-5°F
warmer average annual temperature than now.

+5-10 more days
annually with a high temperature over 95°F.

+25% more
air conditioning demand and energy needed than now.

+8% higher
annual average rainfall than now.

+15% more
Heavy precipitation events annually.

+20-25 days longer
growing, allergy, and mosquito season.

The time is right for Hartford's first Climate Action Plan.

Executive Summary

The Town has been dedicated to climate and energy issues for many years, and its focus on these topics has become increasingly strong in recent years. In 2007, Hartford became one of the first towns in the State of Vermont to form an Energy Commission, dedicated to reducing energy consumption and increasing Hartford's share of renewable energy. In 2019 as part of a Town Plan update, the Town completely overhauled its Energy Chapter to create a plan to meet or exceed the State of Vermont's energy goals and achieved a Determination of Energy Compliance from the Two-Rivers Ottauquechee Regional Commission (TRORC).

In October 2020, the Town of Hartford engaged paleBLUEdot for the development of a Climate Action Plan outlining strategies and actions to support achieving Carbon Neutral for Town of Hartford Municipal Operations emissions as well as Town-Wide emissions. This report plan is the result, developed in collaboration with the Town's Climate Action Planning Team.

Our Challenge

The complex systems that make up modern civilization result in stressors on the delicate balance of our ecosystems. The combustion of fossil fuels is warming earth's atmosphere and changing our climate. Climate change is already affecting Hartford and its impacts are projected to become much more severe in the coming decades. These impacts also contribute to additional strain on vulnerable populations, social systems, and overall community resilience.

Our Opportunity

Transformation of our energy system is essential in order to stop burning fossil fuels. This transition presents an opportunity for Hartford. Directing our energy investments into renewable sources will make them more resilient and provide for local job creation. Innovation, technology, and collective social change inherent in climate action can also support greater community abundance and shared equity.

Hartford CAP Guiding Principals:

The Climate Advisory Committee established guiding principals by which the development and implementation of the Climate Action Plan are to be evaluated:

- The impact on the 7th generation, the wellbeing of people worldwide, and the health of the planet; and
- Leaving our community and the world better than we found it; and
- Fostering innovation and creativity; and acting in ways that respect the most vulnerable and impacted members of our society.

The Process

The work that went into developing the Hartford Climate Action Plan

8 month
planning timeframe

32
planning team members

4
foundational research study documents

Executive Summary

GHG Emission Reduction Goal in Global Context

Reviewing the Town's Climate Action Plan emissions reduction goal within a global context can help validate the appropriateness of the goal. The International Panel on Climate Change (IPCC) is the United Nation Environment Programme (UNEP) body for assessing the science related to climate change and providing support in climate action policy making. IPCC science has guided a number of international agreements to address climate change, most recently the Paris Agreement.

The Paris Agreement is a landmark international accord that was adopted by nearly every nation in 2015 to address climate change and its negative impacts. The agreement affirms IPCC recommendations by aiming to limit global warming to 1.5°C to 2°C above pre-industrial levels, considered to be the threshold for dangerous climate impacts. The agreement includes commitments from all major emitting countries to cut their climate pollution and to strengthen those commitments over time.

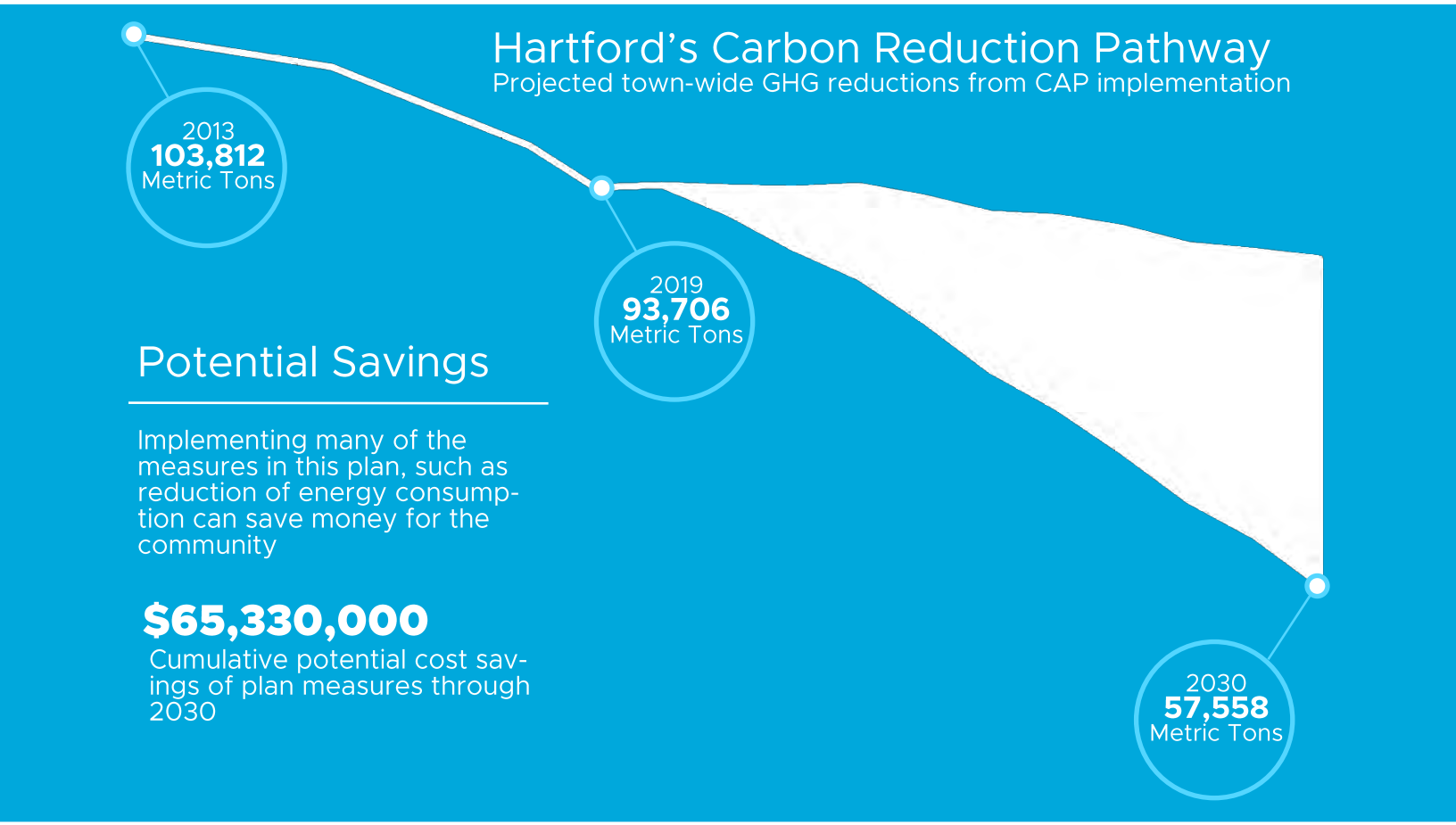
Our Carbon Reduction Goal

The Hartford Selectboard and School Board formed the Ad-Hoc Climate Advisory Committee in 2019 and subsequently voted unanimously to pass a Joint Resolution Declaring a Climate Emergency, making climate change a defining focus for Town planning, funding, and action. The action resolves that:

> **The Town shall achieve net-zero greenhouse gas (GHG) emissions town-wide by 2030 and that "Hartford's response to the climate emergency be just and equitable, especially with respect to the most vulnerable and impacted members of society."**

Following the passage of the Resolution, an additional ballot resolution ("Article 25") passed with 65% of the vote, requiring the Town to lead by example and that:

> **The operation and maintenance of the Town of Hartford's municipal infrastructure and equipment shall achieve carbon neutrality by 2027.**



Executive Summary

Climate Action Plan as Living Plan

This Climate Action Plan is intended as a "living plan" rather than a static document. This means that the implementation phase of this plan should be characterized by intermittent measurement of progress and plan adjustments. Plan adjustments should look towards increasing implementation goals for actions which illustrate success, modify goals for actions which may fall short of desired outcomes, and identifying additional action opportunities.

As a "living plan," the 2030 emission reduction goal should be seen as a guiding constant and recognition should be given that initial implementation actions may not yet fully achieve plan goals. Intermittent plan progress measurements and adjustments should identify additional actions, or increases in action implementation targets as needed to meet the ultimate 2030 GHG reduction goal.

Next Steps and Implementation

This Hartford Climate Action Plan is only the beginning of an on-going process of evaluating and advancing the Town's climate resilience, GHG emissions reductions, and overall sustainability. The plan includes a Climate Action Implementation section providing a framework for launching, guiding, monitoring, and evaluating the execution of this plan. The implementation section outlines specific next steps, and important implementation considerations and recommendations. As details and outcomes are uncovered during the implementation phase, adjustments to quantitative goals, milestones, and detailed actions will be made responsively.

The Plan

The Hartford Climate Action Plan:

addresses **9 sectors** of GHG emissions and climate vulnerabilities

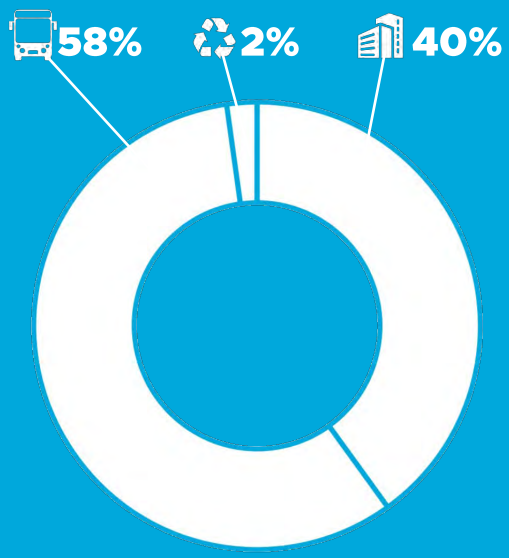
through **37 strategies** addressing climate goals

supported by **176 actions** detailing steps to be taken

during a **9 year** implementation timeframe

Reduction Share by Sector

Share of Total 2030 Reductions of Climate Action Plan actions by Sector:



Acknowledgements

We are deeply grateful for the community collaboration and input that went into this plan. Below are some of the main contributors that made Hartford's first CAP possible:

Town of Hartford Project Leads

Erik Krauss	Hartford Climate Advisory Committee, Chair
Lori Hirshfield	Town of Hartford, Director, Planning and Development

Selectboard Members

Dan Fraser, Chair

Joe Major, Vice-Chair

Rachel Edens

Kim Souza

Ally Tufenkjian

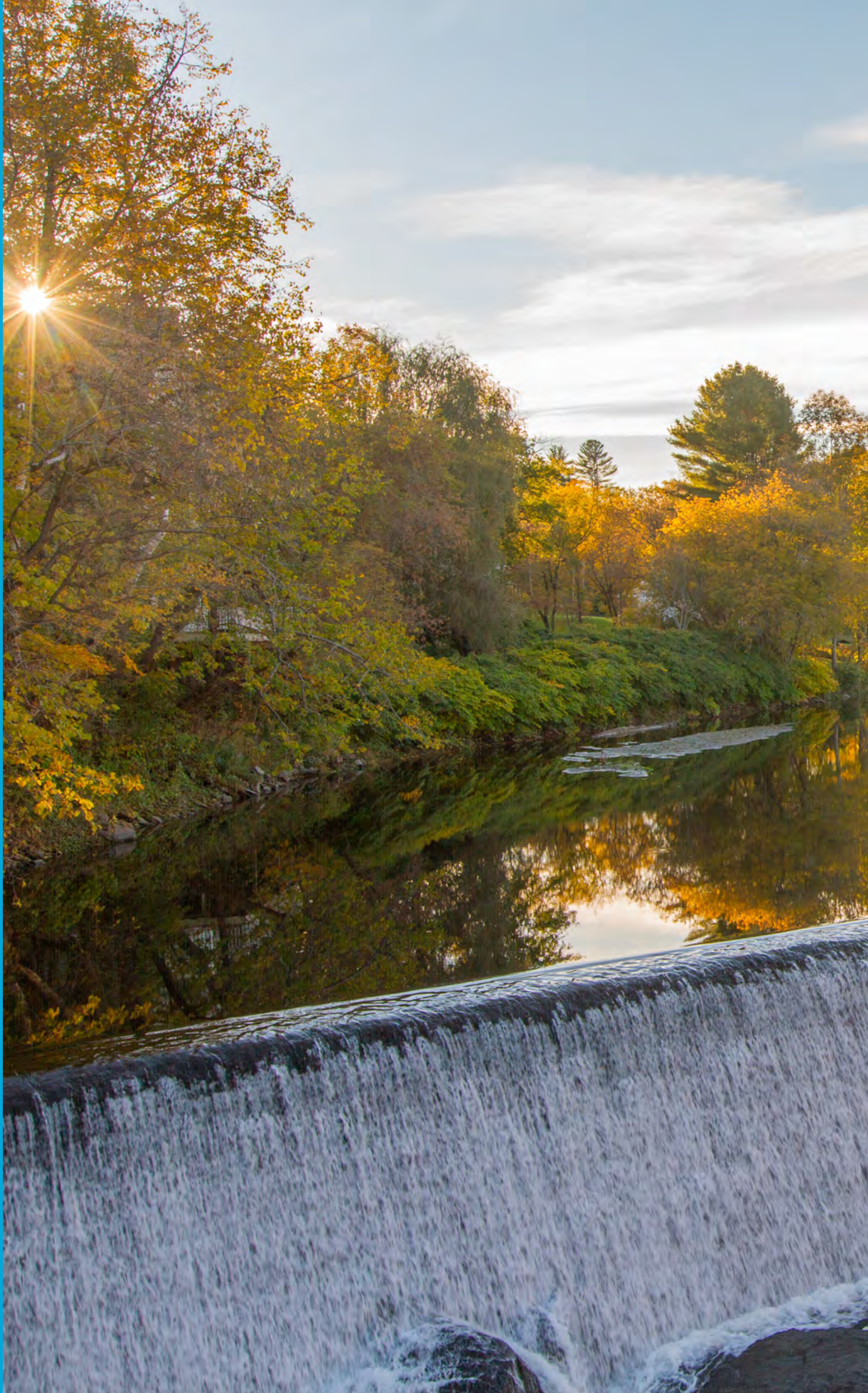
Julia Dalphin

Dennis Brown

Community Climate Action Planning Team

Ashley Andreas	Vermod
Ariel Arwen	Hartland Energy Committee
Liane Avery	Sustainable Lebanon
Jon Bouton	Conservation Commission, Resident
Jennie Chamberlain	Hanover Bike/Ped Committee
Rachel Edens	Selectboard, Liason to Hartford Climate Advisory Committee
Alice Ely	UV Public Health Council
Lucas Gilbert	Climate Advisory Committee
Linda Gray	Norwich Energy Committee
Carolyn Hooper	Executive Committee of the Upper Valley Sierra Club chapter, Resident
Mary Hutchins	Resident, Conservation Commission
Ralph Hybels	Hartford Resident, Owner of Leadership in Medicine, Inc
Karl Kemnitzer	Sierra Club, VBike
Toby Kravitz	Resident
Aaron Lamperti	Norwich Energy Committee
Kyle MacLaury	Resident, Solution Architect, Landis + Gyr
Meg MacLaury	Resident, Hartford Highschool
Ron McGarvey	Vermont Interfaith Power and Light
Ana Mejia	Hartford Climate Advisory Committee
Cynthia Monroe	Wilder Resident, Dartmouth College Lecturer
Matt Osborn	Town of Hartford, Assistant Zoning Administrator and Planner
Rebecca Owens	Planner for City of Lebanon
Laura Perez	Special Needs Support Center
John Reid	Planning Commission, Vice Chair
Bruce Riddle	Planning Commission, Chair
Laura Simon	Resident, member: Resilient Hartford Committee
Molly Smith	Energy Commission, Chair
Jack Spicer	Hartford Climate Advisory Committee
Liz Storn	Wilder resident, University of Florida Office of Sustainability
Courtney Williamson	Hartford Climate Advisory Committee, Vice Chair

Section 01 Introduction



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GHG Emissions

generated community-wide in Hartford

46,470
Metric tons CO2e in 2019 from vehicle use.

45,810
Metric tons CO2e in 2019 from building energy.

1,009
Metric tons CO2e in 2019 from solid waste

446
Metric tons CO2e in 2019 from water and wastewater

Introduction

Hartford, Vermont is located at the confluence of the White and Connecticut Rivers and includes a third river, the Ottauquechee. Hartford is part of a thriving Upper Valley region. The quality of life, jobs, and a well-managed Town with abundant educational, recreational and cultural resources are some of the assets that draw people and businesses to the Town. What makes Hartford special is shaped in part by its rich history and its ability to adapt to changing conditions over time. The Town was established by Charter in 1761 as an agricultural community with several settlement areas. Today, the Town is principally comprised of five Villages (White River Junction, Wilder, Quechee, West Hartford and Hartford Village) each with its unique character and identity, heritage and a strong sense of place.

The Town has been dedicated to climate and energy issues for many years, and its focus on these topics has become increasingly strong in recent years. In 2007, Hartford became one of the first towns in the State of Vermont to form an Energy Commission, dedicated to reducing energy consumption and increasing Hartford's share of renewable energy. In 2019 as part of a Town Plan update, the Town completely overhauled its Energy Chapter to create a plan to meet or exceed the State of Vermont's energy goals and achieved a Determination of Energy Compliance from the Two-Rivers Ottauquechee Regional Commission (TRORC).

In October 2020, the Town of Hartford engaged paleBLUEdot for the development of a Climate Action Plan outlining strategies and actions to support achieving Carbon Neutral for Town of Hartford Municipal Operations emissions as well as Town-Wide emissions. This report plan is the result, developed in collaboration with the Town's Climate Action Planning Team.

In support of establishing the goals, strategies, and actions included in this plan, paleBLUEdot also produced a Greenhouse Gas Inventory, a Climate Vulnerability Assessment, a town wide Solar Renewable Energy Potentials Study, and a town wide Carbon Neutral Pathways and Strategic Goals recommendations report. These assessments created the foundation of the Climate Action Planning process.

Why Create a Climate Action Plan

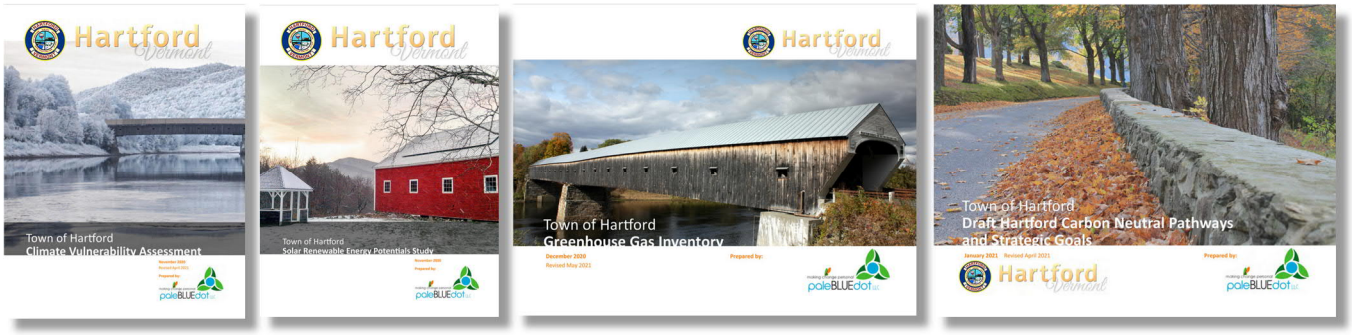
The creation and dedicated implementation of a Climate Action Plan (CAP) is an organized way for a town to contribute to solving the global climate crisis while helping its resident and business communities create improved resilience to the current and future impacts and risks of climate change. Climate action can also create investment in innovation, jobs and actions that save households and businesses money.

What is a Climate Action Plan (CAP)

Climate action plans are comprehensive road maps that outline the specific Strategies and Actions that a Town will implement to reduce greenhouse gas emissions and build resilience to related climatic impacts. The Hartford CAP addresses both climate mitigation and climate adaptation actions.

The Role of Communities in Climate Action

With a large majority of Americans living in urban areas, municipalities play a key role in addressing climate change. While each individual community's impact on global GHG emissions is relatively small, the leadership municipalities provide in motivating change can be extremely significant. According to a survey by the US Conference of Mayors, more than half (53%) of the communities they represented had committed to reducing greenhouse gas emissions.



Introduction

Climate Action as a Journey

The Climate Action Plan represents a robust vision of the future with a comprehensive scope of actions befitting the magnitude of our collective climate challenge ahead. This Climate Action Plan establishes a long-term climate resilience vision and mitigation goal for the community. The plan itself, its strategies, and detailed actions, are intended as a 9 year plan. It is anticipated that this plan would be updated by 2030 to outline the next phase of action towards achieving the long-term community-wide goals.

The Hartford Climate Action Plan should be seen as a living document. Action progress and effectiveness should be reviewed at regular intervals through the plan's implementation and adjustments should be made to expand or modify the scope of individual actions and to augment the plan with new actions as appropriate to respond to ever-changing market and community conditions.

Benefits of Climate Action

The strategies and actions contained in this plan seek to reduce Hartford's dependence on fossil fuels, prioritize sustainable uses of land and water, reduce waste, and support improved equity and livability. The actions outlined in this plan will reduce Hartford's GHG emissions. In addition to reducing the community's contribution to climate change this plan strives to identify how climate change will increasingly impact the community. The Climate Action Plan addresses next steps for Hartford to adequately respond to climate change. If implemented successfully the plan will enhance Hartford's economic vitality, resilience, and viability as a healthy, livable community.

Introduction

Hartford's Vulnerability to Climate Risks:

Climate change is a global phenomenon that creates local impacts. It presents one of the most profound challenges of our time. A broad international consensus exists among atmospheric scientists that the Earth's climate system is being destabilized in response to elevated levels of greenhouse gas emissions in the atmosphere.

Two changes to Vermont's climate are occurring already: shorter winters with fewer cold extremes, and more heavy and extreme precipitation. Increases in the global surface temperature and changes in precipitation levels and patterns are expected to continue and intensify for decades. In turn, these changes in climate have impacts on the economy and health of local communities.

The following highlight the vulnerabilities to climate risks facing Hartford, excerpted from the 2020 Hartford Climate Vulnerability Assessment:

Heat Stress
(Medium)

Warmer temperatures and more extreme heat may lead to higher risk of heat-related illness.

Air Quality
(Medium-low)

Increased heat may result in more days of poor air quality and exposure to allergens, impacting respiratory illnesses.

Vector-Borne Disease
(Medium-high)

Longer growing seasons and higher temperatures may increase vector-borne diseases like West Nile Virus and Lyme disease.

Mental Health
(Medium)

Exposure to increased climate impacts and disasters may lead to increased anxiety and other mental health ramifications.

Housing
(High)

Warmer temperatures will increase demand for air conditioning and weatherization needs. Energy costs may be difficult for vulnerable populations to meet. Heavier rains coupled with higher risk of surface drought conditions may cause more local flooding, particularly "flash flooding" which could cause damage to housing and reduce mobility for portions of the community.

Stormwater Management
(High)

Heavier rains coupled with higher risk of surface drought conditions may significantly increase demand on stormwater management. The Town's stormwater infrastructure may not be capable of handling the amount of runoff during more frequent heavy down pours, requiring resources to make needed upgrades.

Trees, Greenspace, and Agriculture
(High)

Increased temperatures and changes to precipitation will stress trees, greenspace, and agriculture. Conditions may be more favorable for disease, pests, and invasive species. Trees and crop species which formerly thrived in the area's climate may be less suited for future climate conditions.

Surface Water Quality
(Low)

Increases to heavy rain events and flooding/flash flooding risk may negatively impact water quality in the Town's lakes, streams, and rivers. Increased pollutants and contamination potential, combined with increased annual water temperatures could increase risk to algal and bacterial growth, harming habitats and limiting recreation.

Introduction

Estimated Economic Risk of Climate Change to Hartford by 2100

Incidents of severe weather in the United States, such as significant storms and flooding in the Northeast are tangible examples of the types of economic impacts of projected climate trends. Future economic and social impacts of climate change include impacts to agriculture, energy costs, labor impacts, death rates, and crime impacts among others. "Estimating Economic Damage from Climate Change in the United States," a study by Solomon Hsiang et al from the Goldman School of Public Policy at the University of California Berkeley, was a comprehensive effort at quantifying the economic impacts for every county within the United States. (https://science.sciencemag.org/content/356/6345/1362)

The study collected national data documenting the responses in six economic sectors to short-term weather fluctuations. These data were integrated with probabilistic distributions from a set of global climate models and used to estimate future costs during the remainder of this century across a range of scenarios. In terms of overall effects on gross domestic product, the authors predict negative impacts in the southern United States and positive impacts in some parts of the Pacific Northwest and New England.

The sectors assessed, and the findings for annual economic impact as a percentage of GDP for the Town of Hartford based on a pro rata share of Windsor County estimates are:

Energy	Productivity	Property Crime	Violent Crime
+6.4%	-1.1%	+2%	+3.9%

$9,862,237
Annual Cost Impact (in 2020 dollars)*

* Figure does not include increased healthcare costs nor increased property damage due to increased extreme weather events. These values, however, can be significant. Damages from hurricane Sandy, for instance, have been calculated at over $14 Billion for the State of Vermont alone.

Estimated Social Cost of Carbon

"Social Cost of Carbon" is an effort to properly account for the damages caused by greenhouse gas emissions and the resulting climate change impacts. By including the social cost of carbon in planning efforts, agencies and business can properly evaluate policies and decisions that affect greenhouse gas emissions. The "Social Cost of Carbon" is measure of the share of climate change economic harm and impacts from emitting one ton of carbon dioxide into the atmosphere. For Hartford it can be calculated as follows:

Estimated Economic Risk of Climate Change:		Current Annual GHG Emissions:		Current Estimated Localized Social Cost of Carbon:
$9,862,237 Annual Cost Impact	÷	**93,735** Metric Tons	=	**$105** Per Ton

Cumulative Economic Savings Potential of Implementing the Climate Action Plan Through 2030

Transportation Savings Potential:		Energy Efficiency and Renewable Energy Savings Potential:		Waste Reduction Savings:		Social Cost of Avoided Carbon:
$33,700,000	+	$10,530,000	+	$6,780,000	+	$13,880,000

Cumulative Community-Wide Savings Potential:

= **$64,890,000***

* Value does not include economic potential of job creation and new business potential represented in the Climate Action Plan actions. (see Appendix for more)

Introduction

What Are GHG's?

A greenhouse gas is a molecule in the atmosphere which does not react to light energy in the visible range (like sunlight), but does react to light energy in the infrared range -like that which is emitted from the Earth after being warmed by the sun. The most common greenhouse gases include carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O).

Why do GHG's Matter?

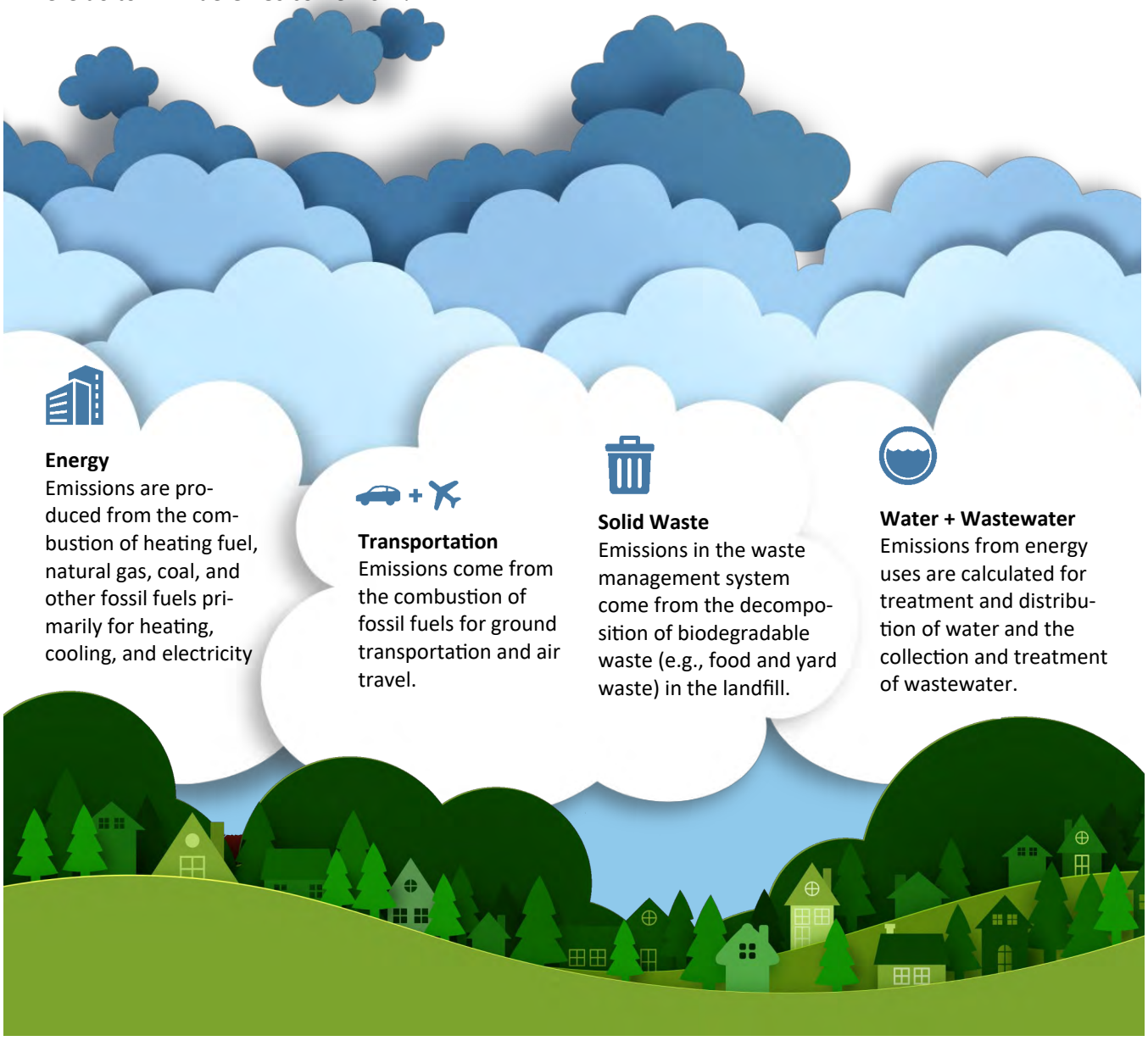
GHG's let the sun's light shine onto the Earth's surface, but they trap the heat that reflects back up into the atmosphere. In this way, they act like the insulating glass walls of a greenhouse. The more GHGs there are, the more heat that is trapped in our atmosphere and the more we experience the impacts of global warming.

What can we do to reduce GHG's?

Greenhouse gases can be reduced by making changes within the key greenhouse gas sectors within our community—particularly through the reduction and elimination of fossil fuel combustion and the advancement of clean energy sources.

Key Greenhouse Gas Sectors

Where do town wide GHGs come from?



Energy
Emissions are produced from the combustion of heating fuel, natural gas, coal, and other fossil fuels primarily for heating, cooling, and electricity

Transportation
Emissions come from the combustion of fossil fuels for ground transportation and air travel.

Solid Waste
Emissions in the waste management system come from the decomposition of biodegradable waste (e.g., food and yard waste) in the landfill.

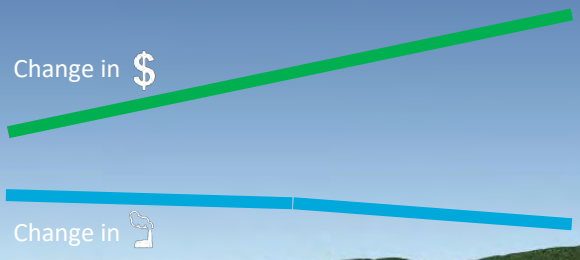
Water + Wastewater
Emissions from energy uses are calculated for treatment and distribution of water and the collection and treatment of wastewater.

Hartford Community Wide GHG Emissions Trends

2013 By The Numbers	2019 By The Numbers	6 Year Trend Dashboard	
GHG Emissions	**GHG Emissions**	**GHG Emissions**	
103,940	93,735	-10,205	-9.82%
10.51 MT Per-Capita	9.72 MT Per-Capita	-0.79 MT Per-Capita	
9.41 MT / Job	8.11 MT / Job	-1.30 MT / Job	
0.2497 MT / $1,000 GDP	0.1958 MT / $1,000 GDP	-0.05 MT / $1,000 GDP	
Population	**Population**	**Population**	
9,893	9,643	-250	-2.53%
GDP	**GDP**	**GDP**	
415,775,971	478,504,672	+$62,728,701	+15.09%
$42,027 GDP Per-Capita	$49,622 GDP Per-Capita	+$7,595 GDP Per-Capita	
Employment	**Employment**	**Employment**	
11,043	11,554	+511	+4.63%

Is Economic Development Tied To Increased Emissions?

No! Between 2013 and 2019 the Town was able to decrease it's GHG emissions by 9.82% while growing it's economy by 15.09% (pro rata share of County reporting) and adding 4.63% more jobs!



How Large Are Town Wide GHG Emissions?

The community's total emissions for 2019 are equal to **1.85 Billion** cubic feet of man-made greenhouse gas. This volume of atmosphere is equal to a cube **1,227** feet on each face.

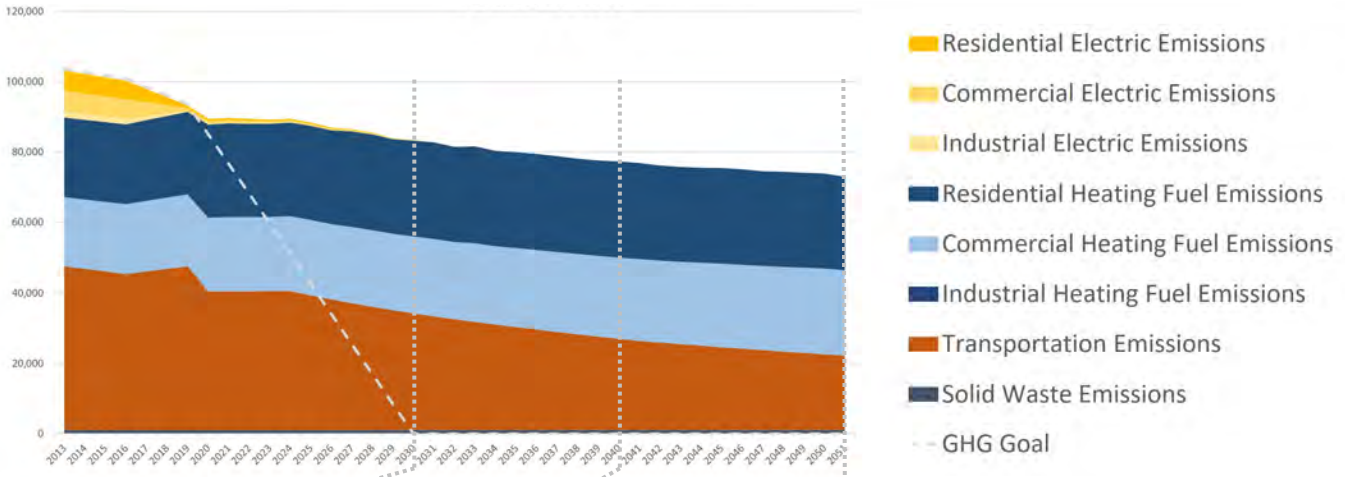
Community Wide GHG Emissions By Sector

Introduction

Townwide GHG Emissions Forecast

A GHG emission forecast supports GHG reduction planning efforts by anticipating what emissions may be like if actions are not taken. Emissions are typically forecast under a business-as-usual (BAU) scenario. The Intergovernmental Panel on Climate Change (IPCC) defines a "business-as-usual" baseline case as the level of emissions that would result if future development trends follow those of the past and no changes in policies take place.

The Town of Hartford GHG forecasts included here were based on population, employment, and vehicle use growth estimates determined by the State of Vermont. In addition to these data, the BAU draws from information from the US Environmental Protection Agency, US Department of Transportation, and US Energy Information Agency. The full assumptions used for the Business-as-usual GHG Emissions Forecast model are outlined in detail in the appendix of this plan.



	2030	2040	2050
Change from 2019			
GHG Emissions	**-19.2%**	**-25.0%**	**-28.3%**
Total Annual GHG	83,902	77,830	74,393
Goal Annual GHG	0	0	0
Difference	83,902	77,830	74,393
Energy (Building heating fuels and electricity)			
Electricity Use Emissions:	**-100.0%**	**-100.0%**	**-100.0%**
Residential	0	0	0
Commercial	0	0	0
Industrial	0	0	0
Heating Fuel Use Emissions:	**15.7%**		
Natural Gas Use Emissions:		**19.3%**	**21.0%**
Residential	27,271	27,405	27,079
Commercial	21,734	23,128	24,197
Industrial	0	0	0
Transportation Emissions	**-28.5%**	**-45.5%**	**-53.6%**
* VMT (Thousands)	97,302	100,269	102,470
Solid Waste Emissions:	**1.5%**	**4.6%**	**7.2%**
** LFG Emissions	1,073	1,105	1,132
Water + Wastewater	**1.5%**	**11.1%**	**-100.0%**
Water Emissions	31	32	33
Wastewater Emissions	443	455	466

* VMT = "Vehicle Miles Traveled

** LFG = Landfill Gas

Introduction

Our Carbon Reduction Goal

The Hartford Selectboard and School Board formed the Ad-Hoc Climate Advisory Committee in 2019 and subsequently voted unanimously to pass a Joint Resolution Declaring a Climate Emergency, making climate change a defining focus for Town planning, funding, and action. The action resolves that:

> **The Town shall achieve net-zero greenhouse gas (GHG) emissions town-wide by 2030 and that "Hartford's response to the climate emergency be just and equitable, especially with respect to the most vulnerable and impacted members of society."**

Following the passage of the Resolution, an additional ballot resolution ("Article 25") passed with 65% of the vote, requiring the Town to lead by example and that:

> **The operation and maintenance of the Town of Hartford's municipal infrastructure and equipment shall achieve carbon neutrality by 2027.**

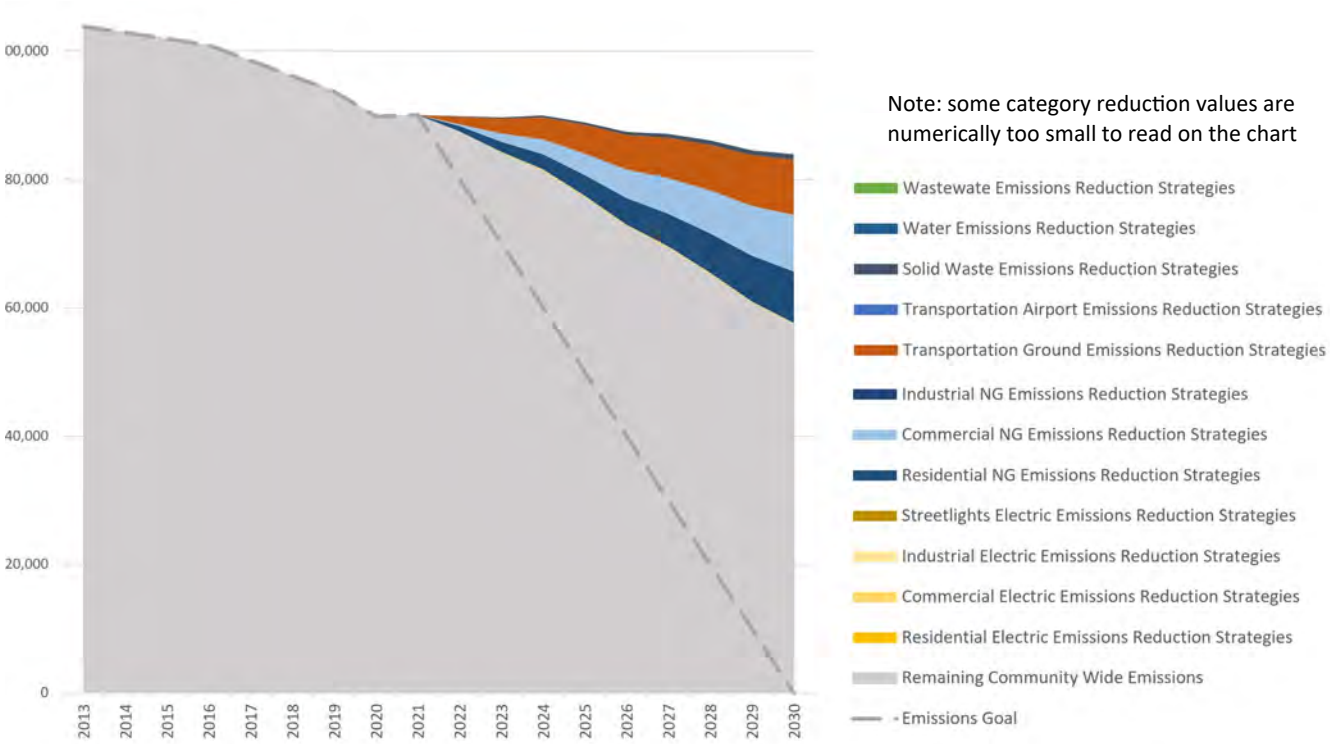
These goals are reflected in strategies established for individual sectors which seek to both support the Town's Climate Action Plan in creating a climate resilient community and to reduce town wide GHG emissions in line with the above goal. Sector goals related to GHG emissions reductions are designed to balance reduction across all sectors and achieve the overall emissions goals set forth for the community. The goals seek to strike a balance between achievability and support of the Town's bold emission reduction targets.

Introduction

Estimated Town Wide GHG Reductions Included in This Plan

Long-term emission reduction potentials of the strategies and actions included in this plan have been modeled based on projected energy and fuel reductions and adoption rates of renewable energy and low/no emission transportation modes outlined in the strategies and actions. From this modeling, we know that with the successful implementation of this climate action plan, by 2030 Town wide annual GHG emissions are projected to be 46,383 metric tons below 2013 levels and 36,177 metric tons below 2019 levels. The potential cumulative GHG emissions reductions over the 10 year implementation period are estimated at over 131,959 metric tons - an elimination of over **2.6 billion cubic feet** of man made greenhouse gas atmosphere resulting from this climate action plan.

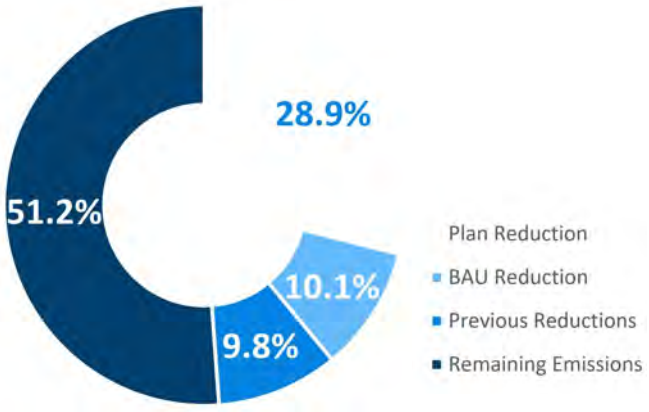
Town Wide GHG Emission Reductions Wedge Diagram



Breakdown of Town Wide GHG Emissions Reductions From 2013 to 2030

Total anticipated GHG emissions reductions by 2030 include emissions reductions which have already occurred since 2013, reductions which are anticipated within the Business-as-Usual forecast, and the reductions resulting from the strategies and actions included in this plan.

As illustrated in the chart to the right, town-wide emissions in 2030 are anticipated to be 48.8% less than they were in 2013.



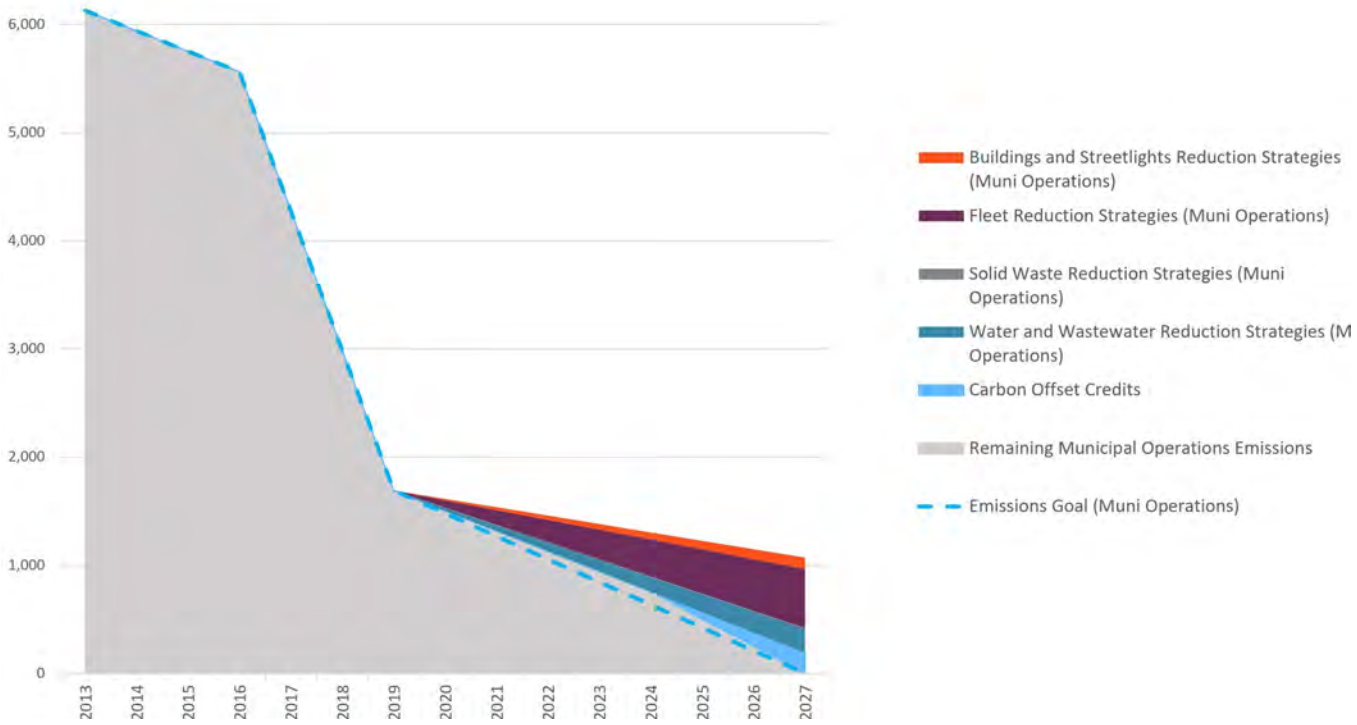
Introduction

Estimated Town Operations GHG Reductions Included in This Plan

By 2027, the modeled emissions reductions associated with Town Operations reductions strategies and actions are projected to be 5,935 metric tons below 2013 levels and 1,499 metric tons below 2019 levels prior to purchase of carbon offsets (Strategy MO 6). It is projected that potentially 3.2% of Town Operations emissions may remain by 2027. These potentially remaining emissions include an estimated 191 metric tons of biogenic emission from municipal wastewater treatment and 2 metric tons from solid waste.

Town Operations GHG Emission Reductions Wedge Diagram

(note: sharp emission reduction shown between years 2016 and 2019 primarily reflect a significant change in the emissions factor—emissions per kWh of electricity consumed—associated with grid purchased electricity in Hartford.)



Breakdown of Town Municipal Operations GHG Emissions Reductions From 2013 to 2030

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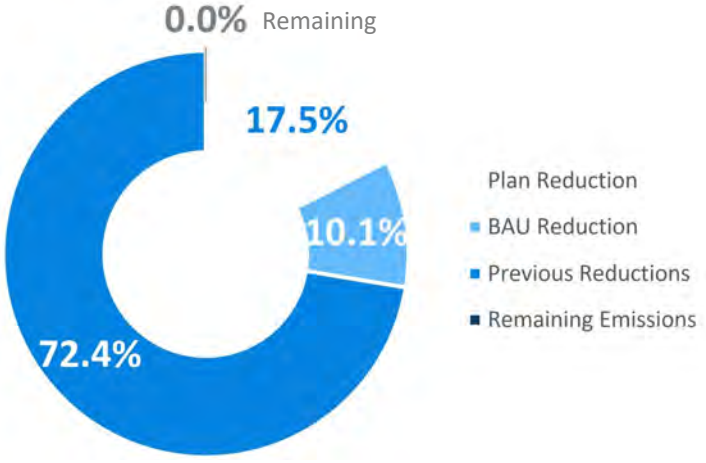


Introduction

The Process

The plan was developed in collaboration with a 32 person planning team of community members, business community members, non-profit organizations, Town commissions, and Town of Hartford staff. The planning team was organized into sub-teams aligned with each of the community-wide climate action sectors included in this plan (see Plan Framework). The plan was developed through a number of planning workshops from January 2021 through May 2021.

Development and implementation of the Hartford Climate Action Plan are opportunities for the Town of Hartford government and partners in the community to research and articulate some of Hartford's most pressing resilience challenges; identify specific, multi-benefit actions that contribute to solutions to those challenges; and secure additional resources, technical assistance, and partnerships to accelerate next steps.

The goals and actions identified in the Climate Action Plan are grounded in community input, expert analysis, and best practices from other cities throughout the United States. Strategic goals and detailed actions were developed by the Planning Team through a series of workshop meetings. A preliminary draft of actions were reviewed against action screening criteria which enabled the Planning Team to evaluate, refine, finalize, and prioritize the actions to be incorporated in the final Climate Action Plan.

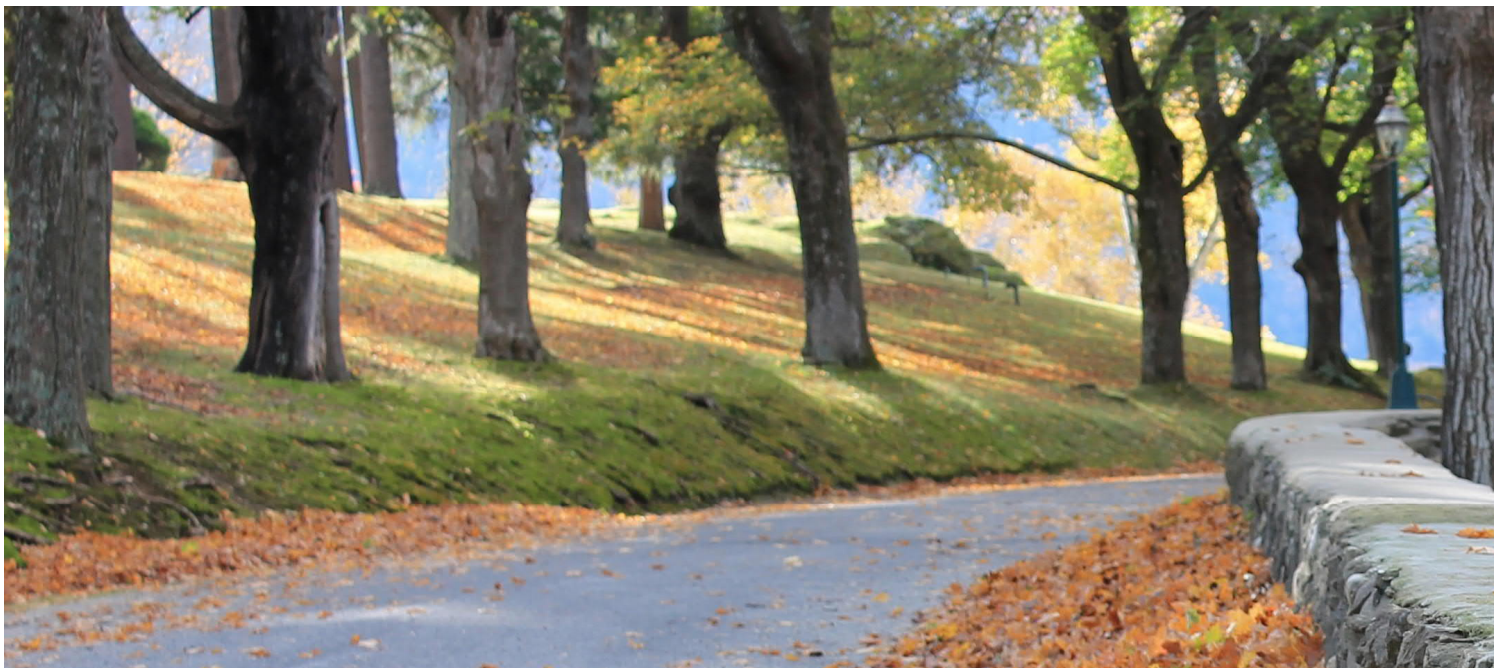
Hartford Action Screening Criteria

Actions were prioritized within each sector based on Planning Team review against the following action screening criteria established by the team (note, action prioritization across all sectors should be conducted by the Hartford CAP Team based on resources and annual implementation plan—see Implementation Section for more)

Support: How likely is it to be adopted by the municipality or community-wide? Is it politically feasible? Is there community support? Is it consistent with the municipal or community priorities and readiness to implement?

Impact of Implementation: How likely is it to achieve the goal? Will it impact a large portion of the targeted emissions sector or population? What are the potential impacts to the 7th generation? the wellbeing of people worldwide? and the health of the planet? How likely is it to address the goal?

Equity of Implementation: Will it positively support advancing equity within the community? Address an existing inequity in the community, such as disproportionate poor air quality, access to transit, flood risk, etc? Does it address the needs of vulnerable and historically marginalized populations? Does it reduce vulnerability for all populations? Is it fair? Does it avoid having a negative impact on people outside our community?



Introduction

Climate Action Plan Framework
This Climate Action Plan includes an implementation framework designed to achieve community-wide goals for greenhouse gas reduction and climate adaptation and resilience. The plan is organized around a unifying framework organized by sector as illustrated to the right. Each sector has over-arching Strategies established to meet 2030 goals and detailed Actions for implementation. Sector actions include a focus on Climate Mitigation, Climate Adaptation, or both.

Climate Mitigation: addresses the root causes of climate change through the reduction or prevention of greenhouse gas (GHG) emissions. Sectors with this as a significant focus are shown to the right with this symbol:

Climate Adaptation: seeks to lower the risks posed by the impacts of climate change which are now inevitable or likely. Sectors with this as a significant focus are shown to the right with this symbol:

Buildings and Energy

Emissions associated with all electricity and heating fuel/propane consumption within the Town. Approaches to this sector area include improved energy efficiency and resilience.
Sector strategies include:

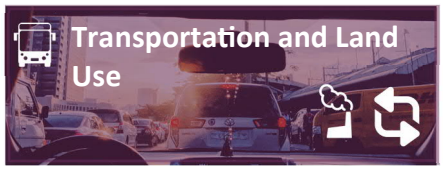
Strategy BE 1: Improve total Community wide residential, commercial, and industrial building energy efficiency by 10% Electricity and 10% Thermal Fuel by 2030.

Strategy BE2: Increase Net Zero buildings within the community to 5% of building stock by 2030.

Strategy BE 3: Achieve 30% residential, commercial and industrial building thermal "fuel switching" (to renewable source) to reduce on-site fossil fuel use by 2030.

Strategy BE 4: Increase on-site distributed renewable energy from 3% to 15% of Residential and Commercial electric use by 2030.

Transportation and Land Use



Emissions from on-road vehicle traffic occurring in the community. Approaches to this sector area include reductions in vehicle miles traveled as well as shifts to public transit and alternative modes of transportation like biking and walking. Sector strategies include:

Strategy TL 1: Decrease community wide VMT by 2.9% by 2030.

Strategy TL 2: Increase average population per developed acre by 5% by 2030.

Strategy TL 3: Increase battery electric vehicle (BEV, eBike, etc) utilization to 21.5% of community wide rolling stock by 2030 (for autos, this requires an increase from approximately 25 vehicles in 2019 to 2,333 vehicles in 2030 community-wide).

Strategy TL 4: Establish viable no/low emission vehicle fuel sources to serve community by 2025. Achieve 25% diesel consumption replacement with no/low emission fuels by 2030.

Strategy TL 5: Increase Public Transit Access and Ridership for all forms of trips, including increasing commuter ridership from 1.72% to 8% by 2030.

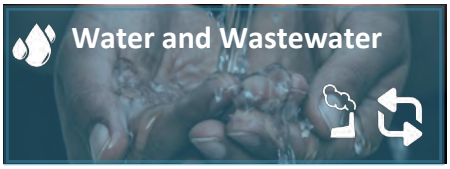
Introduction

All solid waste generated by residents and businesses within the community and their associated emissions. Approaches in this sector focus on diversion of food, consumer, and construction waste.
Sector strategies include:

Strategy WM 1: Achieve 100% organics landfill waste diversion by 2023.

Strategy WM 2: Increase recycling from 5% to 20% of total MSW handled by 2030 in an energy efficient, low emission manner.

Strategy WM 3: Decrease total per capita municipal solid waste handled by 5% by 2030.



All potable water, wastewater collection and treatment, flood mitigation, and surface water health. Approaches to this sector focus on water conservation, wastewater reduction, flood mitigation, and stormwater management.
Sector strategies include:

Strategy W 1: Promote increased water conservation Town Wide with a targeted reduction of 6% (water and wastewater) by 2030.

Strategy W 2: Mitigate the projected increased flood hazards and impacts due to climate change.

Strategy W 3: Increase stormwater and wastewater treatment capacity to meet newly defined criteria of major storm and climate events by 2027.

Food cultivation and distribution, nutrition insecurity, and food waste. Approaches to this sector include reduction of food waste, food system resilience, strengthening of local food production, and equitable access to healthy food. Sector strategies include:

Strategy LF 1: Increase production of local food, particularly serving low income and food insecure individuals.

Strategy LF 2: Increase access to local food.

Strategy LF 3: Reduce food waste and hunger, achieve a 50% reduction in food insecurity community-wide by 2030.

Strategy LF4: Increase local agricultural resilience to climate shocks.

Resilience of urban tree canopy, ground cover, greenspace, parks, and ecosystems. Focus includes expansion of tree canopy coverage, improvement of beneficial use of lawn areas, and mitigation of heat island impacts.
Sector strategies include:

Strategy GT 1: Increase Tree Cover and Diversity, achieve an increase of 90 acres by 2030.

Strategy GT 2: Increase the use of Native Species and Pollinator Restorations Areas with a targeted conversion of 10% of Town-wide lawn coverage.

Strategy GT 3: Reduce Micro-Heat Island Effect through Town-Wide impervious surface reduction of 2% by 2030.

Strategy GT 4: Care for forest and wildland ecosystem health to enhance their resilience to climate change and capacities for carbon sequestration.

Strategy GT 5: Increase the resilience of the urban tree canopy and greenspaces to climate change impacts.

Community health impacts and resilience in the face of current and projected climate impacts & risks. approaches in this sector focus on community resilience and connections.
Sector strategies include:

Strategy HS 1: Educate, engage, and empower the public on health and safety risks of climate change impacts.

Strategy HS 2: Assist the Town's vulnerable populations in preparing for and mitigating climate change impacts from extreme heat, flooding, storm, and vector borne disease.

Strategy HS 3: Maintain updated plans to address climate risks and impacts.

Strategy HS 4: Strengthen community response capacity and support networks.

Economic development, jobs, and business creation potential represented by the actions and goals of all sectors in this Climate Action Plan. Approaches include workforce and economic development, and resilience of businesses.
Sector strategies include:

Strategy CE 1: Capture local economic potential of climate action.

Strategy CE 2: Increase workforce development and retention for the climate economy.

Strategy CE 3: Build marketplace climate resilience.

Strategy CE 4: Establish sustainable financing for the Town's climate action implementation.

Introduction

Addressing Municipal Operations Reductions

This plan includes six strategies focused on achieving the established Municipal Operation GHG reduction goals. These strategies include five which relate directly to the eight sectors outlined in the Climate Action Plan Framework outlined on the previous page and an additional strategy addressing potential carbon offsetting required to achieve full carbon neutrality of Municipal Operations by 2027.

Municipal Operations

Strategy MO 1: Improve total Municipal building energy efficiency by 15% Electricity and 15% Thermal Fuel by 2030.

Strategy MO 2: Achieve 100% Municipal building thermal "fuel switching" to reduce on-site fossil fuel use by 2027.

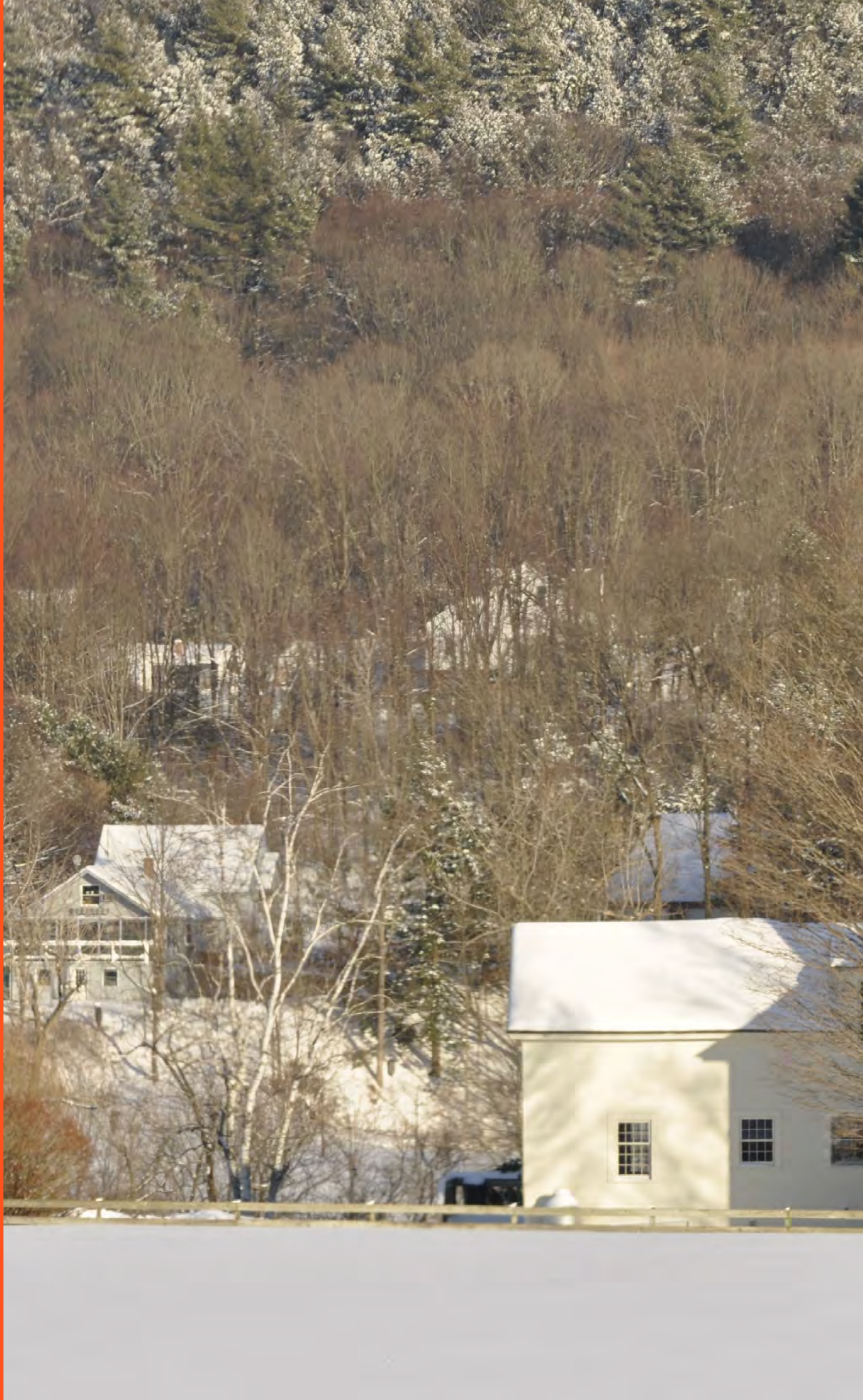
Strategy MO 3: Achieve 100% conversion of municipal operations gasoline and e10 gasoline fleet vehicles and equipment within municipal fleet to EV's by 2027. Achieve 100% conversion of all municipal fleet vehicles and equipment to EV's by 2040.

Strategy MO 4: Convert all remaining municipal operations diesel fuel utilization to no/low emission fuels by 2027.

Strategy MO 5: Achieve 100% organics landfill waste diversion, 10% increased recycling diversion, and 5% overall waste reduction for municipal operations by 2027.

Strategy MO 6: Achieve Carbon Neutral Municipal Operations by 2027.

Section 02
Buildings and Energy



Click here to return to TOC

Buildings + Energy
In Hartford

104,919,000
kWh of electricity in 2019

680,489
Million BTU of heating energy

+3.9%
Change in community-wide heating fuel consupmption since 2013

+8.4%
Change in residential electricity consumption since 2013

+33.8%
Change in commercial electricity consumption since 2013

Buildings and Energy

Why Buildings and Energy Is Important

Building construction and operations can have extensive direct and indirect impacts on the environment, society, and economy. Buildings use significant resources (energy, water, raw materials, etc.), generate waste (occupant, construction, and demolition), emit potentially harmful atmospheric emissions, fundamentally change the function of land, and the ability of that land to absorb and manage water.

Building energy use is a major contributor to greenhouse gas (GHG) emissions. The Building Energy sector includes all residential, commercial, and industrial buildings. Greenhouse gas emissions from this sector come from **direct emissions** – from fossil fuels burned *on-site* for heating or cooking needs – as well as **indirect emissions** – from fossil fuels burned *off-site* in order to supply that building with electricity. Building design plays a large role in determining the future efficiency and comfort of facilities. Increasing energy efficiency can help reduce GHG emissions and result in significant cost savings for both homes and businesses. The Hartford community can also achieve environmental, social, and economic benefits through enhancements to the built environment. The Buildings and Energy sector is 49% of Townwide GHG emissions for the Town of Hartford. Within this sector, the share of residential consumption is 53%, commercial/industrial and government buildings are 47%.

Hartford Energy Use Profile

Residential:

According to 2019 community wide data, the residential sector in Hartford consumes nearly 40.3 million kWh of electricity annually. This is equal to 8,679 kWh per household. The sector also consumes over 378.5 billion BTU's of heating energy annually primarily from heat oil, propane, and wood.

Commercial:

The Hartford commercial and industrial sector in 2019 consumed nearly 64.6 million kWh, equal to 5,590 kWh per job. These sectors also consume over 302 billion BTU's of heating energy from heat oil, propane, and natural gas.

Climate Change Considerations

Climate Impacts

This sector impacts climate change through the combustion of fossil fuels (coal, natural gas, heating oil, propane) to generate electricity and heat/cool our buildings.

Climate Hazards

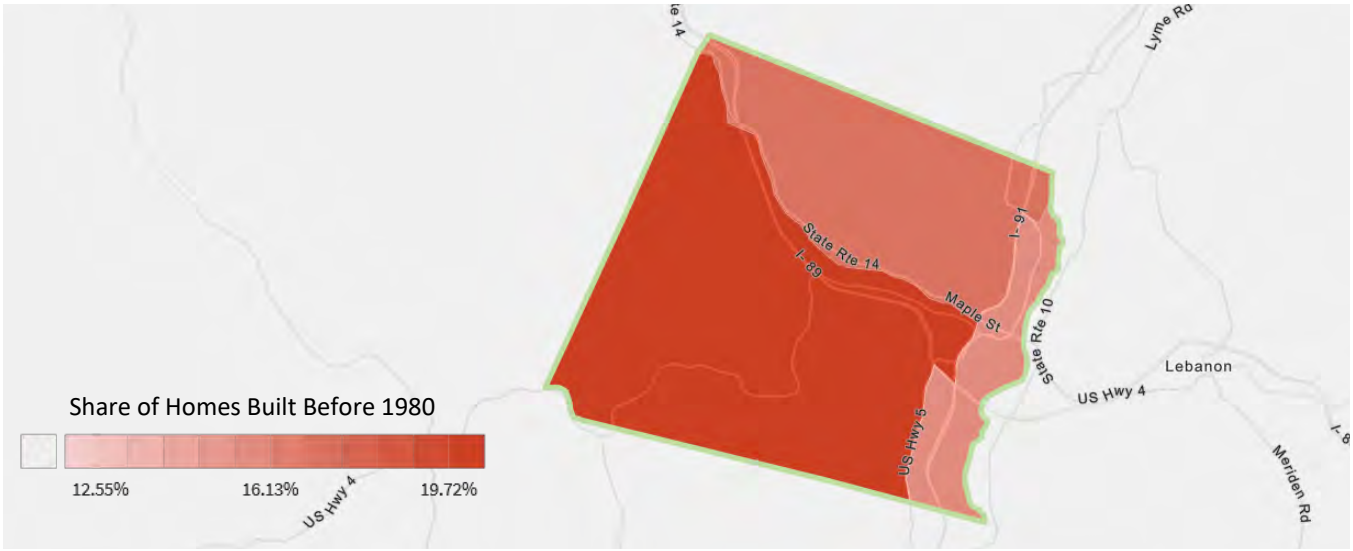
Hazards to Buildings and Energy include damage to buildings and energy grid infrastructure from extreme weather and flooding, increased power outages, and increased energy demand and cost expenditure due to rising temperatures and weather variability.

Buildings and Energy

Hartford Building Stock Efficiency

The measure of a community's existing building stock, certified high performance buildings, and housing characteristics provides a basis for determining the current and potential energy efficiency gains for the community. Energy and water efficiency upgrades are one of the simplest and most effective ways to conserve resources, save money, and reduce greenhouse gas emissions. New building technology has increased energy efficiency significantly in recent decades. Although newer U.S. homes are 30 percent larger, they consume a similar amount of total energy as older homes - meaning they are more energy efficient per square foot of space. According to the US Energy Information Administration, homes built between 2000 and 2009 used 15% less energy per square foot than homes built in the 1980s, and 40% less energy than homes built before 1950.
This means that retrofitting older homes with some of these technologies provides ample opportunity to improve energy efficiency throughout the community. Below is a map of the distribution of homes built before 1980 in Hartford and a chart outlining the estimated annual energy savings potential for households built before 1980:

Hartford Homes Built Before 1980



Energy Savings and Thermal Fuel Switching Potential of Hartford Homes Built Before 1980

	Estimated Units	Est Thermal Energy Consumption (Billion BTU)	Targeted Energy Improvement Participation by 2030*	Anticipated Annual Electric Savings by 2030 (MMkWh)	Anticipated Annual Thermal Energy Savings by 2030 (Billion BTU)	Targeted Fuel Switching Participation by 2030 by sf	Combined Estimated GHG Reduction by 2030
Total Households	**4,340**		**2,920**				
Owner Occupied	**2,750**	**251.78**	**1,851**	**3.17**	**25.43**	**550**	**(4,855)**
Built 1980 to 1999	857	78.63	229	0.39	3.16	63	(600)
Built 1960 to 1979	746	68.31	746	1.28	10.25	224	(1,900)
Built 1940 to 1959	261	23.83	261	0.45	3.57	78	(663)
Built 1939 or Earlier	615	56.39	615	1.05	8.46	185	(1,568)
Renter Occupied	**1,590**	**145.35**	**1,069**	**1.82**	**14.64**	**318**	**(2,800)**
Built 1980 to 1999	513	46.86	125	0.21	1.71	35	(328)
Built 1960 to 1979	473	43.29	473	0.81	6.49	142	(1,204)
Built 1940 to 1959	162	14.69	162	0.27	2.20	49	(409)
Built 1939 or Earlier	309	28.20	309	0.53	4.23	93	(784)
Total Reduction Potential				**5.00**	**40.07**	**868**	**(7,655)**

Hartford Heating Fuel Switching Potential

According to data collected for the Hartford Greenhouse Gas Inventory, approximately 42% of residential heating is provided by fuel oil, 38% from propane/tanked natural gas, and 11% by electricity, 7.8% by fire wood or wood pellet fuel, and approximately 1% by solar thermal. Similarly, 61% of commercial and industrial heating is provided by fuel oil and the remaining 39% from propane/tanked natural gas (note, extent of electric heating for commercial and industrial properties is unknown). As Hartford's electric grid nears carbon neutrality, building heating fuel will become an increasingly important target for emission reductions. Consequently, reduction, and ultimately the elimination of all fossil fuel heating (oil, propane, natural gas) will be required in order to achieve community wide carbon neutrality.

	Estimated Units		Heating Fuel Emissions Remaining Following Energy	Targeted Fuel Switching Participation by 2030 by sf	Estimated GHG Reduction by 2030 Metric Tons
Total Households	**4,340**				
Owner Occupied	**2,750**	**63.4%**	**15,543**	**688**	**(3,886)**
Built 2010 or Later	18	0.4%	109	5	(27)
Built 2000 to 2009	253	5.8%	1,582	63	(395)
Built 1980 to 1999	857	19.8%	5,183	214	(1,296)
Built 1960 to 1979	746	17.2%	3,987	187	(997)
Built 1940 to 1959	261	6.0%	1,391	65	(348)
Built 1939 or Earlier	615	14.2%	3,292	154	(823)
Renter Occupied	**1,590**	**36.6%**	**8,976**	**398**	**(2,244)**
Built 2010 or Later	0	0.0%	0	0	**0**
Built 2000 to 2009	133	3.1%	845	33	(211)
Built 1980 to 1999	513	11.8%	3,101	128	(775)
Built 1960 to 1979	473	10.9%	2,527	118	(632)
Built 1940 to 1959	162	3.7%	858	41	(214)
Built 1939 or Earlier	309	7.1%	1,646	77	(411)
Total Reduction Potential			**24.519**	**1.085**	**(6.130)**

Hartford Renewable Energy Market Potential

As outlined in the Hartford Renewable Energy Potentials Study, a number of scenarios for potential future market absorption of on-site solar installations exist. Scenario B outlined below, is the recommended scenario:

> Scenario B: This scenario anticipates the Town's share of the projected future Vermont solar pv installation rates to match the Town's current share of the State population. This scenario would mean an increase of approximately 2,074 KW of installed capacity within the Town by 2025, approximately 11.25% annual increase over that timeframe. This would result in around 5,974 KW of installed capacity, equivalent to approximately 20% of the total rooftop technical capacity potential.
> NOTE: This projection does not include distributed ground-mounted solar pv potentials nor utility scale solar pv installation potential.

The chart below shows projections through 2040 using the assumptions outlined above.

Scenario B: Hartford Rooftop Solar PV Share of Statewide Projections Based on Population Share (11.25% Initial Annual Increase)

Year	Cumulative Installed (KW)	Annual Generation (KWH)	% of Townwide Electric Consumption	This is Equivalent to adding (x) Average Residential Arrays Annually:	Or Equivalent to adding (x) Average Commercial Arrays Annually:
2025	5,974	6,476,800	**8.92%**	**61**	**10.4**
2030	10,180	11,037,242	**15.20%**	**144**	**18**
2040	17,597	19,077,778	**26.27%**	**145**	**19**

Buildings and Energy

Equity Considerations

- Often, families that live in properties that are not energy efficient are also those that can least afford high-cost utility bills. These households may lack the ability to pay for energy efficiency improvements or access renewable energy options.
- Renters of both single family homes as well as multi-family housing usually do not have the ability to implement energy efficiency measures to the buildings they live in to gain the benefits of energy efficiency.
- Families with fewer resources must dedicate a disproportionately larger share of their income towards energy costs, which exacerbates other vulnerabilities including exposure to heatwaves and other climate vulnerabilities. These same families are sometimes forced to forego basic access to service altogether - an estimated 66 households in Hartford go without heating fuel of any type (US Census heating fuel utilization data).

Town-Wide Buildings and Energy Targets Supporting Sector Goals

Sector goals are established to both support the Town's Climate Action Plan in creating a climate resilient community and to reduce Town-wide GHG emissions.

	Townwide Renewable Energy (% of total consumption)	Townwide Electricity Consumption	On-Site Thermal Fuel Consumption	Structures Weatherized	Structures with Electrified Heating
	+	-	-	+	+
Today	3%	105 GHW	680 Billion BTU	134	10%
2030 Targets	**15%**	**94 GWH**	**612 Billion BTU**	**2,910**	**30%**

Strategies Supporting Sector Goals

Sector goals related to GHG emissions reductions are designed to balance reduction across all sectors and achieve the overall emissions goals set forth for the community. The goals seek to strike a balance between achievability while also reaching for improvement beyond business-as-usual.

As indicated in the introduction, the Climate Action Plan is intended to be a 9 year plan to be updated at the completion of that time. Consequently, the goals and strategies outlined in this section are intended to be achieved by 2030 (or earlier) unless otherwise noted.

Implementation of actions are anticipated to be initiated over 3 phases: phase 1 within 1-2 years, phase 2 within 2-5 years, and phase 3 within 3-7 years of CAP approval.

1. **Strategy BE 1:** Improve total Community wide residential, commercial, and industrial building energy efficiency by 10% Electricity and 10% Thermal Fuel by 2030.
2. **Strategy BE2:** Increase Net Zero buildings within the community to 5% of building stock by 2030.
3. **Strategy BE 3:** Achieve 30% residential, commercial and industrial building thermal "fuel switching" (to renewable source) to reduce on-site fossil fuel use by 2030.
4. **Strategy BE 4**: Increase on-site distributed renewable energy from 3% to 15% of Residential and Commercial electric use by 2030.

Buildings and Energy

1 Strategy BE 1:

Improve total Community wide residential, commercial, and industrial building energy efficiency by 10% Electricity and 10% Thermal Fuel by 2030.

	Actions	Implementation Phase
BE 1-1	Work with Green Mountain Power and other local partners to establish or expand and promote a residential and multi-family energy efficiency audit and upgrade program similar to Xcel Energy's "Home Energy Squad Visits". Target 200 households per year (https://www.homeenergysquad.net/)	1
BE 1-2	Establish a policy or ordinance requiring landlords to provide an energy disclosure, a statement of previous occupants' energy usage and expenses, when advertising and leasing properties. https://palebluedot.llc/hartford-cap-policy-examples	1
BE 1-3	Work with Green Mountain Power and other partner organizations to establish and promote building retro commissioning program to identify energy efficiency upgrades and operation and maintenance practices that improve affordability, comfort, indoor air quality and energy efficiency in all commercial and multifamily buildings. Goal 40 businesses commissioned annually	1
BE 1-4	Partner with Efficiency VT and other energy efficiency programs to develop, implement and moderate energy efficiency programs serving hard-to-reach segments of commercial properties (e.g., commercial rental, restaurants, large scale manufacturing, offices, affordable multifamily housing)	1
BE 1-5	Work with partner organizations to promote building retro-commissioning and operation and maintenance practices that improve affordability, comfort, indoor air quality and energy efficiency in all commercial and multifamily buildings.	1
BE 1-6	Work with school district to encourage and support energy efficiency programs, geothermal energy and solar energy installations at all school district facilities and to promote these strategies through curricula with students and communications with families.	1
BE 1-7	Develop and adopt a rental housing energy efficiency policy by 2025 requiring single family and multi-family rental housing properties to meet minimum energy efficiency level to qualify for rental licensing. Program to include an energy efficiency rating system (ENERGY STAR or HERS) or a Town "Green Landlords" certification program based on the energy efficiency of their rental units. Example program: https://bouldercolorado.gov/plan-develop/smartregs. https://palebluedot.llc/hartford-cap-policy-examples	2
BE 1-8	Establish new incentives and expand and promote existing incentives for energy and efficiency, weatherization, energy storage, renewable energy, and water efficiency (e.g. expedited permitting, rebates, property tax incentives, utility programs, etc) for all public and private buildings. Re-instate impact fees and increase impact fees over 5 years and add rebates for projects that meet Town CAP objectives for increased building efficiency and greenspace.	2
BE 1-9	Establish a Cool Roof policy to promote and advance the development of cool roofs on existing buildings and new construction. For information on cool roofs: https://cutt.ly/in3Q7M2 https://palebluedot.llc/hartford-cap-policy-examples	2
BE 1-10	Create a motivational program that provide incentives based on energy use reduction in addition to demand reduction (e.g., initiate a competition and offer prizes/ incentives based on energy use reduction by groups of residents, schools, businesses, municipal buildings, etc)	3
BE 1-11	Explore introducing an energy audit at the home point-of-sale or through the building permitting process, while making the audit an entry-point into all available efficiency products and services.	3

Buildings and Energy

2 Strategy BE 2:

Increase Net Zero buildings within the community to 5% of building stock by 2030.

	Actions	Implementation Phase
BE 2-1	Complete the pilot Net Zero / Net Zero Ready new construction program initiated in 2019.	**1**
BE 2-2	Establish a Net Zero Ready ordinance for new commercial buildings, multi-family residential buildings, and residential subdivision construction that improves energy efficiency and supports increased adoption of net zero construction techniques. Ordinance should include a "solar ready" requirement. Collaborate with the four core towns to establish similar ordinances/policies. Reach for best practices such as Living Building Challenge, Architecture 2030, LEED, Passive House, net zero, etc. for new residential, commercial, and municipal buildings. Goal: achieve ordinance and compliance by 2025 with an anticipated average of 15 new single family residents annually and 17 multi-family units annually by 2026 (based on permit history from 2017 through 2020). https://palebluedot.llc/hartford-cap-policy-examples	**1**
BE 2-3	In support of the Town's net zero and net zero ready program, conduct a study of costs and options for financing mechanisms for achieving Hartford community wide net zero goals.	**1**
BE 2-4	Establish a Net Zero Energy Building Guide providing building owners, renters, developers, designers, and contractors with detailed information on strategies to make new construction or significant renovation projects Net Zero Energy or Net Zero Energy ready. https://view.publitas.com/palebluedot/bloomington-net-zero-energy-building-guide/	**1**
BE 2-5	Continue town's initiative to promote net zero and net zero ready program, resources, and information educating community members on building/renovation strategies, costs, and financing options. Include education and promotion of use of Green Appraisals (i.e. what is a green appraisal? Their value and why you should get one? When and how do you get one? Etc)	**1**
BE 2-6	Develop standard deep retrofit specifications and incentives for existing residential building owners to reduce the carbon footprint of the building to zero.	**2**
BE 2-7	Build market demand for net-zero energy buildings through incentives, education, demonstration projects, partnerships and recognition.	**2**

Buildings and Energy

3 Strategy BE 3:

Achieve 30% residential, commercial and industrial building thermal "fuel switching" (to renewable source) to reduce on-site fossil fuel use by 2030.

	Actions	Implementation Phase
BE 3-1	Coordinate and promote a residential and small business "Electrification and Energy Efficiency/Weatherization" group purchase campaign annually to help reduce the costs of energy efficient heating systems such as air source heat pumps and ground source heat pumps through volume purchasing power (goal, 150 households and 20 businesses annually). Program design to focus on improved equity (residential and commercial) in its implementation and explore strategies to support local small business contractors such as being set up to enable small contractors to collaborate or having a competitive "marketplace" approach with more than one contractor to choose from. NOTE: Action may be implemented in combination with the renewable energy group purchase program action.	1
BE 3-2	Implement a policy or sales license requiring fuel dealers to report sales within Hartford annually. https://palebluedot.llc/hartford-cap-policy-examples	1
BE 3-3	Deploy an incentive program for electrification for switching building space heating and water heating from fossil fuel-based to electric. Collaborate with Green Mountain Power and other regional partnerships to create financial incentives to electrify new and existing buildings. For example, rebates for electric heat pumps, panel upgrades, and electric appliances can encourage the transition to electric energy use in homes and businesses.	2
BE 3-4	Adopt regulations to require all-electric buildings for new construction and major remodels/redevelopment by 2027. Options such as building code updates and ordinances should be explored as tools for transitioning new construction to all-electric. https://palebluedot.llc/hartford-cap-policy-examples	2

4 Strategy BE 4:

Increase on-site distributed renewable energy from 3% to 15% of Residential and Commercial electric use by 2030.

	Actions	Implementation Phase
BE 4-1	Coordinate and promote a residential Solar Group Purchase Campaign annually to help reduce the costs of solar installation through volume purchasing power (goal, 80 households annually). Program design to focus on improved equity (residential and commercial) in its implementation and explore strategies to support local small business solar installers such as being set up to enable small installers to collaborate or having a competitive "marketplace" approach with more than one installer to choose from. NOTE: Action may be implemented in combination with the electrification and energy efficiency group purchase program action.	1
BE 4-2	Identify the "Solar Top 50" commercial/industrial properties within the Town and produce detailed solar feasibility assessments for each site. Assessments should focus on Hartford's Hierarchy of Suitability and on the State's preferred siting locations (e.g. parking lot and rooftop solar PV capacity). Assessments to include potential solar generation and economic performance and return on investment estimates, information on financing and ownership models, and next step resources. Provide solar assessment reports to properties and conduct an informational workshop to assist building owners and businesses in understanding the assessments and next step potential. "Solar Top 50" assessment effort could be repeated annually, particularly through 2025.	1

Buildings and Energy

	Actions	Implementation Phase
BE 4-3	Coordinate and promote a commercial Solar Group Purchase Campaign annually to help reduce the costs of solar installation through volume purchasing power (goal, 860KW installed annually). Group purchase campaign could include/focus on properties identified in the "Solar Top 50" assessment effort and should include both direct purchase/ownership as well as 3rd party ownership options like Solar Lease and Power Purchase Agreements. Program design to explore strategies to support local small business solar installers and strategies to support local workforce development.	**1**
BE 4-4	Incentivize local renewable energy projects. Explore leveraging existing incentives to increase renewable energy utilization and generation throughout the entire Town. These incentives would include support for solar installation, low-income housing, and the creation of green jobs	**1**
BE 4-5	Establish a Solar Ready Guide providing building owners, renters, developers, designers, and contractors with detailed information on strategies to make new construction or significant renovation projects fully Solar Ready enabling more cost efficient and easier installation of on-site solar arrays. https://view.publitas.com/palebluedot/llbo-solar-ready-guidelines/	**2**
BE 4-6	Establish a clean energy fund to invest in energy efficiency and renewable energy projects. Develop and expand financing tools such as Clean Energy Works and commercial Property Assessed Clean Energy that are broadly accessible to households and building owners, including rental properties, throughout the community. Remove financial barriers to building retrofits, including limiting property tax increases due to completed energy projects.	**2**
BE 4-7	Review the solar process including permitting, and planning, zoning and development regulations to identify and reduce barriers to installing solar through the national SolSmart designation program. Become a SolSmart Gold community by 2025.	**2**
BE 4-8	Collaborate with Green Mountain Power and solar developers to offer community solar subscription opportunities for Hartford residents and businesses. Support program offerings through communications and promotions.	**3**

Buildings and Energy

Planned Buildings and Energy GHG Emission Reductions

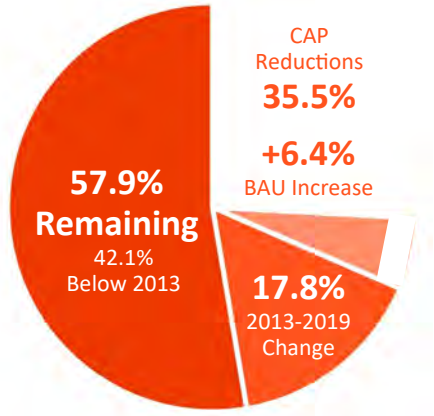
Planned Sector Emission Reductions Through 2030

The strategies and actions included in this section of the Climate Action Plan are projected to reduce the Town's annual GHG emissions by 16,908 metric tons (MT) by 2030 - a 35.5% reduction over 2013 levels. Changes in business-as-usual impacts over the same period are anticipated to increase emissions by an additional 3,559 metric tons and previous changes between 2013 and 2019 decreased emissions in this sector by 9,924 metric tons. The result is a total community wide Buildings and Energy sector reduction of 42.1% over 2013 levels.

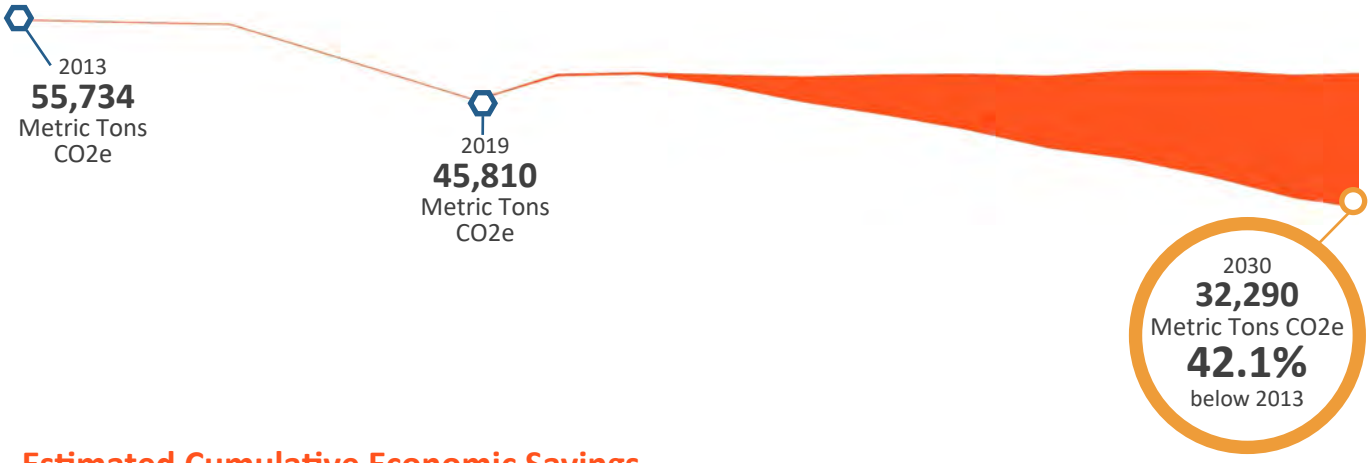
When compared to 2013 emissions, this is equivalent to eliminating 5,061 cars from the road, or **460 million** cubic feet of man-made greenhouse gas atmosphere annually by 2030.

Sector Emissions Reduction below 2013 by 2030

The total change to sector emissions include CAP Plan reductions, BAU emission changes, and previous changes between 2013 and 2019 as follows:



Hartford's Buildings and Energy Carbon Reduction Pathway



Estimated Cumulative Economic Savings

Implementing many of the measures in this plan, such as increased energy efficiency and renewable energy, can save money for the community. The estimated community savings of the goals for this section include:

Residential Energy Efficiency and Renewable Energy Savings:		Commercial/Industrial Energy Efficiency and Renewable Energy Savings:		Estimated Cumulative Savings Potential*	
$2,230,000	$452 per household	$8,300,000	$675 per job	$10,530,000	$1,022 per capita

* Savings for residential and commercial/industrial energy efficiency are based on current average energy rates applied to projected energy reductions. Savings for residential and commercial/industrial renewable energy are based on an estimated 15 year ROI on solar installations with an average solar array design life of 30 years. See Appendix for Cumulative Potential Cost Savings Assumptions and data sources.

What You Can Do

You can support the goals of the Buildings and Energy section of the Hartford Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- Schedule a home energy audit with a licensed contractor or Efficiency Vermont. https://www.efficiencyvermont.com/
- Properly insulate your home — or work with a licensed contractor.
- Install energy-efficient windows and doors, working with a licensed contractor.
- Install solar panels at your home, working with a licensed contractor. If possible, participate in Hartford's residential solar group purchasing program.
- If you don't own your home but support clean, renewable energy, talk to Green Mountain Power to see if community solar is available. https://cutt.ly/RbC6wa0
- Convert 3 or more lights or lamps to LED bulbs.
- Set your thermostat 2 or more degrees higher during cooling season, lower during heating season.
- Turn down your water heater to 120°.
- Replace an older home thermostat with a "smart," programmable model.
- Replace a major appliance (e.g., refrigerator, air conditioner, furnace) with a newer, energy-efficient model.
- Replace a gas range or clothes dryer with an electric model—or better yet line dry your clothes outside!
- Unplug 2 or more electricity "vampires" in your home or apartment. https://www.comed.com/News/Pages/NewsReleases/2019-10-30B.aspx
- • Learn about adding solar panels to your home.

Section 03
Transportation and Land Use

Click here to return to TOC

Transportation
In Hartford

91,566,000
Vehicle Miles Driven (VMT) in 2019

+3.4%
Increase in VMT since 2013

77.1%
Commuters drive alone

25
Electric vehicles currently registered

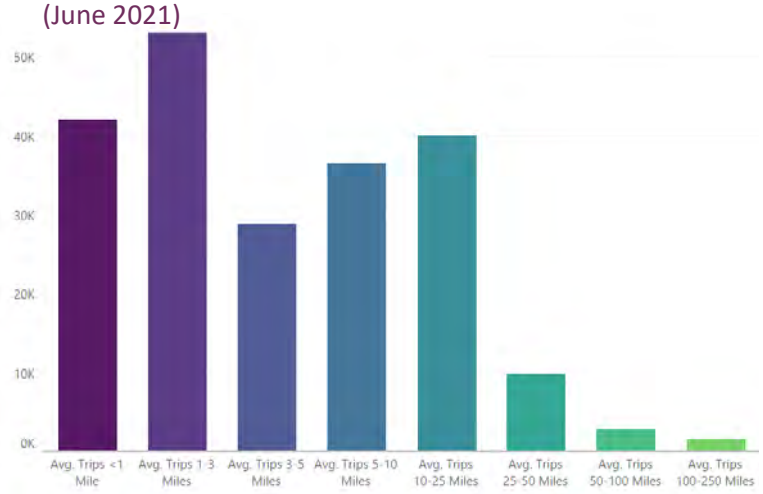
Transportation and Land Use

The design of a Town can limit or expand the choices and opportunities available to its residents. Where and how we live, our mobility to and from the places in our community we visit daily, and the related global impact of those decisions are all influenced by how our community is designed. The transportation systems we have access to and choose to use—including private and public vehicles, trains, and planes - can have significant impacts on the environment.

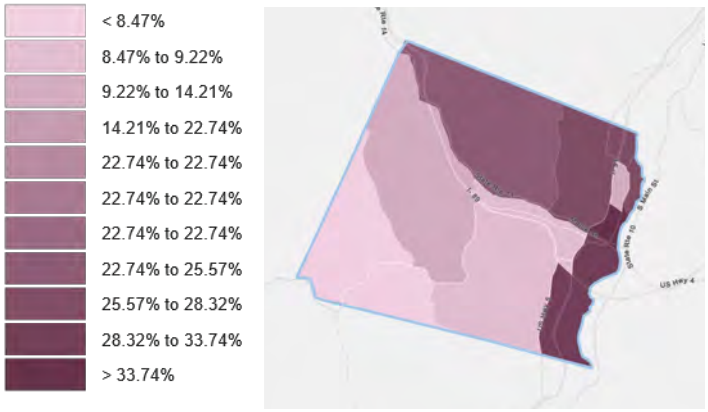
In Hartford, the transportation sector accounts for 49.6% of Town wide greenhouse gas emissions (2019 GHG Inventory). According to the US Bureau of Transportation Statistics, the average household in the United States have daily trips totaling 33,600 miles annually. Over 77% of those miles are trips associated with shopping, family, recreation, and other non-work related trips. The remaining 23% are for commuting to work and other business related trips.

Average Trips per Day by Distance in Windsor County

(June 2021)



Commuters with <10 Minute Commute in Hartford



In Windsor County, there are over 230,000 daily trips conducted. The majority of those (61.6%) are 5 miles or less in distance and nearly 23% are less than 1 mile. For work related trips in Hartford, the average commute-to-work time is 19 minutes. Over 22% of commuters have a commute of less than 10 minutes. The majority (77.1%) of Hartford residents drive to work alone. The remaining carpool (14%), use public transit (1.7%), walk /bicycle (1.5%), or telecommute (5.5%). These statistics illustrate a significant opportunity for converting trip modes for personal and work related trips from driving to public transit, biking, or walking – representing a large annual GHG reduction potential.

Continuing to improve the equity and sustainability of Hartford's land use and transportation systems requires a focus on developing systems and networks that allow for greater choice in where residents live and work, as well as how they commute. Implementation of Complete Streets and a connected system of transit, bike and pedestrian infrastructure along with emphasis on neighborhood design that supports well designed density and walkability. These strategies are lower cost solutions that will save households money while helping Hartford reach its goal to reduce Town wide GHG emissions by 2030.

Climate Change Considerations

Climate Impacts

This sector impacts climate change through the combustion of fossil fuels (gasoline, diesel, propane) for on-road cars and trucks and off-road vehicles and equipment.

Climate Hazards

Hazards to transportation and land use include increased damage to roads and transportation infrastructure due to increased freeze and thaw cycles, flooding, and extreme weather and temperatures.

Transportation and Land Use

Equity Considerations

- Increased opportunities for public transit and active transportation can help address health disparities for many at-risk populations.
- Affordable and reliable options for mobility for people with special transportation needs can significantly improve transportation equity. Populations with special transportation needs include older adults, youth, persons with disabilities, and persons with reduced incomes.
- Improving the accessibility (ADA) of reliable and affordable transportation allows people with disabilities and mobility restrictions important opportunities in education, employment, healthcare, housing and participation in community life
- Some portions of Hartford have fewer housing and transportation options than others. This can limit people's choices in where they live and how they get to work or other activities. According to the US Census, 7.3% of Hartford households have no vehicles. Households that rely on public transit service or who rent their home will be limited in where they may find housing that meets both needs.

Mode Shift Targets Supporting Sector Goals

	Vehicle Miles Traveled (VMT)	Population Density Per Acre	Electric Vehicles	Replace Diesel use with No Emission Alternatives	Public Transit Utilization
	-	+	+	+	+
Today	91.6 MVMT	3.16/acre	25	0%	1.72%
2030 Targets	**88.8** MVMT	**3.32**/acre	**825**	**25%**	**8%**

Strategies Supporting Sector Goals

Sector goals related to GHG emissions reductions are designed to balance reduction across all sectors and achieve the overall emissions goals set forth for the community. The goals seek to strike a balance between achievability while also reaching -for improvement beyond business-as-usual.

As indicated in the introduction, the Climate Action Plan is intended to be a 9 year plan to be updated at the completion of that time. Consequently, the goals and strategies outlined in this section are intended to be achieved by 2030 (or earlier) unless otherwise noted.

Implementation of actions are anticipated to be initiated over 3 phases: phase 1 within 1-2 years, phase 2 within 2-5 years, and phase 3 within 3-7 years of CAP approval.

1. **Strategy TL 1:** Decrease community wide VMT by 2.9% by 2030.
2. **Strategy TL 2**: Increase average population per developed acre by 5% by 2030.
3. **Strategy TL 3:** Increase battery electric vehicle (BEV) utilization to 21.5% of community wide rolling stock by 2030 (from approximately 18 vehicles in 2019 to 825 vehicles in 2030 community-wide).
4. **Strategy TL 4:** Establish viable no/low emission vehicle fuel sources to serve community by 2025. Achieve 25% diesel consumption replacement with no/low emission fuels by 2030.
5. **Strategy TL 5:** Increase Public Transit Access and Ridership for all forms of trips, including increasing commuter ridership from 1.72% to 8% by 2030.

Transportation and Land Use

1 Strategy TL 1:

TL 1: Decrease community wide VMT by 2.9% by 2030.

	Actions	Implementation Phase
TL 1-1	Create mobility hubs for enhanced mobility options such as ride share, car share, and bike share.	1
TL 1-2	Modify zoning codes to reduce or eliminate Townwide minimum parking requirements and set parking maximums for most land-use types and require developers and landlords to “unbundle” parking from rent. https://palebluedot.llc/hartford-cap-policy-examples	1
TL 1-3	Continue to support Safe Routes to Schools programs.	1
TL 1-4	Collaborate with upper valley employers to encourage and incentivize work-at-home adoption.	1
TL 1-5	Develop an Active Transportation Plan (ATP) to facilitate the expansion of strong bicycle and transit connections within and between villages. The ATP will serve as the basis for expanding and establishing safe, convenient and complete altnerative transportation networks in Hartford for pedestrians, bicycles, eBikes, and transit. ATP to identify prioritized active transportation projects in the Town, emphasizig multimodal transportation, access to transit, pedestrian safety, bike racks and lockers, beautification, green infrastructure, and a seamless regional bike network that favors protected bike lanes particularly on high-traffic streets without the potential for bicycle facilities on parallel streets (e.g. Sykes Mt. Ave.). Resource: https://atpolicy.org/active-transportation-plans-index/	2
TL 1-6	Create park'n ride lot at Exit 1 to encourage use of buses and car-pool.	2
TL 1-7	Expand rapid transit serving job centers.	2
TL 1-8	Prioritize transportation funding for Vision Zero engineering improvement projects to create safe streets for people walking, biking and riding transit. Resource: https://visionzeronetwork.org/about/what-is-vision-zero/	2

Strategy TL 2:

Increase average population per developed acre by 5% by 2030.

	Actions	Implementation Phase
TL 2-1	Amend the zoning ordinance to allow higher density development. These amendments should include increasing building heights, allowing projects to build out to approved densities, and should consider opportunities for mixed land use. Increased density can minimize vehicle miles travelled and increase quality of life. https://palebluedot.llc/hartford-cap-policy-examples	1
TL 2-2	Encourage development of accessory dwelling units ("ADU") to create additional legal ADUs compatible with residential neighborhoods. This will add additional housing options for the town's workforce, seniors, families with changing needs, and others for whom ADUs present an affordable housing option.	1
TL 2-3	Conduct a Development Study to identify and prioritize available sites for redevelopment and in-fill development to advance town's walkability, bikeability, and transit utilization. Study should include a review of under utilized surface parking infrastructure capable of being redeveloped.	1
TL 2-4	Issue competitive redevelopment Request for Proposals based on findings of Development Study to encouraging high quality mixed use redevelopment on redevelopment, infill properties and existing surface parking lots within village downtown districts. RFP's should focus on equity, affordability, livability, and compliance/support of Climate Action Plan goals.	2
TL 2-5	Incentivize infill and mixed-use developments which result in increased density and improved mobility (e.g., through alternative code compliance, fee waivers, density bonuses, investment prioritization, development impact fees, tax benefits).	2
TL 2-6	Explore applying for the state's Neighborhood Development Area designation to provide tax and permit incentives for developers to pursue infill development and provide additional grant opportunities for the town.	2

3 Strategy TL 3:

Increase battery electric vehicle (BEV, eBike, etc) utilization to 21.5% of community wide rolling stock by 2030 (for autos, this requires an increase from approximately 25 vehicles in 2019 to 2,333 vehicles in 2030 community-wide).

	Actions	Implementation Phase
TL 3-1	Create an Electric Vehicle Action Plan (EVAP) to guide access to chargers town-wide on public and private property. EVAP should Explore alternative technologies like Smart Cable technology and streetlight/EV charger integration, address barriers to charging for garage-free homes and rental properties, increase use of EVs in car sharing programs, assess options to lower EV and EV charger implementation costs, and recommend EV charging station requirement amendments to zoning ordinances to support EVAP. EVAP should also consider EV charging needs for town residents and businesses as well as consider opportunities to support EV charging for travelers in ways which support the community as well as the traveler. Resource: https://palebluedot.llc/llbo-ev	**1**
TL 3-2	Implement an "EV Ready" building ordinance that requires new developments to have wiring capacity to charge electric vehicles and establish minimum parking requirements for exclusive EV use. https://palebluedot.llc/hartford-cap-policy-examples	**1**
TL 3-3	Educate the public on existing state, federal, and utility incentives for efficient and electric vehicles, including tax incentives and at-home electric vehicle charging outlet incentives.	**1**
TL 3-4	Build public awareness of EV options through communications, Ride-And-Drive events, etc (Example: Columbus OH https://cutt.ly/bbwUKu8)	**1**
TL 3-5	Establish and promote a regional EV group-buy program.	**2**
TL 3-6	Encourage car dealers to to retain EVs for resale here by demonstrating market for used EVs and work with Upper valley towns to create list of preferred dealers.	**2**
TL 3-7	Evaluate, monitor, and promote incentive programs to expand EV charger deployment on private property, including rebates and financing options (e.g. on-bill financing, etc.).	**2**

4 Strategy TL 4:

Establish viable no/low emission vehicle fuel sources to serve community by 2025. Achieve 25% diesel consumption replacement

	Actions	Implementation Phase
TL 4-1	Conduct a No/Low no/low Emission Diesel Vehicle Fuel Alternative Feasibility study to identify viable no/low diesel vehicle fuel alternatives, sources, and outlets for increasing no/low emission fuel alternative availability and utilization. Study to include analysis of efficiency chain and impact on land use and other communities. Study may include exploration of existing supply chains as well as potential new sources such as through a locally operated biodiesel plant or plasma gasification plant producing hydrogen or biodiesel.	1
TL 4-2	Collaborate with existing fuel retailers to establish, increase, and promote use of no/low emission fuels in lieu of fossil fuel diesel (minimum B20 level or equivalent).	2
TL 4-3	Establish communication and education campaign to encourage the use of no/low emission fuels for vehicles unable to be replaced with electric alternatives.	2

5 Strategy TL 5:

Increase Public Transit Access and and Ridership for all forms of trips, including increasing commuter ridership from 1.72% to 8% by 2030.

	Actions	Implementation Phase
TL 5-1	Support a new regional (Vermont and New Hampshire) multimodal transportation funding source for transit, bicycle and pedestrian services and facilities. Advocate for including provisions that prioritize transit and multimodal designs for facilities.	1
TL 5-2	Conduct a Public Transit Expansion Feasibility Study to assess existing transit availability, community daily transportation needs, identify options to cost effectively increase public transit offerings and ridership, identify potential transit partners and funding, and establish a public transit expansion implementation plan. Study to include exploration of alternative public/shared mobility options with reduced GHG emissions such as micro transit (e.g. Montpelier's MyRide solution) . Study should recognize relationship and interconnected aspect of community transportation needs beyond Hartford Town borders.	1

Transportation and Land Use

Planned Transportation and Land Use GHG Emission Reductions

Planned Sector Emission Reductions Through 2030

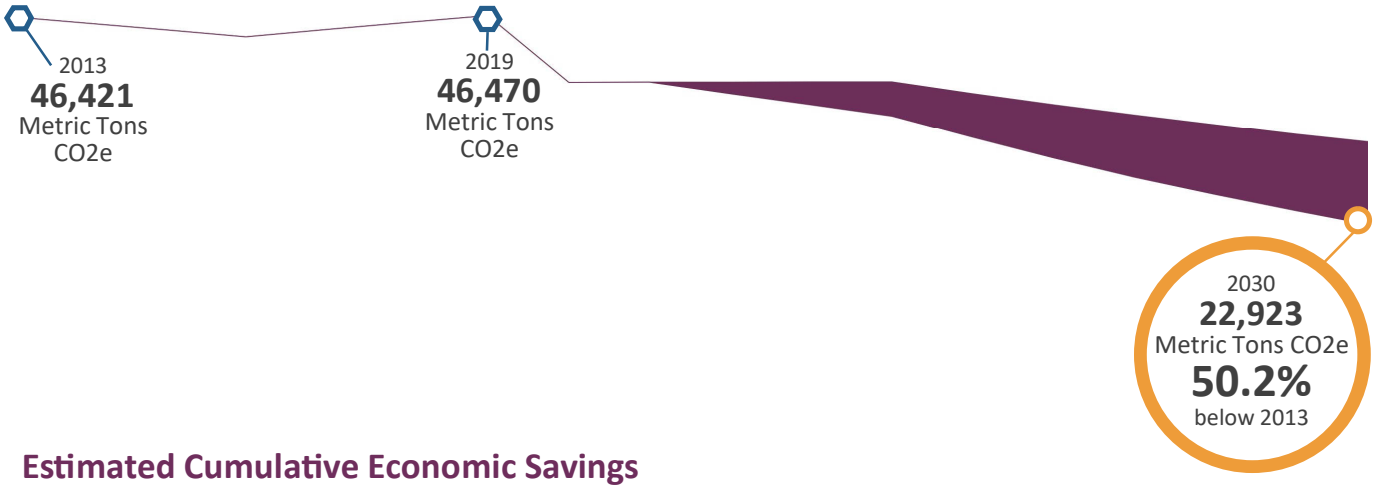
The strategies and actions included in this section of the Climate Action Plan are projected to reduce the Town's annual GHG emissions by 10,282 metric tons (MT) by 2030 - a 21.6% reduction over 2013 levels. Changes in business-as-usual impacts over the same period are anticipated to reduce an additional 13,265 metric tons. The result is a total community wide Transportation sector reduction of 50.2% over 2013 levels.

When compared to 2013 emissions, this is equivalent to eliminating 4,756 cars from the road, or **428 million** cubic feet of man-made greenhouse gas atmosphere annually by 2030

Sector Emissions Reduction below 2013 by 2030

The total change to sector emissions include CAP Plan reductions, BAU emission changes, and previous changes between 2013 and 2019 as follows:

Hartford's Transportation and Land Use Carbon Reduction Pathway



Estimated Cumulative Economic Savings

Implementing many of the measures in this plan, such as reduction of single-occupancy auto use, can save money for the community. The estimated community savings of the goals for this section include:

Decrease VMT by 2.9%:		Increase EV utilization to 21.5% of VMT		Estimated Cumulative Savings Potential*
$25,000,000	+	**$8,700,000**	=	**$33,700,000**
$2,593 per capita		**$901** per capita		**$3,494** per capita

* Savings for VMT reductions are based on multiplying the estimated vehicle miles saved by AAA calculated auto use cost per mile and 2020 PACE transit pass costs. Savings for EV utilization are calculated based on multiplying the estimated vehicle miles switching from gas/diesel fuel vehicle by the sum of the AAA calculated gas/diesel auto use cost per mile subtracting the EPA estimated EV auto use cost per mile. See Appendix for Cumulative Potential Cost Savings Assumptions and data sources.

Transportation and Land Use

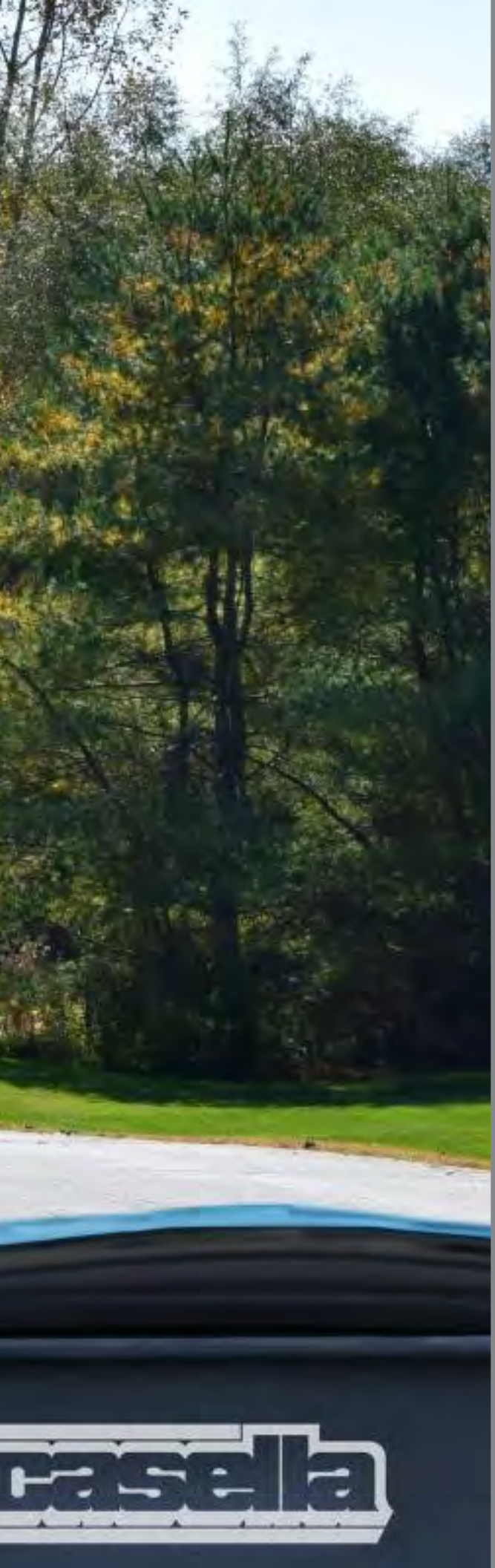
What You Can Do

You can support the goals of the Transportation and Land Use section of the Hartford Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- Join a carpool or use ridesharing to get to work, a group activity or event.
- Take public transit to work, an appointment, a group activity or event. Plan your trip here: https://advancetransit.com/
- Buy or lease an electric or hybrid vehicle.
- Walk to work, an appointment, a group activity or event.
- Ride a bike, electric bike or scooter to work, an appointment, a group activity or event.
- Merge two or more errands into a single driving trip.
- With a family member or friend, take public transit to a group activity or event.
- Buy or tune up a used bike.
- Sell or donate a bike (in good condition) you aren't using.

Section 04
Waste Management

Click here to return to TOC



Solid Waste
In Hartford

371
tons of recycling in 2019

6,468
tons of landfill waste in 2019

4.9%
Decrease in total waste collected since 2013

Waste Management

Why Waste Management Is Important

In Hartford, solid waste contributed 1.1% of Town-wide greenhouse gas emissions in 2019. Town-wide municipal solid waste (MSW) handled in 2019 totaled 6,839 tons. Of the MSW handled an estimated 371 tons (5.4% of total) was recycled and the remaining 6,468 tons (94.6%) was landfilled. Municipal solid waste sector has great potential to avoid emissions throughout the economy thanks to waste reduction and waste recovery.

Food discards and residuals that decompose in landfills release methane, a greenhouse gas that is at least 28 times more potent than carbon dioxide. This fact makes food wasting a significant contributor to solid waste greenhouse gas emissions. Habitat destruction, global warming, and resource depletion are some of the effects of our materials consumption.

Waste Management Hierarchy

Important strategies to reducing our solid waste impacts on the environment include reduction, reuse, recycling, and composting.

Hartford Recycled Material Breakdown

According to data collected by the Hartford Department of Public Works, the breakdown of community wide recycled materials includes aluminum, steel, and glass containers, mixed paper, cardboard, metal, plastics, tires, and used motor and heating oil. See the chart to the right for breakdown by type.

Hartford Landfill Waste by Material

The Vermont Department of Environmental Conservation Solid Waste Program prepared a State-wide Waste Characterization Study in 2018. Based on that study, reasonable assumptions can be made regarding the likely breakdown of municipal solid waste (MSW) landfilled from Hartford community-wide collection. We have organized the characterization study categories based on their potential for waste diversion as follows (see chart on next page):

Organics
(food waste, yard waste)
Potentially Recyclable Materials
(paper, plastics, glass, and metal)
Potentially Recoverable Materials
(C&D, textiles and leather, electronics)
Other Materials
(hazardous waste, all other waste)

MSW Breakdown by Type

Climate Change Considerations

Climate Impacts

This sector impacts climate change through combustion of fossil fuels in the collection and processing of materials, as well as the generation of methane from anaerobic decomposition of organic materials in landfills.

Opportunities

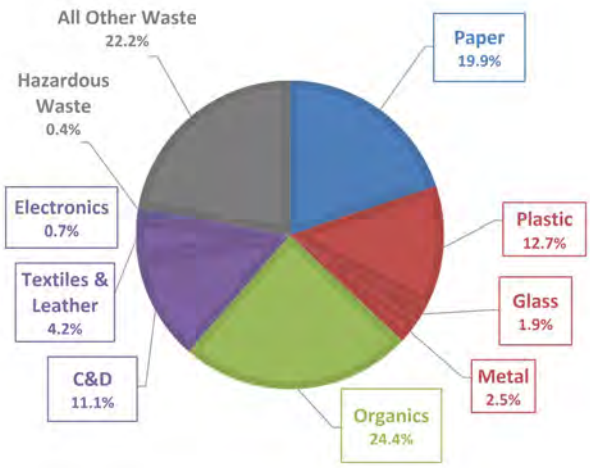
As indicated in the Waste Diversion Potential Estimate diagram, a significant portion of Hartford's waste stream has the potential for being put to beneficial use while avoiding GHG emissions.

Climate Hazards

Hazards to the waste management system include damage to infrastructure from extreme weather and flooding.

Waste Management

MSW Breakdown by Type



Hartford Solid Waste Per Capita Trends

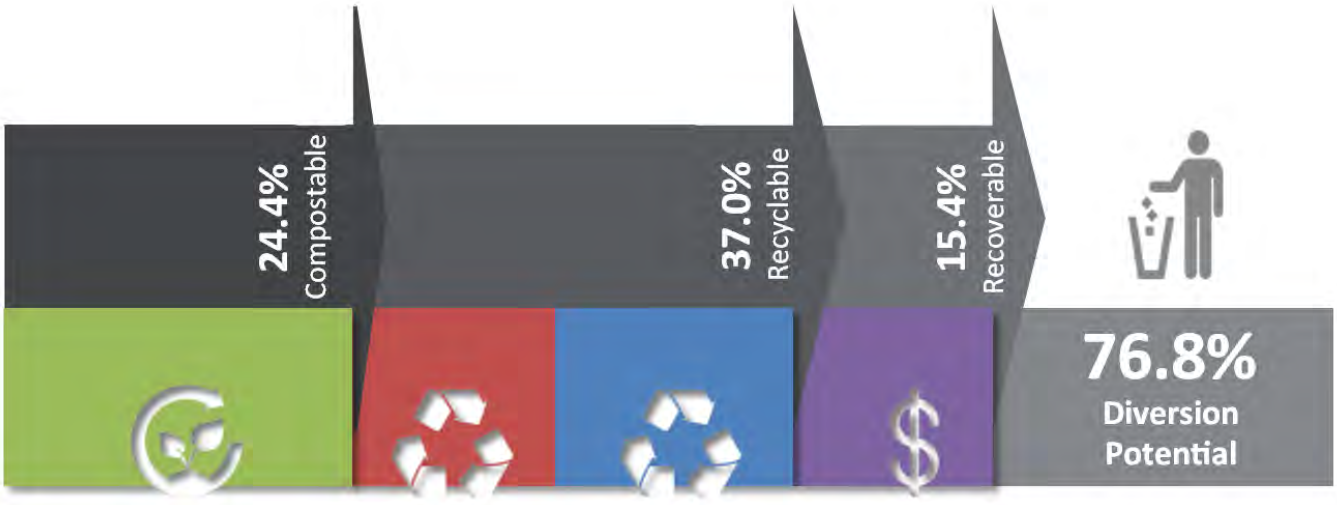
According to data collected by the Hartford Department of Public Works, total community-wide MSW handled in 2013 was equivalent to 3.98 pounds per person per day with recycling comprising 0.25 pounds and the remaining 3.73 pounds being landfilled waste. By 2019 the community-wide MSW handled reduced to 3.89 pounds per person per day with recycling comprising 0.21 pounds and the remaining 3.68 pounds being landfilled waste. The Hartford per capita landfill waste compares to the State-wide average of 3.7 pounds as reported by the State's 2018 Waste Characterization Study.

According to these numbers, the total per capita MSW handled reduced 2.43% from 2013 to 2019. Meanwhile, the total existing diversion rate (solid waste diverted from landfills) in Hartford was 5.4% in 2019 a drop from 6.3% in 2013.

Waste Diversion Potential

Based on the State-wide Waste Characterization Study, there may be waste diversion potential of up to 76.8% in the current landfilled materials (idealized maximum). Below is the breakdown of the estimated total potential waste diversion:

Organics	**24.4%**
Potentially Recyclable Materials	**37.0%**
Potentially Recoverable Materials	**15.4%**
Other Materials (remaining landfill waste)	**23.2%**



Waste Management

Equity Considerations

- Accessibility to recycling and composting programs may not be equally and readily available to all community residents and may also be impacted by other participation-related barriers, including awareness of programs, user fees, accessibility based on housing type, and language barriers.
- Populations that are situated very close to the landfill or composting facility may experience nuisance issues like bad odors and potential health issues unless mitigation actions are implemented.

Town-Wide Solid Waste Targets Supporting Sector Goals

Sector goals are established to both support the Town's Climate Action Plan in creating a climate resilient community and to reduce Town-wide GHG emissions.

	Organics Diversion	Recycling Diversion	Total MSW Handled
	+	+	-
Today (% of total waste)	25%*	5%	6,839 tons
2030 Targets (% of total waste)	**100%**	**15%**	**6,497** tons

*Estimated

Strategies Supporting Sector Goals

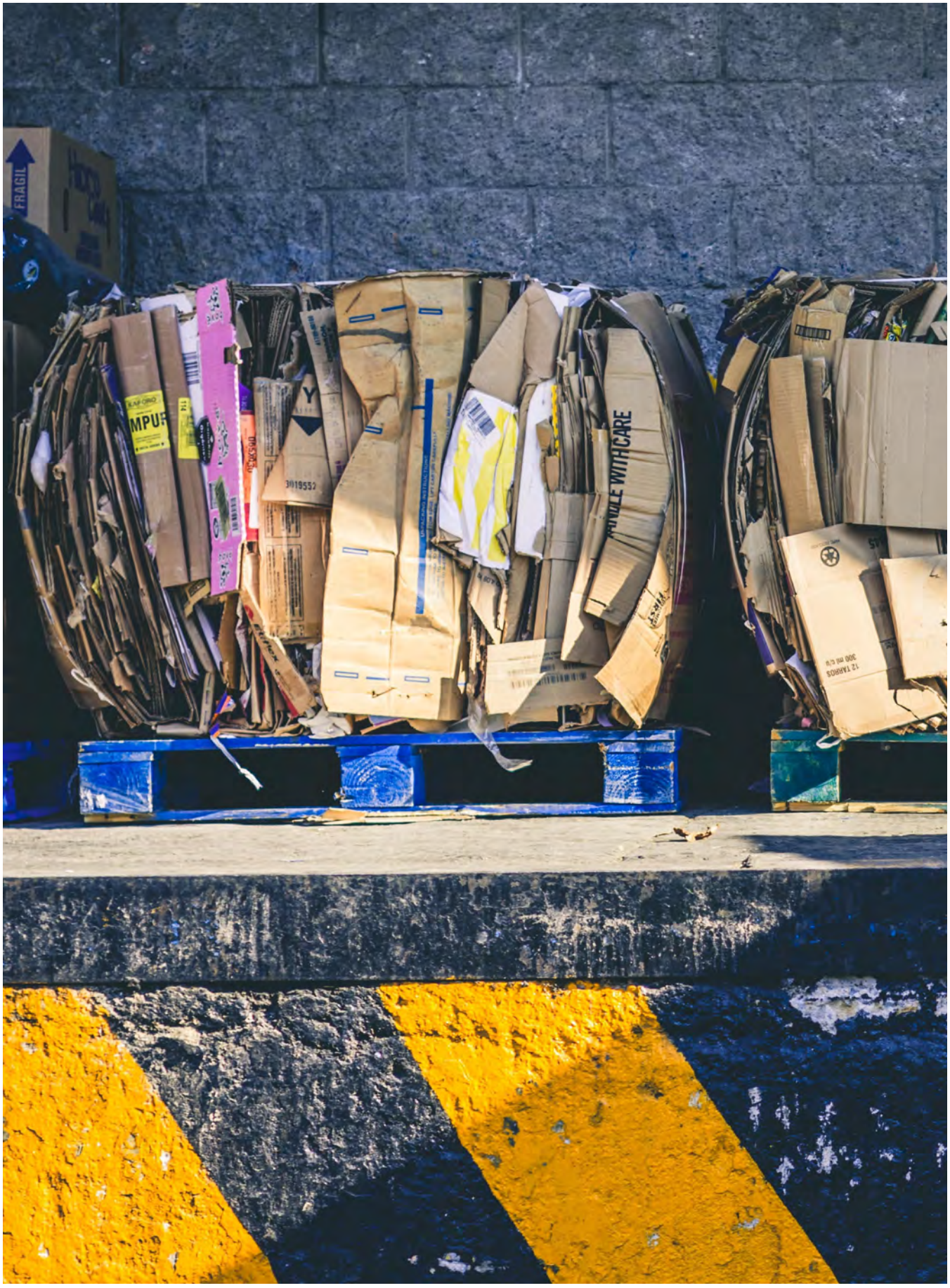
Sector goals related to GHG emissions reductions are designed to balance reduction across all sectors and achieve the overall emissions goals set forth for the community. The goals seek to strike a balance between achievability while also reaching -for improvement beyond business-as-usual.

As indicated in the introduction, the Climate Action Plan is intended to be a 9 year plan to be updated at the completion of that time. Consequently, the goals and strategies outlined in this section are intended to be achieved by 2030 (or earlier) unless otherwise noted.

Implementation of actions are anticipated to be initiated over 3 phases: phase 1 within 1-2 years, phase 2 within 2-5 years, and phase 3 within 3-7 years of CAP approval.

1. **Strategy WM 1:** Achieve 100% organics landfill waste diversion by 2023.*
2. **Strategy WM 2:** Increase recycling from 5% to 20% of total MSW handled by 2030 in an energy efficient, low emission manner.
3. **Strategy WM 3:** Decrease total per capita municipal solid waste handled by 5% by 2030.

* Note: Vermont Universal Recycling Law (Act 148) which went into effect bans food scraps and other organics from the trash. This strategy looks to reinforce and support implementation of that requirement.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HANDLE WITHCARE

Waste Management

1 Strategy WM 1:
Achieve 100% organics landfill waste diversion by 2023.

	Actions	Implementation Phase
WM 1-1	Offer curbside compost collection to all residential properties (e.g., single-family and multifamily) for yard waste, food waste and certified compostable products. This service is optional for all residential properties. Provide information on the value and methods for composting.	**1**
WM 1-2	Examine options for expanding commercial and residential composting; assess the feasibility of establishing a permitted facility to compost or anaerobically digest organic materials and food waste.	**2**
WM 1-3	Offer five days a week (Monday through Friday) collection for food waste and certified compostable material at businesses. Change the type of compost operation or increase land allocation to handle additional feedstock, as needed.	**2**
WM 1-4	Expand networks for food rescue efforts to connect to hunger services.	**2**

2 Strategy WM 2:
Increase recycling from 5% to 20% of total MSW handled by 2030 in an energy efficient, low emission manner.

	Actions	Implementation Phase
WM 2-1	Develop and enforce ordinances requiring commercial customers to recycle material streams like cardboard, paper, beverage containers, etc https://palebluedot.llc/hartford-cap-policy-examples	**1**
WM 2-2	Expand community-wide educational efforts on available services, incentives, and facilities as well as proper recycling/ composting/source reduction methods.	**1**
WM 2-3	Add more recycling options and info on recycling outside of town's system; example: Tetra paks can be recycled for just cost of shipping - closest location VA. Facility in MA that will accept Styrofoam. Sponsor a Terracycle box for hard-to-recycle items and a Greendisk box for eWaste.	**2**
WM 2-4	Increase outreach and education to residents and businesses on proper recycling	**2**

3 Strategy WM 2:

Decrease total per capita municipal solid waste handled by 5% by 2030.

	Actions	Implementation Phase
WM 3-1	Establish a policy to make zero and reduced waste events standard for large community events. Implementation to focus initially on Town of Hartford events with community-wide events as a second phase. https://palebluedot.llc/hartford-cap-policy-examples	**1**
WM 3-2	Launch a zero waste comprehensive planning process to identify strategies and actions to move the town toward zero-waste.	**1**
WM 3-3	Expand consumer education on sustainable consumption and materials management, including prevention of wasted food in households and businesses and low-carbon food consumption.	**1**
WM 3-4	Identify and promote reuse and repair businesses and opportunities which can reduce the disposal of used goods.	**1**
WM 3-5	Implement town-wide pay-as-you-throw requirement for all curbside trash pickup.	**1**
WM 3-6	Eliminate petroleum-based, single-use products through phasing out the use of single-use plastics by 2025. Require food service retailers to use biodegradable, compostable or recyclable packaging. Explore the feasibility of establishing a reusable takeout container service	**2**
WM 3-7	Explore "rating" system or certifications for businesses (especially restaurants) based on waste (and other sustainability) practices. Creates better disclosure for consumer choice and encourages consumers/employees to get involved in seeing where we are now and encouraging even better practices.	**2**
WM 3-8	Encourage, incentivize, and reward sustainable behaviors (refuse, reduce, reuse) through campaigns and competitions. In addition to general efforts, target high impact times/events such as holidays and weddings. Encourage local businesses to run their own campaigns and competitions for employees.	**2**
WM 3-9	Promote or require the reduction of resource consumption of the waste collection fleet through efforts such as alternative fuel, fuel efficiency, vehicle optimization, and other new technologies.	**2**

Waste Management

Planned Waste Management GHG Emission Reductions

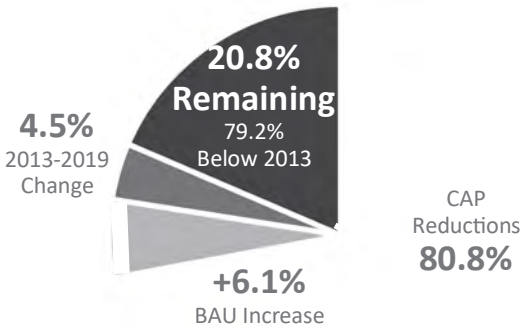
Planned Sector Emission Reductions Through 2030

The strategies and actions included in this section of the Climate Action Plan are projected to reduce the Town's annual GHG emissions by 853 metric tons (MT) by 2030 - an 80.8% reduction over 2013 levels. Previous changes between 2013 and 2019 decreased emissions in this sector by 47 metric tons. Changes in business-as-usual impacts in the future, however, are anticipated to *increase* 64 metric tons. The result is a total community wide Waste Management sector reduction of 79.2% when compared to 2013 levels.

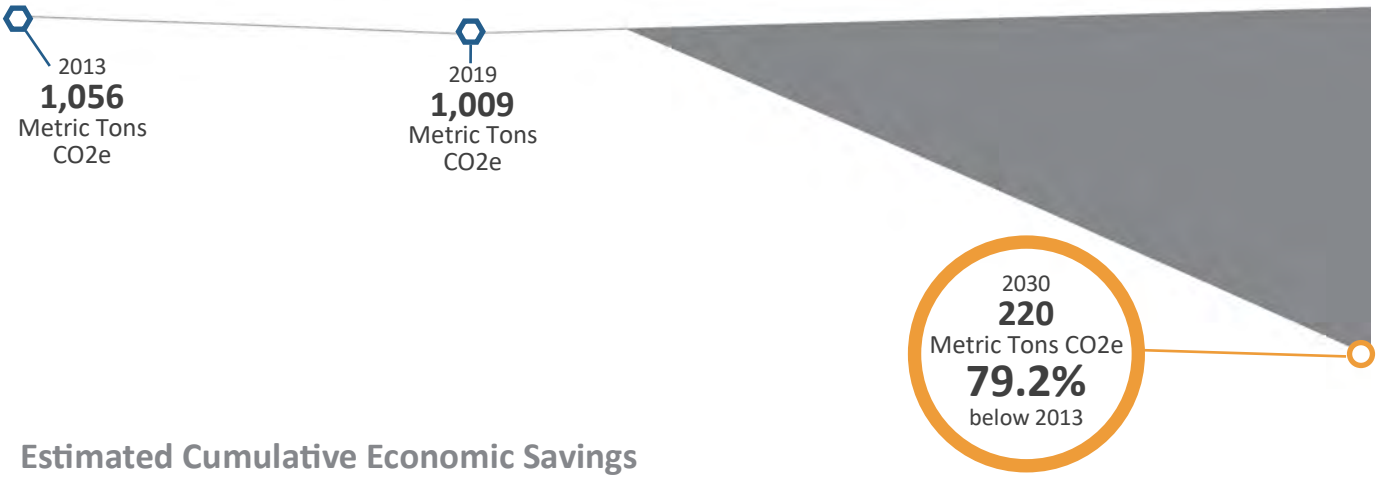
When compared to 2013 emissions, this is equivalent to eliminating 182 cars from the road, or **16.4 million** cubic feet of man-made greenhouse gas atmosphere annually by 2030

Sector Emissions Reduction below 2013 by 2030

The total change to sector emissions include CAP Plan reductions, BAU emission changes, and previous changes between 2013 and 2019 as follows:



Hartford's Waste Management Carbon Reduction Pathway



Estimated Cumulative Economic Savings

Implementing many of the measures in this plan, such as reduction of food waste, material waste, and overall consumption, can save money for the community. The estimated community savings of the goals for this section include

Residential Organics/Food Waste Diversion Savings:		Commercial/Industrial Waste Reduction Savings:		Estimated Cumulative Savings Potential
$5,450,000	+	$1,330,000	=	$6,780,000
$1,174 per household		$115 per job		$703 per capita

*Savings for organics/food waste diversion are based on multiplying the estimated pounds of food waste reduced by an estimated value per pound based on "A Roadmap to Reduce US Food Waste" by ReFED. Savings for commercial waste reduction are calculated based on multiplying the estimated number of participating organizations by the average savings per company reported by the MN WasteWise program (a similar initiative). See Appendix for Cumulative Potential Cost Savings Assumptions and data sources.

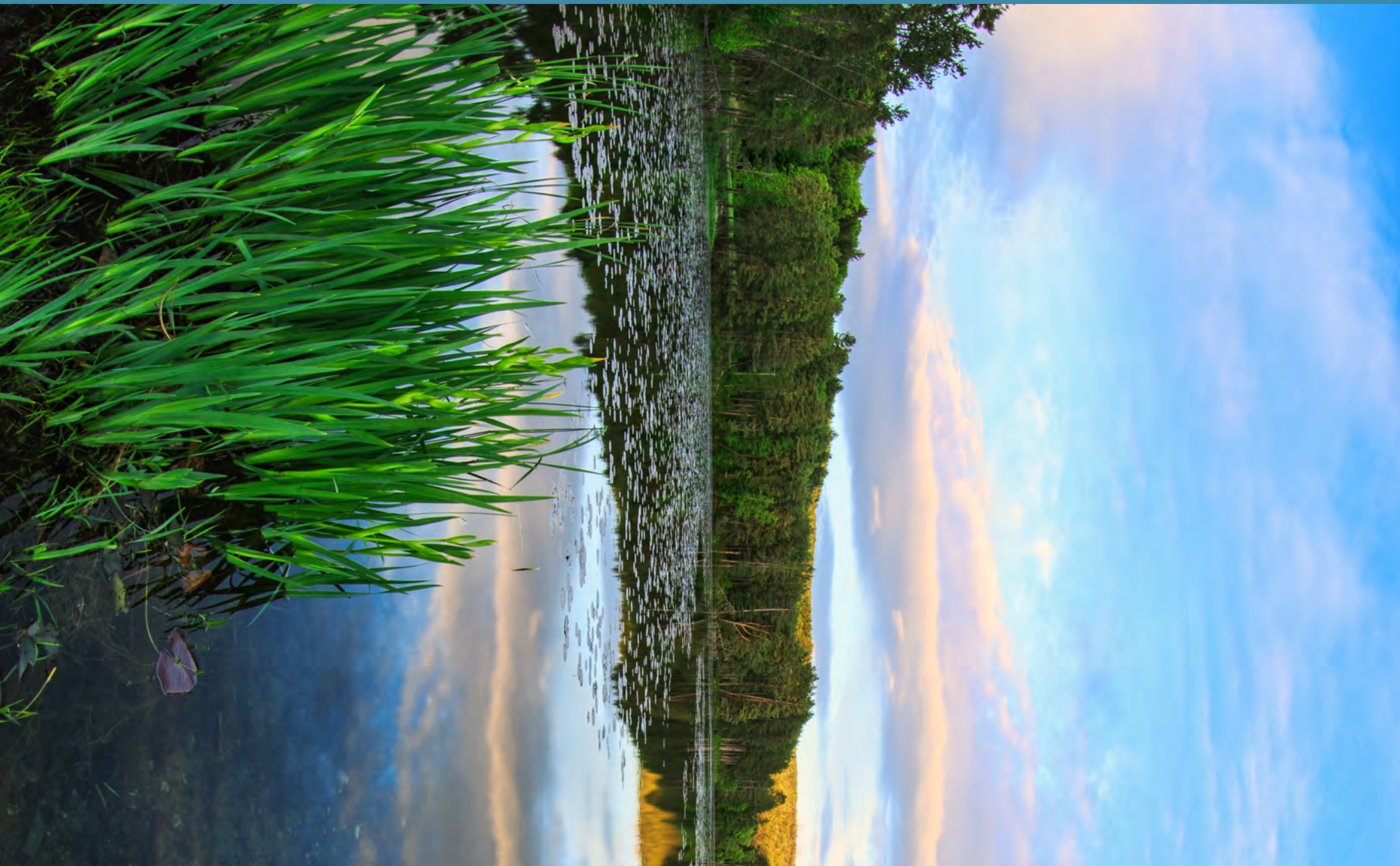
What You Can Do

You can support the goals of the Waste Management section of the Hartford Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- Create a composting bin and routine.
- Challenge yourself and your household to eliminate your food waste. Minimize your food waste by first eating what you already have in your fridge. Meal planning and making grocery lists can also reduce your food waste. https://www.epa.gov/recycle/reducing-wasted-food-home.
- How much of your waste can you divert to recycling? Challenge yourself and your household to increase your recycling. Make sure to rinse and dry your recyclables; dirty materials contaminate the process and have to be landfilled.
- Carry groceries and other purchases in reusable bags. Remember to bring your bags to the grocery store, farmer's market, and when you go retail shopping.
- Give up single-use plastics by switching to sturdy, reusable items like metal/hard plastic water bottles, cutlery, & to-go containers.
- Choose items with no packaging, minimal packaging, or packaging that is compostable or completely recyclable.
- Give unused clothes and household items (in good condition) to a local nonprofit, neighbor or friend.
- Shop local second-hand and vintage stores.

Click here to return to TOC

Section 05
Water + Wastewater



Water + Wastewater
In Hartford

285 million
gallons of water consumed in 2019

328 million
gallons of wastewater generated in 2019

27
Community flooding events reported in Windsor County since 2001 (NOAA)

-12.3%
Change in total water consumption since 2013

+11.6%
Change in total wastewater generation since 2013

Water and Wastewater

Why Water and Wastewater is Important

Water is at the core of climate change and sustainable development. Quality water is vitally important for socio-economic development, maintaining healthy ecosystems, and for human survival. Water is central to the production and preservation of a wide range of services benefiting people. How we process water is also linked to our greenhouse gas emissions. Water related energy use totals 13% of US electricity consumption and has a carbon footprint of at least 290 million metric tons. Meanwhile, wastewater treatment is responsible for 3% of global GHG emissions.

Water is also at the heart of adaptation to climate change. Climate change will increase the likelihood of drought combined with additional heavy rain events, flooding, and flash flooding. Climate change will also/ result in increased stress on our water systems, increase water pollution potential, and place more risk on maintaining safe water resources. Water is an irreplaceable, critically important resource fundamental to the well-being of our communities. Water can only be considered renewable with high quality best water management practices in place.

According to the USGS "Vermont is fortunate to have abundant freshwater resources. However, as populations have grown (10.6 percent between 1990 and 2015), freshwater resources have come under significant stress in many areas, particularly during periods of drought."

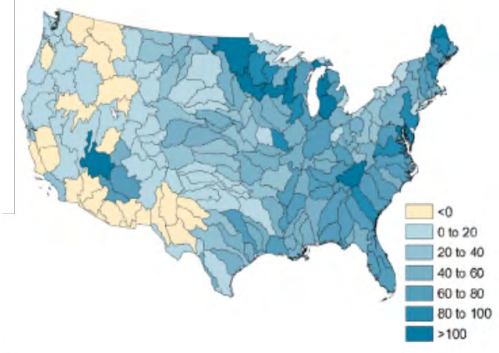
Water and Energy Nexus

Water and energy are fundamental components of our 21st century life. Production, distribution, consumption, and treatment of water consumes energy. Production of energy - particularly those generated through fossil fuel use - consumes water. The water-energy nexus is the relationship between how much water is used to generate and transmit energy, and how much energy it takes to collect, clean, move, store, and dispose of water. Both fresh water production and waste water treatment are typically the highest energy and carbon emission sources within a community's operations. Reduction of water demand saves energy not only in the production and distribution of fresh water but also in the collection and treatment of wastewater.

Regional Water Stress

By 2025, an estimated 1.8 billion people will live in areas plagued by water scarcity, with two-thirds of the world's population living in water-stressed regions. Since 1985 the Hartford region has had a reduction in water yield of approximately 10%. Through 2050, the Town can anticipate an increase in water demand of 20%.
(Sources: "Adaptation to Future Water Shortages in the United States Caused by Population Growth and Climate Change", World Resources Institute, USGS).

Projected Change in Water Demand by 2050



Climate Change Considerations

Climate Impacts

This sector impacts climate change through fossil fuel use to generate the electricity required to process and distribute water.

Climate Hazards

Hazards to the water and wastewater system include damage to infrastructure from extreme weather and flooding. Town-wide hazards include increased flooding and flash flooding potential.

Water and Wastewater

Equity Considerations

- Low-income neighborhoods frequently suffer more damage from flooding, according to studies by the National Academies of Sciences, Engineering and Medicine (*Framing the Challenge of Urban Flooding in the United States*, 2019). The frequency and magnitude of heavy rain events is expected to increase as a result of a changing climate, making the future flooding impacts for at-risk neighborhoods potentially more acute. Hartford can look to the damages experienced in recent extreme weather events such as hurricane Sandy for a better understanding of areas of higher vulnerability throughout Hartford.
- Disadvantaged communities within cities often have denser populations, more impervious surfaces, and less open/green spaces. These areas can also be prone to flooding and sewer overflows. Stormwater management through the creation of open, green spaces serve to revitalize and promote health within these disadvantaged communities.

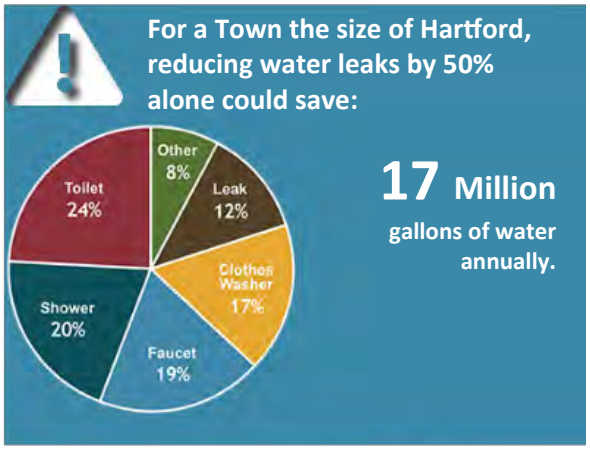
Town-Wide Water and Wastewater Targets Supporting Sector Goals

Sector goals are established to both support the Town's Climate Action Plan in creating a climate resilient community and to reduce Town-wide GHG emissions.

Potable Water Consumption

Today	285 Million Gallons
2030 Targets	**268** Million Gallons

Water Conservation Potential



Source: Water Research Foundation, Residential End Uses of Water, Version 2. 2016

Strategies Supporting Sector Goals

Sector goals related to GHG emissions reductions are designed to balance reduction across all sectors and achieve the overall emissions goals set forth for the community. The goals seek to strike a balance between achievability while also reaching -for improvement beyond business-as-usual.

As indicated in the introduction, the Climate Action Plan is intended to be a 9 year plan to be updated at the completion of that time. Consequently, the goals and strategies outlined in this section are intended to be achieved by 2030 (or earlier) unless otherwise noted.

Implementation of actions are anticipated to be initiated over 3 phases: phase 1 within 1-2 years, phase 2 within 2-5 years, and phase 3 within 3-7 years of CAP approval.

1. **Strategy W 1:** Promote increased water conservation Town Wide with a targeted reduction of 6% (water and wastewater) by 2030.
2. **Strategy W 2:** Mitigate the projected increased flood hazards and impacts due to climate change.
3. **Strategy W 3:** Increase stormwater and wastewater treatment capacity to meet newly defined criteria of major storm and climate events by 2027.

Water and Wastewater

1 Strategy W 1:
Promote increased water conservation Town Wide with a targeted reduction of 6% (water and wastewater) by 2030.

	Actions	Implementation Phase
W 1-1	Implement or expand water leak detection within municipal water supply system with the goal of reducing water leaks by 50% by 2030. Resources: https://cutt.ly/8brg1ad https://cutt.ly/lbrhdp4	1
W 1-2	Facilitate reduction of water use by top 20 customers through an opt-in program. Offer free technical resources to large institutions and businesses to identify specific opportunities for employees or customers to conserve water and incorporate water efficiency into internal operations.	1
W 1-3	Implement a policy to require installation of rainwater collection systems and WaterSense water efficient fixtures and appliances at all municipal facility projects and all projects receiving support from the Town including tax abatement, financing, funding, PUD, or Conditional Use Permits. Provide information and technical assistance to projects as needed. https://palebluedot.llc/hartford-cap-policy-examples	1
W 1-4	Encourage the installation of low-flow water fixtures in residential homes and expand the program to commercial businesses.	1
W 1-5	Explore creation of an ordinance requiring moisture sensors with all new irrigation systems installed in the town. https://palebluedot.llc/hartford-cap-policy-examples	2
W 1-6	Reduce landscaping water use by encouraging water-efficient irrigation systems, grass replacement, planting native and drought-resistant trees and vegetation, soil amendments, and proper tree watering. Consider requiring these approaches during the permitting process.	2

2 Strategy W 2:
Mitigate the projected increased flood hazards and impacts due to climate change.

	Actions	Implementation Phase
W 2-1	Promote native landscaping, restore and conserve habitat; encourage rain gardens on private property, avoid turf grass, and convert Town-owned space to include stormwater absorption features.	1
W 2-2	Manage upstream flows to minimize downstream flood risk, such as through habitat protection, restoration, or land use regulations.	1
W 2-3	Establish policies or ordinances to prevent new infrastructure in floodplain and Channel Migration Zone (CMZ) areas.	2
W 2-4	Increase stream buffer requirements to provide additional flood water storage and minimize property damage due to erosion and flooding.	2
W 2-5	Continue to restore and maintain streams, including removing and controlling invasive species in riparian buffers, to accommodate increased rain events. Stream restoration can reduce the likelihood and magnitude of flooding and support healthy habitat.	2

2 Strategy W 2:
Mitigate the projected increased flood hazards and impacts due to climate change. (Continued)

	Actions	Implementation Phase
W 2-6	Encourage more permeable parking lots and driveways and use more recycled materials with concrete.	2
W 2-7	Periodically update a flood risk assessment using historical data and future precipitation forecasts to identify areas and critical infrastructure vulnerable to flooding	2

3 Strategy W 3:
Increase stormwater and wastewater treatment capacity to meet newly defined criteria of major storm and climate events by 2027.

	Actions	Implementation Phase
W 3-1	Develop a town Stormwater Master Plan to mitigate stormwater impacts due to current and projected increases in precipitation and extreme weather events as well as development and redevelopment of properties currently exempted from stormwater management requirements. Master Plan should strive to go beyond baseline regulatory requirements and include green infrastructure with the goal of eliminating Combined Sewer Overflows. Plan should look to the damages experienced in recent extreme weather events such as hurricane Sandy for a better understanding of areas of higher vulnerability throughout Hartford	1
W 3-2	Prioritize managing stormwater before it enters the sewer system through a combination of overland flow, detention, and infiltration strategies (for example, permeable surfaces)	1
W 3-3	Strategically use available funding programs to improve stormwater management.	1
W 3-4	Enhance stormwater systems to handle an increase in severe weather events.	1
W 3-5	Update town review of culverts and replace those that are inadequate. Continue to explore ways to divert stormwater from the sewer.	1

Water and Wastewater

Planned Water and Wastewater GHG Emission Reductions

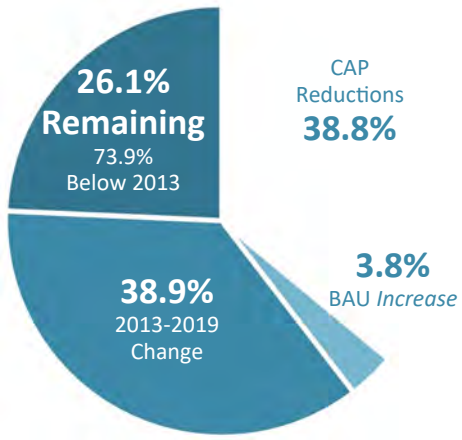
Planned Sector Emission Reductions Through 2030

The strategies and actions included in this section of the Climate Action Plan are projected to reduce the Town's annual GHG emissions by 283 metric tons (MT) by 2030 - a 26.1% reduction over 2013 levels. Previous changes between 2013 and 2019 decreased emissions in this sector by 47 metric tons. Changes in business-as-usual impacts in the future, however, are anticipated to *increase* 28 metric tons. The result is a total community wide Water and Wastewater sector reduction of 73.9% when compared to 2013 levels..

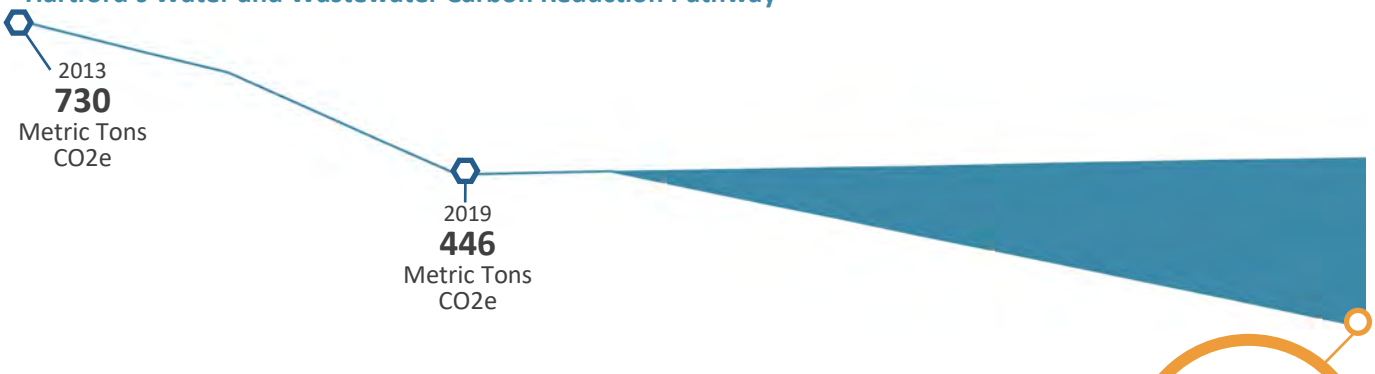
When compared to 2013 emissions, this is equivalent to eliminating 66 cars from the road, or **10.6 million** cubic feet of man-made greenhouse gas atmosphere annually by 2030.

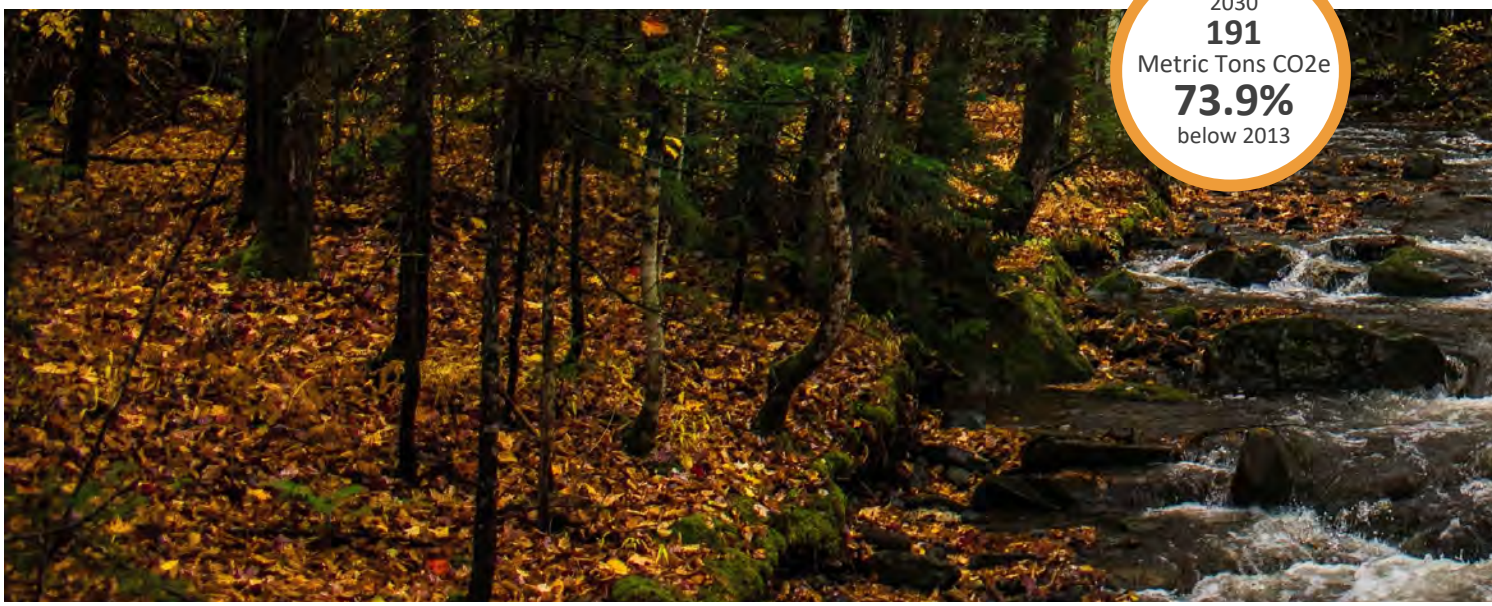
Sector Emissions Reduction below 2013 by 2030

The total change to sector emissions include CAP Plan reductions, BAU emission changes, and previous changes between 2013 and 2019 as follows:



Hartford's Water and Wastewater Carbon Reduction Pathway





Water and Wastewater

What You Can Do

You can support the goals of the Water and Wastewater section of the Hartford Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- Collect rainwater and use it for indoor and outdoor plants.
- Install — or have a licensed plumber install — water-saving aerators on 2 or more showerheads and faucets.
- Install — or have a licensed plumber install — a water-saving low-flow toilet.
- Replace your lawn or portions of your lawn with drought resistant native plantings, prairie grasses, and wild flowers and eliminate or greatly reduce exterior watering.
- Turn off the faucet while brushing your teeth.
- If you have dishwasher, use it. Research shows we use more water washing dishes by hand than running a full or nearly full dishwasher.
- If you have a lawn and garden irrigation system, or use hoses and sprinklers, water thoroughly less often, and do so in the early morning or evening.

Section 06
Local Food + Agriculture

Click here to return to TOC

Local Food
In Hartford

2
Community gardens

10.4%
Food insecurity in Windsor County

3,262 acres
Crop and pasture land in Hartford

Local Food and Agriculture

Why Local Food and Agriculture Are Important

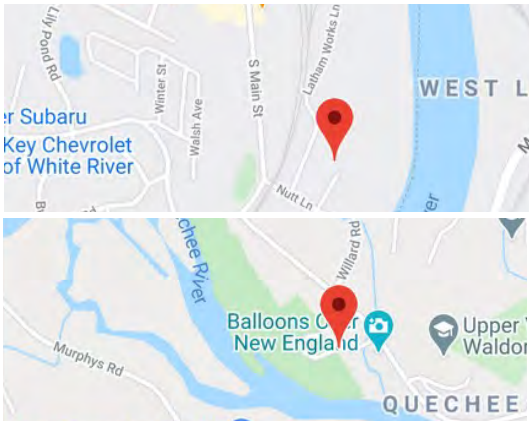
Food and climate change are directly linked. For nutritionally insecure people, climate change is a threat multiplier. Extreme weather events, extreme temperature variations, changes in precipitation, changing soil temperatures and other climate impacts will affect crop yields. Climate impacts can also introduce interruptions in the current food processing and distribution system. Disruptions that occur in the food system are likely to cause food availability or pricing fluctuations.

Our choices about what we eat and where our food comes from also directly impact our personal and community greenhouse gas emissions. Transporting food across long distances burns fossil fuels and emits greenhouse gases. In addition, the extended period of time of long-distance transport increases the need for refrigeration. The less transportation and refrigeration needed to supply us our food, the more sustainable it becomes.

Strengthening local food sources can address both climate change relationships with food and also supports your small business local economy. Studies have indicated that nearly 32 jobs are created for every $1 million in revenue generated by produce farms involved in a local food market, compared to only 10.5 jobs for those involved in wholesale channels exclusively. Increased local food systems also increase community resilience. A robust local food system establishes additional supply chains and resilience to distribution disruptions. Healthy local food systems can also play a critical role in addressing food access vulnerability and food insecurity within neighborhoods of higher vulnerability. Increased local food systems also tend to increase diversity and long-term food system resilience in food crops cultivated.

Community Gardens In Hartford

(White River Junction and Quechee)



Community Gardens Per 100,000 Residents

United States: 18,000 Total (est)	**5.5**
State of Vermont: 500 Total	**0.8**
Town of Hartford: 2 Total	**20.7**

(Sources: American Community Gardening Association, Vermont Community Garden Network)

Equity Considerations

- People in low-income neighborhoods may have limited access to full-service supermarkets or grocery stores - an area known as a "food desert."
- Studies have also shown that communities with fewer resources often have more outlets that promote unhealthy dietary behaviors such as fast food restaurants, and little access to affordable nutritious food. This condition is known as a "nutrition desert."

Climate Change Considerations

Climate Hazards

Hazards to the local food and agriculture system include reduced crop quality and yield, vulnerability to pests and soil moisture as well as fluctuation in availability, food price volatility and change.

Opportunities

Increased capacity of local food and agriculture systems and improved farm-to-table approaches can reduce community food insecurity while creating local jobs and improved community resilience.

Local Food and Agriculture

Strategies Supporting Sector Goals

As indicated in the introduction, the Climate Action Plan is intended to be a 9 year plan to be updated at the completion of that time. Consequently, the goals and strategies outlined in this section are intended to be achieved by 2030 (or earlier) unless otherwise noted.

Implementation of actions are anticipated to be initiated over 3 phases: phase 1 within 1-2 years, phase 2 within 2-5 years, and phase 3 within 3-7 years of CAP approval.

1. **Strategy LF 1:** Increase production of local food, particularly serving low income and food insecure individuals.
2. **Strategy LF 2:** Increase access to local food.
3. **Strategy LF 3:** Reduce food waste and hunger, achieve a 50% reduction in food insecurity community-wide by 2030.
4. **Strategy LF4**: Increase local agricultural resilience to climate shocks.

1 Strategy LF 1:

Increase production of local food, particularly serving low income and food insecure individuals.

	Actions	Implementation Phase
LF 1-1	Establish a communication/education effort to clarify the allowances of local food production activities within Town ordinances such as front yard vegetable gardening, community gardens, urban farming, beekeeping, poultry keeping, etc. Explore potential or need for modification of zoning ordinances to further clarify local food production allowances in support of the goals of this CAP. https://palebluedot.llc/hartford-cap-policy-examples	1
LF 1-2	Review/Update code to provide incentives for multi-unit buildings and developments/sub-divisions and commercial developers to preserve topsoil and provide space for backyard or community gardens.	1
LF 1-3	Support existing school and community gardens and provide opportunities to expand community growing spaces located within neighborhoods and locations that serve youth, immigrant, and low-income residents.	1
LF 1-4	Integrate sustainable food system issues that affect climate into land use planning processes and, where practical, incorporate quantitative goals and metrics.	2
LF 1-5	Support organizations and schools promoting local food production and community gardens, through partnerships, funding, and educational programs on the benefits of a plant-based diet and the importance of locally sourced, humanely raised meats for any meats consumed.	2
LF 1-6	Equitably promote educational opportunities for residents to gain skills in organic gardening, fruit production, food preservation and cooking and affordable, healthy eating	2
LF 1-7	Work with community organizations and neighborhood groups to organize a garden-tool lending program and garden bounty exchange program.	2

Local Food and Agriculture

2 Strategy LF 2:
Increase access to local food.

	Actions	Implementation Phase
LF 2-1	Analyze existing Municipality and school purchasing and procurement policies and explore creating a preference for purchasing locally grown foods.	1
LF 2-2	Create collaborative partnerships with community-based organizations and affinity groups, including low-income populations and communities of color, to: a) Promote healthier, low-carbon diets. b) Encourage local food production. c) Support affordability and access to healthier foods through neighborhood food buying clubs and co-ops. d) Reduce food waste.	1
LF 2-3	Develop edible landscaping initiatives to educate residents about these local food resources and to showcase the variety of plants that can grow in the town.	2
LF 2-4	Establish a public Food Forest by adding edible trees, shrubs, and planting regionally native vegetables to existing public landscaping. Select an existing property for a pilot project. (https://burnsvillemn.gov/2271/Grow-Burnsville https://projectfoodforest.org/)	2
LF 2-5	Incentivize installation of permaculture and urban agriculture boulevard gardens on private property; and install permaculture and urban agriculture boulevard gardens and rain gardens on Town-owned lands and promote food harvests benefiting Town residents, particularly within at-risk communities	2

3 Strategy LF 3:
Reduce food waste and hunger, achieve a 50% reduction in food insecurity community-wide by 2030.

	Actions	Implementation Phase
LF 3-1	Support the development of education strategies in collaboration with existing groups for teaching town residents about growing, harvesting, cooking, and processing local agricultural goods and subsistence resources in neighborhoods most at risk of food insecurity.	1
LF 3-2	Support the research of regional work to implement an end-to-end food waste reduction and recovery technology infrastructure to support recovery of food for human consumption (see: Austin / Travis County Food Policy Board Recommendation 20170522-2) https://palebluedot.llc/hartford-cap-policy-examples	2
LF 3-3	Partner with schools and other organizations to create “edible school yards” and sustainable gardening programs at public and private schools.	2

Local Food and Agriculture

4 Strategy LF 4:
Increase local agricultural resilience to climate shocks.

	Actions	Implementation Phase
LF 4- 1	Collaborate with the State, universities, local organic farmers associations and others to encourage adoption of strategies to increase soil health and increased carbon sequestration for Croplands and Grazing Lands. Tools: http://www.comet-farm.com/ GHG and Carbon Sequestration Ranking Tool: https://cutt.ly/Vf04djN https://www.farmcarbontoolkit.org.uk/	**1**
LF 4- 2	Incentivize and reward soil best management practice for urban lawns, gardens, landscaping, parks, open spaces, prairies, environmentally sensitive areas, and agricultural land uses.	**2**
LF 4- 3	Develop and deliver educational materials for producers that will assist them in understanding the differences between normal weather fluctuations and long term climate change, as well as provide information on the agricultural crops, varieties, and methods most suitable for our area.	**2**

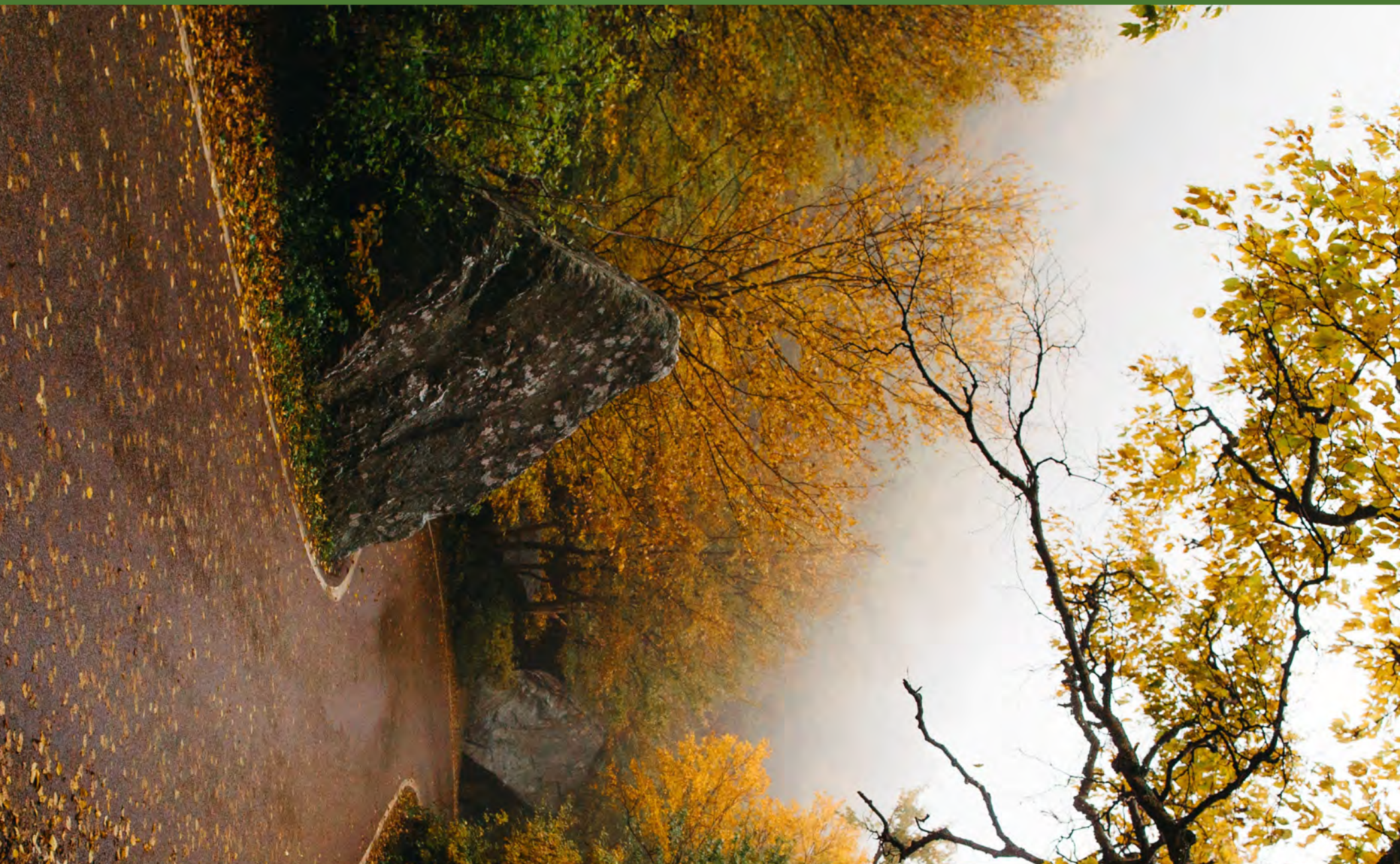
What You Can Do

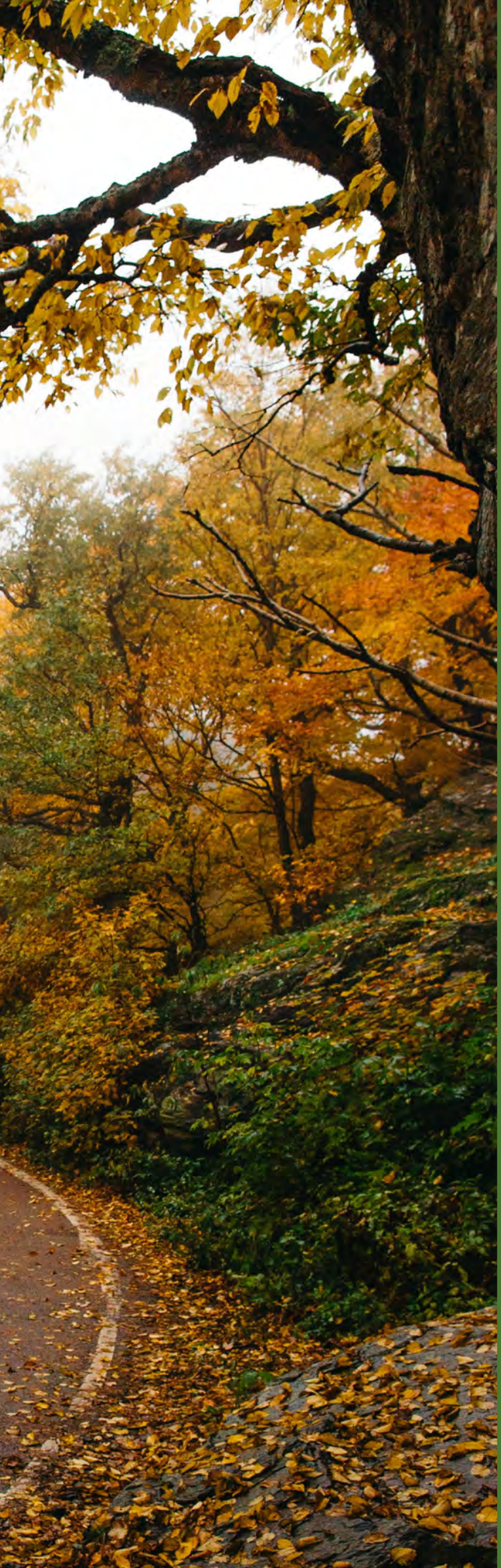
You can support the goals of the Local Food and Agriculture section of the Hartford Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- Eat a plant-rich diet. Animal products are extremely GHG-intensive to produce compared to plants. Eating less meat and dairy will reduce emissions associated with food consumption. Eating regionally-grown food that is suitable for the Vermont climate will also make a difference through reduced transportation-related emissions. A great place to start is with “Meatless Mondays” or one meat-free meal a day. https://ourworldindata.org/food-choice-vs-eating-local
- Support your local farmers markets.
- Rent a plot at your local community gardens and grow your own.
- Buy food directly from a local grower on an ongoing basis by joining a Community Sponsored Agriculture (CSA) group or frequenting the farmer’s market.
- Plant fruit or nut bearing trees or shrubs that are well suited for our hardiness zone on your property. Examples include: Trees: Apple, Black Cherry, Pear, Serviceberry, Black Walnut, Shagbark Hickory
- Support restaurants and grocery stores that use and sell locally-grown food.
- Buy food that is in season, minimizing the distance food must travel.
- Buy ethically grown and harvested food, like fair-trade coffee and chocolate.

Click here to return to TOC

Section 07
Greenspace and Trees





Greenspace
In Hartford

65%
Forest coverage

10%
Estimated Impervious surface coverage

136 acres
Estimated maintained lawn coverage

Greenspace and Trees

Why Greenspace and Trees Are Important

Human activities coupled with natural variations in the carbon cycle, have resulted in a significant increase in the concentration of carbon dioxide (CO_2) and other "greenhouse gases" in the atmosphere, thus causing measurable global warming. Controlling atmospheric CO_2 requires deliberate action that combines reducing emissions and increasing storage, while planning for adaptation to the changes that result. Part of this Climate Action Plan addresses ways that greenspace protection and enhancement is one of Hartford's most important avenues for lowering our environmental footprint.

Greenspace, plays a central role in supporting community health, improving air, soil, and water quality, reducing energy use in buildings, and supporting climate -change mitigation. An urban greenspace includes any permeable vegetated surface, public or private, set apart for recreational, aesthetic, or ecosystem services (EC) in an otherwise urban environment. It is space set aside for providing life-essential benefits people and other living things obtain from properly-functioning ecosystems. The key benefits and services greenspaces provide include:

- Carbon sequestration: Plants on land convert carbon dioxide into biomass (leaves, stems, etc.) through photosynthesis. If more plants grow in more places, they will remove more CO_2 from the atmosphere.
- Stormwater infiltration and flood mitigation: Greenspace helps protect from flash flooding by absorbing water through roots and slowing down rainwater running off.
- Reduce the urban heat island effect: The more vegetated greenspace we have in Hartford, the better the cooling effects. High levels of impervious surfaces (a surface that does not allow water to infiltrate such as pavement and buildings) results in an increased urban heat island effect, which raises the temperature of the near-surface air, buildings, and pavement higher than the surrounding areas.
- Purify and humidify the air: Plants purify the air when they absorb light, carbon dioxide, and water to manufacture sugar.
- Support pollinators: Animal species that pollinate plants, termed pollinators, carry pollen, either accidentally or intentionally, from the male part of a flower to the female part of the same or another flower. Pollinators play a critical role in maintaining the health of our greenspace, species diversity, and food chain. It is estimated that a minimum of 35% of all of our food directly relies on pollinator species health.

Climate Change Considerations

Climate Hazards

Projected climate change impacts may cause forests and urban trees to experience increased mortality and reduced productivity, more prevalent invasive species and disease all resulting in forest and tree loss, reduction in crop yield. Loss of greenspace, in turn, reduces carbon capture potential of green infrastructure.

Opportunities

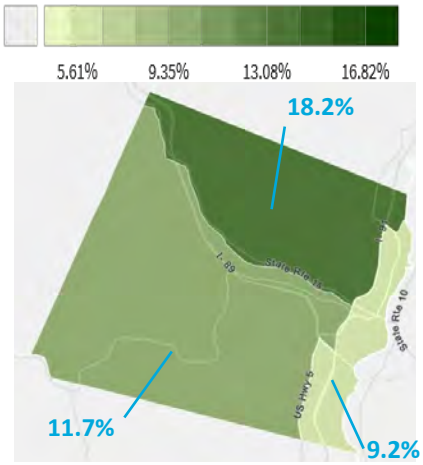
Many strategies within the Greenspace sector can advance community resilience and quality of life. Increased tree canopy, decreased impervious surfaces, and increased utilization of native grasses and plantings can reduce heat island experiences, energy consumption, stormwater runoff, and flood impacts.

Greenspace and Trees

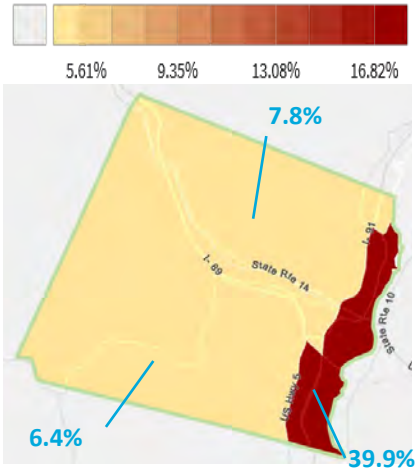
Hartford's Heat Island Contribution

Higher levels of impervious surfaces (pavement and buildings) within a community will increase the heat island of the community. Heat island refers to the phenomenon of higher atmospheric and surface temperatures occurring in developed areas than those experienced in the surrounding rural areas due to human activities and infrastructure. Increased heat indicies during summer months due to heat island effects effectively raise human discomfort and health risk levels in developed areas, especially during heat waves. Based on a 2006 study done by Minnesota State University and the University of Minnesota, the relationship between impervious surface percentage of a City and the corresponding degree of heat island temperature increase can be understood as a ratio.

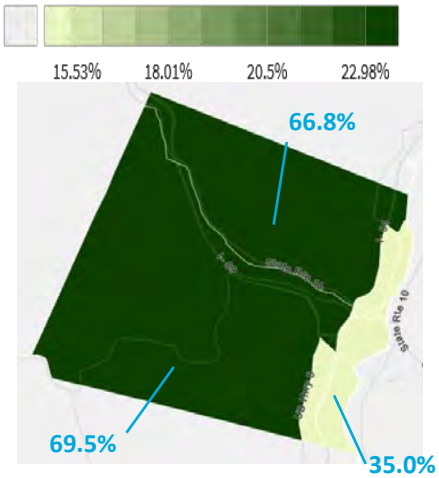
Croplands and Grasslands
Town-wide by Census Tract



Impervious Surfaces
Town-wide by Census Tract



Tree Canopy Coverage
Town-wide by Census Tract



Greenspace and Trees

Equity Considerations

- Lower income neighborhoods and neighborhoods with higher proportions of people of color regularly have lower tree canopy coverage, and the environmental, economic, and quality of life benefits trees support than more affluent neighborhoods.
- "Heat islands" and "micro heat islands" are built up areas that are hotter than other nearby areas. This is caused by lack of adequate greenspace and healthy tree canopy coverage combined with too many hard surfaces like roads, parking lots, and hard building surfaces. Frequently neighborhoods with higher vulnerable populations have the highest heat island impacts.

Strategies Supporting Sector Goals

As indicated in the introduction, the Climate Action Plan is intended to be a 9 year plan to be updated at the completion of that time. Consequently, the goals and strategies outlined in this section are intended to be achieved by 2030 (or earlier) unless otherwise noted.

Implementation of actions are anticipated to be initiated over 3 phases: phase 1 within 1-2 years, phase 2 within 2-5 years, and phase 3 within 3-7 years of CAP approval.

1. **Strategy GT 1:** Increase Tree Cover and Diversity, achieve an increase of 90 acres by 2030 (approximately 3% of developed land area).
2. **Strategy GT 2:** Increase the use of Native Species and Pollinator Restorations Areas with a targeted conversion of 10% of Town-wide lawn coverage.
3. **Strategy GT 3:** Reduce Micro-Heat Island Effect through Town-Wide impervious surface reduction of 2% by 2030.
4. **Strategy GT 4:** Care for forest and wildland Trees to enhance their resilience to climate change and capacities for carbon sequestration.
5. **Strategy GT 5:** Increase the resilience of the urban tree canopy and greenspaces to climate change impacts.

1 Strategy GT 1:

Increase Tree Cover and Diversity, achieve a Town-wide Tree Canopy/Forest coverage increase of 90 acres by 2030 (approximately 3% of developed land area).

	Actions	Implementation Phase
GT 1-1	Create a comprehensive community tree plan. A community tree plan would focus on increasing urban canopy cover and include elements such as 1) conducting an inventory of street trees and community-wide canopy cover in each of the villages, 2) determining canopy goals, 3) developing a planting guide that prioritizes carbon sequestration, resilience, and other equitably-distributed co-benefits, and 4) devising a plan for retiring trees and addressing unintended consequences such as sidewalk uplifts. The plan should also include potential ways to support trees on private property	1
GT 1-2	Preserve existing forested areas through practices that re-purpose already developed areas, such as establishing codes that retain minimum canopy cover on new developments and minimize removal of native soil, ground cover, and shrubs	1
GT 1-3	Support current development regulations to recommend or require the use of appropriate native trees and plants for new and redevelopment.	1
GT 1-4	Continue Conservation Commission annual tree sale program and collaborate with the Hartford Area Career & Technology Center Natural Resources program free sapling offering to promote both events. Explore other collaborations to expand tree sales and reduced cost/free tree programs particularly for low income households and households in low tree cover / high micro heat island locations. Programs should prioritize native and climate adaptive species.	1
GT 1-5	Adopt a No Net Loss policy for street trees and other trees in urban public spaces—every public street/space tree that is removed shall be replaced by a seedling or sapling of optimal size. If a tree is removed in a location in which it is not feasible to replant, a new tree shall be planted in a nearby void space or within a designated "tree bank" location within the Town.	2
GT 1-6	Partner with local sustainability organizations to foster public volunteer efforts to maintain and grow park systems and green infrastructure, through tree plantings and integrated invasive species control. These programs could help contain costs and foster public involvement. Potentially hold partnered events on environmentally focused holidays such as May Day, Arbor Day, Earth Day, solstices, Mother's Day, Father's Day, etc	2
GT 1-7	Explore options for public and private partnerships to help reduce or share the cost of tree planting and maintenance	2

Strategy GT 2:

Increase the use of Native Species and Pollinator Restorations Areas with a targeted conversion of 10% of Town-wide lawn coverage to pollinator restoration coverage.

	Actions	Implementation Phase
GT 2-1	Transition maintenance of all Town owned properties to Carbon Gardening practices including elimination of synthetic fertilizer and pesticide use, high mow deck settings, use of biochar amendments, and native pollinator restorations or polyculture lawn mixture.	1
GT 2-2	Require the use of native plants in landscaping at Town-owned properties	1
GT 2-3	Remove and ease lawn/grass requirements in ordinances as applicable. Establish a communication/education effort to clarify the allowances of lawn alternatives including native grasses, wild flowers, vegetable gardens, etc.	1
GT 2-4	Encourage the use of low-impact landscaping, to reduce consumption of water in yard maintenance and improve permeability and reduce stormwater runoff	2
GT 2-5	Enhance the connectivity of greenbelt and habitat corridors across the community	2
GT 2-6	Promote the conversion of portions of manicured lawns to restored native species/ wild flower grasses	2
GT 2-7	Manage publicly-owned natural areas to enhance and maintain diverse native communities	2
GT 2-8	Develop a list of invasive non-native plants commonly used in landscaping and proven to seriously reduce diversity of native plants and wildlife. Adjunct to this list, provide native alternatives to each non-native species. Publicize this list widely and encourage plant nurseries and landscapers to provide the native alternatives	2

3 Strategy GT 3:

Reduce Micro-Heat Island Effect through Town-Wide impervious surface reduction of 2% by 2030 and 5% by 2040.

	Actions	Implementation Phase
GT 3-1	Promote the expansion of tree canopy in urban heat islands or areas that need air conditioning such as schools	1
GT 3-2	Evaluate opportunities to plant additional trees near Town facilities to reduce heat island.	1
GT 3-3	Develop a policy that requires all commercial development projects receiving Town funding, PUD approval, and/or Conditional Use Permitting to implement commercial scale heat island mitigation strategies including cool surfaces, solar-friendly landscape shading strategies, impervious surface reduction, and breeze capture. Reference Town's Net Zero Energy Building Guide for relevant strategies (see Buildings and Energy actions). https://palebluedot.llc/hartford-cap-policy-examples	2
GT 3-4	Establish a Green Roof policy to promote and advance the development of green roofs on existing buildings and new construction. Encourage rooftop garden / farm installations which advance food security. Examples of incentive programs can be found at: https://cutt.ly/KkmZLDE https://palebluedot.llc/hartford-cap-policy-examples	2

4 Strategy GT 4:

Care for forest and wildland ecosystem health (considering western and indigenous practices) to enhance their resilience to climate change and enhance their capacities to sequester and store carbon.

	Actions	Implementation Phase
GT 4-1	Support efforts to protect and restore extended riparian corridors to maintain wildlife and fish habitat, including efforts to reestablish historical surface channels and connectivity	1
GT 4-2	Extend an invitation to the local indigenous leaders and community to fully participate in the Hartford CAP implementation.	1
GT 4-3	Use green infrastructure such as bioswales, permeable pavement, other pervious surfaces to reduce flood risk and minimize sediment entry into creeks and rivers from trails and roads	1
GT 4-4	Use a diverse selection of native tree species in new plantings, particularly those that will be most resistant to the stresses of climate change: e.g., oak species, hickory species, hackberry, serviceberry, American hornbeam, American sycamore, linden, black gum, and chestnuts (disease-resistant hybrids)	2
GT 4-5	Promote and expand invasive weed pulls, tree plantings, invasive species identification and management, wildfire mitigation, and other educational activities that promote stewardship among the public, businesses, and homeowners	2
GT 4-6	Manage forests to retain biodiversity, resilience, and ecosystem function and services in the face of climate change. Use best available science to inform fire management and planning to manage ecosystem health, community safety, and carbon storage	2

5 Strategy GT 5:

Increase the resilience of the urban tree canopy and greenspaces to climate change impacts.

	Actions	Implementation Phase
GT 5-1	Increase the diversity of urban tree species to improve overall urban forest resilience	1
GT 5-2	Prioritize planting and preservation of native species of plants and trees on public and private property through education, incentives and other promotional programs. Ensure that landscaping requirements articulated in the zoning code include the preservation of the maximum possible tree cover, the use of native plantings and the preservation of natural areas whenever possible; also, reduction of lawn space	1
GT 5-3	Improve the ecological functionality of and resiliency of parks and open space through green infrastructure, best practices for stormwater management, and increased plant diversity and pollinator-friendly habitat	2
GT 5-4	Update the Town's approved street tree guide and landscape design standards for new development for tree species appropriate for a future local climate.	2
GT 5-5	Cooperate with county, township, and urban governmental agencies, schools, clubs, libraries, neighborhoods, faith communities, and NGOs to provide and publicize workshops on gardening, landscaping, composting, and their importance in mitigating and adapting to the stresses of climate change on quality of life	2

What You Can Do

You can support the goals of the Greenspace and Trees section of the Hartford Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- Plant a rain garden with native plantings to absorb storm water and replenish our aquifers.
- Plant trees in your yard to provide shade and cooling in summer heat. Select trees suited for the changing climate of Hartford.
- Replace your lawn and landscape with drought-resistant, native or well-adapted, non-invasive plants.
- Make your backyard a Certified Wildlife Habitat with the National Wildlife Federation. www.nwf.org/garden-for-wildlife/certify
- Remove pavement and increase permeable surfaces. De-pave areas wherever possible to encourage stormwater infiltration onsite.
- Install bioswales/rain gardens or rainwater diversion systems to reduce impact on the stormwater system.
- Install a Green Roof (living roof) to reduce your energy consumption. Decrease heat island impacts, and reduce stormwater runoff.

Section 08
Health and Safety

Click here to return to TOC

Climate Health + Safety

In Hartford

+4-5°F

Increase in temperature by 2050

+30% more

Air conditioning demand by 2050

+20-26 days

Longer allergy season by 2050

Health and Safety

Why Health and Safety Are Important

There is a strong relationship between human health and environmental health. From the air we breathe to the water we drink and use, life here on Earth depends on the natural resources and the environment around us. This link between the environment and human health is a critical consideration of the impacts of climate change. As outlined in the Town's Climate Risk and Vulnerability Assessment, changes in climate, such as higher average temperatures and increased storm frequency and intensity, can intensify public health stressors. These climate change impacts endanger public health and safety by affecting the air we breathe, the weather we experience, our food and water sources, and our interactions with the built and natural environments. As the climate continues to change, the risks to human health continue to grow.

The health of our environment affects our public health, and agencies should promote it as such. There is a direct relationship between climate action and community health because the health of our environment affects public health.

Equity Considerations—Vulnerable Populations

Climate change impacts the health of all community members, however, people within our communities are differently exposed to hazards and some are disproportionately affected by the risks of climate change. According to the National Climate Assessment, greater health risks related to climate impacts can be experienced by some populations in our communities including children, older adults, low-income communities, and some communities of color. Others, like children, older adults, low-income communities, some communities of color, and those experiencing discrimination are disproportionately affected by extreme heat and weather events, and many have increased health and social vulnerability which decreases their access to resources that can help them avoid the risks of climate change.

According to the National Climate Assessment (https://nca2018.globalchange.gov/chapter/14/):

> Additional populations with increased health and social vulnerability typically have less access to information, resources, institutions, and other factors to prepare for and avoid the health risks of climate change. Some of these communities include poor people in high-income regions, minority groups, women, pregnant women, those experiencing discrimination, children under five, persons with physical and mental illness, persons with physical and cognitive disabilities, the homeless, those living alone, Indigenous people, people displaced because of weather and climate, the socially isolated, poorly planned communities, the disenfranchised, those with less access to healthcare, the uninsured and underinsured, those living in inadequate housing, and those with limited financial resources to rebound from disasters.

Climate Change Considerations

Climate Hazards

Climate stressors include increases in the frequency and intensity of poor air quality days, extreme high temperature events, heavy rainfalls, extended pollen seasons, changed distribution of disease carrying pests.

Opportunities

Strategies which improve community connectedness, mobility, community resilience through healthy lifestyles frequently coincide with climate mitigation measures such as improved pedestrian safety and low income home weatherization.

Health and Safety

Hartford Vulnerable Populations Risk Sensitivity Chart

The following identification of Hartford population climate vulnerabilities is excerpted from the Hartford Climate Vulnerability Assessment.

		Primary Risks to The Population								Economic Vulnerabilities				
	Population	Extreme Weather / Temp	Flood	Air Quality	Vector-Borne	Food Insecurity	Water Quality	Waterborne	Power Failure	Crop Yield	Mortality	Energy Costs	Property Crime	Violent Crime
children	476	476		476	476	476		476	476	476	476	476		
seniors	2,435	2,435	2,435	2,435	2,435	2,435			2,435	2,435	2,435	2,435	2,435	
disabled	1,773	1,773	1,773	1,773		1,773			1,773		1,773	1,773	1,773	
Est Total Low Income	2,185	2,185	2,185	2,185	2,185	2,185	2,185	2,185	2,185	2,185		2,185	2,185	2,185
POC	659	659	659	659	659	659	659	659	659			659	659	659
Limited English	71	71	71	71	71	71		71	71	71		71	71	71
Composit At-Risk Workers	843	843	843	843	843			843						843
No Vehicle Access	337	337	337	337		337			337	337				
Total by category		**8,779**	**8,303**	**8,779**	**6,669**	**7,936**	**2,844**	**4,234**	**7,936**	**5,504**	**4,684**	**7,599**	**7,123**	**3,758**
percentage of Vuln pop		100.0%	94.6%	100.0%	76.0%	90.4%	32.4%	48.2%	90.4%	62.7%	53.4%	86.6%	81.1%	42.8%
Rank by Vuln		1	1	1	3	2	6	4	2	4	4	2	3	5
Percentage of Tot Pop		90.7%	85.8%	90.7%	68.9%	82.0%	29.4%	43.7%	82.0%	56.9%	48.4%	78.5%	73.6%	38.8%

Based on the total estimated population count for each vulnerable population and considering the risks each demographic is most sensitive to, the population vulnerabilities can be considered from highest sensitivity (more vulnerable individuals) to lowest (fewer vulnerable individuals) sensitivity. It should be noted that risks which appear to have lower sensitivity levels should not be considered irrelevant for the community.

Hartford Climate Risk Sensitivity Summary

Prioritizing Risk and Vulnerable

Climate change impacts will affect everyone and Town policies and actions should consider climate adaptive needs of the entire community. As with all planning efforts climate adaptation benefits from analysis in order to assist in establishing priorities for initial efforts. An effort to structure a prioritization should not be seen as an attempt to discard the need to address climate impacts for any population within the Town - whether or not it is defined as one of the "vulnerable" populations . Prioritization, however, may be necessary to ensure the greatest impact and effectiveness of limited Town resources.

Based on the above review the Town's adaptive efforts may be most effective by prioritizing strategies which address the climate risks of Extreme Heat, Flooding, Air Quality, Power/Infrastructure Failure, Energy Costs, and Food Insecurity. Particular attention should be paid to strategies which are most effective for Seniors over 65, those in Economic Stress, individuals with disabilities, and workers employed in at-risk jobs.

Health and Safety

Hartford Climate Risk

The chart below reviews the expected climate impacts, likelihood of occurrence, impact level (Vulnerable Population Climate Impact Sensitivity), potential timeframe of impact, and resulting overall potential risk level for climate risks to the population. Each of these impacts are already experienced. The timeframes represent estimations of when the likelihood of occurrence and/or the overall level of impact may be significantly increased. The timeframes should be understood to be approximate and include "short-term" (current to 20 years), "medium-term" (mid-century) and "long-term" (late century).

Health Impacts	Expected Impact(s)	Likelihood of Occurrence	Impact Level (Population Vulnerability)	Timeframe	Risk (Likelihood x Impact)	Impact-related indicators
Extreme Heat	Increased demand for cooling; heat stress and emergency visits, heat related health	Likely	High	Medium-term	Moderate	Cooling Degree Days, days above 95
Flooding	damage to property; flood related health impacts; infrastructure impacts	Likely	High	Short-term	Very High	Flood events, flash flood occurances, wettest 5-day periods, number of heavy rain events, disaster declarations, change in NOAA storm
Drought	Damage to crop/tree/ecosystem, reduced drinking water source, increased flash flood potential due to decreased soil permeability	Possible	Moderate	Medium-term	Moderate	Consecutive days without rain, acquafer level, surface water condition, river flow
Air Quality Impacts	Increased particulate matter, increased ozone impacts, increased instances of asthma	Likely	High	Long-term	Low	Air quality index
Vector-Borne Diseases	Increased instances of lyme disease, encephalitis, heart worm, malaria, zika virus,	Likely	Moderate	Medium-term	Moderate	Disease records
Nutrition Insecurity	Food price volitility/change, fluctuation in availability	Possible	High	Medium-term	High	Food price index, Foodshelf demand, % of school children qualifying for free and reduced lunch
Water Quanity/Quality Impacts	Water shortage, surface water quality impacts due to heat and stormwater runoff	Possible	Low	Long-term	Low	Acquafer health; Water quality test results
Water Borne Disease	Bacteria exposusure at infected surface water locations, contamination of drinking water due to flood	Unlikely	Moderate	Medium-term	Low	flood events; algea blooms

Priority Climate Risks for Hartford

The priority climate risks to the population of Hartford include Flooding, Nutrition Security, Extreme Heat, and Vector Borne Disease Impacts while the priority climate risks to infrastructure/institutions include Land Use Planning, Buildings, Roads, Energy, and Agriculture and Forestry impacts.

Strategies Supporting Sector Goals

As indicated in the introduction, the Climate Action Plan is intended to be a 9 year plan to be updated at the completion of that time. Consequently, the goals and strategies outlined in this section are intended to be achieved by 2030 (or earlier) unless otherwise noted.

Implementation of actions are anticipated to be initiated over 3 phases: phase 1 within 1-2 years, phase 2 within 2-5 years, and phase 3 within 3-7 years of CAP approval.

1. **Strategy HS 1**: Educate, engage, and empower the public on health and safety risks of climate change impacts.
2. **Strategy HS 2:** Assist the Town's vulnerable populations in preparing for and mitigating climate change impacts from extreme heat, flooding, storm, and vector borne disease.
3. **Strategy HS 3:** Maintain updated plans to address climate risks and impacts.
4. **Strategy HS 4:** Strengthen community response capacity and support networks.

Health and Safety

1 Strategy HS 1:

Educate, engage, and empower the public on health and safety risks of climate change impacts.

	Actions	Implementation Phase
HS 1-1	Review and effectively communicate emergency and evacuation plans and relevant content from the Hazard Mitigation Plan on a regular basis to update for climate change forecasted data, paying particular attention to flooding, extended heat waves and tornadoes	**1**
HS 1-2	Increase outreach to diverse populations about climate change and health, natural hazards, and emergency preparedness via broadcast, print, bus ads, social media, and other forms of communication in multiple languages and accessible to individuals with disabilities to ensure that emergency preparedness planning reaches all Town residents	**1**
HS 1-3	Expand languages to the local Emergency Alert System (EAS) capability by incorporating the Integrated Public Warning And Alert System (IPAWS). Platforms used should focus specifically on reaching the Town's top vulnerable populations and top non-English languages.	**2**
HS 1-4	Improve the resilience of emergency response and communications systems. The Town Manager's Office will work with the Health and Human Services Department (HHS) Emergency Response Coordinator (ERC) and the Town's Emergency Manager for employee and resident emergency communications. They will routinely test and utilize communications systems and build in notifications and alerts for extreme environmental situations	**2**

2 Strategy HS 2:

Assist the Town's vulnerable populations in preparing for and mitigating climate change impacts from extreme heat, flooding, storm, and vector borne disease.

	Actions	Implementation Phase
HS 2-1	Conduct a needs assessment of accessible community centers for extreme weather or other emergency situations. Create a development improvement plan, if needed.	1
HS 2-2	Support town-wide program to support families who cannot afford to purchase supplies for household emergency preparedness kits to adequately prepare their homes (e.g. solicit emergency supply donations). Identify possible strategies for the structure of the program through a review of donation programs in other communities and engagement with community partners and businesses (involve COVER and UpperVallley Strong)	1
HS 2-3	Collaborate with existing service organizations to identify and connect with low-income populations, communities of color, older adults and people with disabilities to services that help reduce safety, health and financial risks associated with climate change impacts	1
HS 2-4	Identify need for additional sustainable funding source (and assess current utilization / promote existing programs) for increased utility assistance for low-income residents, including support for energy efficiency projects, such as weatherization	2
HS 2-5	Promote equity in hazard mitigation, and emergency response and recovery activities, and consider populations most vulnerable to weather-related emergencies in all plans and exercises, including evacuation routes, transportation for vulnerable population groups, shelter in place locations, back-up power operations, extended access to fuel/power sources and drinking water, etc.	2
HS 2-6	Ensure that facilities that serve vulnerable populations are resilient to climate hazards. Develop model procedures for ensuring both Town and non-City facilities employ best practices in the event of an emergency such as flooding, power outages, extreme heat, etc	2
HS 2-7	Develop municipal anti-idling policy and ordinance for on-road vehicles as well as heavy equipment and construction vehicle to promote improved air quality. https://palebluedot.llc/hartford-cap-policy-examples	2
HS 2-8	Establish cooling centers and provide information to the community to ensure vulnerable residents are aware of these services, including direct messaging at community facilities and through health providers	3

3 Strategy HS 3:

Maintain updated plans to address climate risks and impacts.

	Actions	Implementation Phase
HS 3-1	Continue liaison between HPD and local mental health agency to develop action plans to address climate-related mental health resilience at the individual, neighborhood and community level	1
HS 3-2	Establish regional collaboration with the VT/NH State, Universities, and others to support, maintain, and expand surveillance and mitigation efforts of disease vectors (e.g. ticks, mosquitoes, fleas, etc) that may impact human or wildlife health.	1
HS 3-3	Establish regional collaboration with VT/NH state agencies, universities, and other appropriate organizations such as DHMC and the Montshire Museum to establish citizen-scientist-based programs to trap mosquitoes, ticks, and other insect vectors to monitor for new climate change driven species presence, and for the presence or potential of disease or disease-carrying species. This will enable continued early detection of changes to potential disease vectors due to climate change impacts.	1
HS 3-4	Establish regional collaboration with VT/NH state agencies, universities, and other appropriate organizations to establish adaptation initiatives to reduce vector-borne illnesses with due caution to avoid damaging the environment or lifecycle of other insects and animals. An example might be a collaboration with Cobb Hill to make "tick tubes" from donated empty cardboard toilet paper tubes and cotton from vitamin bottles, then distribute to residents in high tick areas.	1
HS 3-5	Include specific climate change-related emergency materials and risks in the next update to the Hazard Mitigation Plan and Town emergency plans. These could include press release templates, information on cooling/heating centers, specific plans for populations requiring mobility assistance, and steps to identify and help populations affected by extended power outages, flooding, etc	1
HS 3-6	During Town Plan Update process include the incorporation of climate adaptation strategies into planning process.	2
HS 3-7	Update or develop a community resilience plan to prioritize and prepare for responses in the event of a disaster and extreme weather events. Identify the location of critical facilities including hospitals, medical service providers, senior homes, child-care facilities, shelters, major and alternate transportation routes, public transit facilities and locations where hazardous chemicals are used or stored.	2
HS 3-8	Update the Town's emergency response plan and ensure that preparation and updates recognize and address likely climate change impacts.	2
HS 3-9	After weather-related emergency events, assess response to identify effectiveness, deficiencies and resources needed to build future resilience	2

4 Strategy HS 4:
Strengthen community response capacity and support networks.

	Actions	Implementation Phase
HS 4- 1	Assess community resources to address increases in violence and crime, particularly domestic violence, during periods of stress including emergencies and heat waves (utilize Covid experience)	**1**
HS 4- 2	Support Resilient Hartford in the development of neighborhood resiliency groups.	**1**
HS 4- 3	Set up call trees and block networks to check on neighbors during/after extreme weather events especially involving grid disruption.	**1**
HS 4- 4	Enhance community networks and connections for those who require special attention, such as the elderly, homebound, disabled, isolated, or those likely to be in need of financial assistance during or after extreme weather events (heat, cold and heavy precipitation).	**2**
HS 4- 5	Create a reverse 911 call system where public health officials call vulnerable individuals during extreme heat events.	**2**

What You Can Do

You can support the goals of the Health and Safety section of the Hartford Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- Put together an emergency preparedness kit for your household by visiting https://www.ready.gov/
- Get involved with the Hartford Community Emergency Response Team (CERT). Join your neighbors and receive training to prepare for potential disasters.
- Prepare your home for the extremes. Understand the risk of extreme weather, extreme temperatures, flooding or wildfire to your home, and take action to safeguard your home.
- Keep yourself and your family current with physicals, vaccinations and prescribed medications and therapies.
- Plan and rehearse a fire evacuation plan with everyone who lives in your home or apartment.
- Have breathing-protection masks available for you and your family for when air quality alerts are declared.
- Take first-aid and CPR certification training.
- Notice a person who lives alone. Offer to check on them periodically, especially during extreme weather or a natural disaster.
- Notice a person who sometimes lacks transportation to their doctor, shopping or other services. Offer to drive them.
- Notice a person or family who lacks air conditioning in their home or apartment. Offer to have them visit or stay with you during extreme heat events.

Section 09
Climate Economy

Click here to return to TOC

Climate Economy

Why Climate Economy Is Important

Climate change and the economy are inexorably linked. Left unabated, the impacts of man-made climate change through the end of this century will cost the United States billions of dollars. According to a 2019 study by two EPA scientists, the difference in economic impact between the mid-range climate model and the high range climate model may account for as much as $224 billion in economic impact annually by 2090. According to a 2019 World Bank report on trends in carbon pricing, a carbon price range of $40-$80 per ton is necessary by 2020 to reach the goals set by the 2015 Paris Agreement, while other studies have placed the full cost of carbon at $200-$400 per ton. Using the calculation outlined in Section 10 of the Hartford Climate Vulnerability Assessment (Projected localized annual economic impacts of climate change divided by annual community-wide GHG emissions), an estimate of localized cost for carbon is $105 per metric ton.

The economy is also directly linked to climate action as well. One common reason given by those who wish not to see action taken on climate change is that the economy will be damaged. Setting aside the avoidance of the future costs should we not act to mitigate climate change, evidence is building a clear case that acting on climate change, and reducing fossil fuel emissions can be done without weakening the economy. Since 2013, Hartford has seen community-wide GHG emissions drop over 9.8% while during that same period the community's GDP has ***increased*** 15%.

Climate Action and Economic Development

Rather than weakening the economy, climate action can support economic development. Transitioning away from fossil fuel use, improvements to public transit systems, and growth of local food industries are all, in part, a transition to local energy and labor sources. These transitions represent opportunities for communities to reduce the community wealth that is being exported and increase the percentage of community wealth that remains in the community in the form of local jobs. Additionally, many of the jobs potentials in Climate Action redirect funds away from less labor intensive (but more material resource intensive) sectors of the economy to support greater overall employment combined with less resource utilization. In general, economic opportunities include:

Energy Efficiency Jobs

Public Transit Jobs

Renewable Energy Jobs

Economic Savings

Climate Change Considerations

Climate Hazards

In many sectors, climate change will impact water and energy consumption and costs. Extreme weather and increasing variability in temperatures and precipitation may stress transportation systems and fleets. Increasing extreme weather hazards may threaten supply material and product supply chains.

Opportunities

Climate mitigation strategies like transformation of Hartford's energy system, improvements to the energy efficiency of the Town's building stock, enhancement of transportation alternatives, and the implementation of goals like tree canopy increases and reduction to impervious surfaces represent opportunities for the development of new businesses and job creation.

Climate Economy

Equity Considerations

- Low income individuals in our communities are especially prone to the impacts of climate change and bear a greatly disproportionate share of the costs—including vulnerability to job instability that can be brought about by extreme weather events and other climate change impacts.
- Income inequality is rising in the US, with September 2019 levels being the highest in 50 years—and the impacts of the COVID-19 pandemic have only increased these inequities. High inequality leads to lower life spans, increased instances of mental health issues, and increased obesity rates among other social impacts. Because the impacts and the costs of climate change are disproportionately felt by vulnerable populations and low-income individuals, climate change impacts will exacerbate income inequality in our communities.

Strategies Supporting Sector Goals

As indicated in the introduction, the Climate Action Plan is intended to be a 9 year plan to be updated at the completion of that time. Consequently, the goals and strategies outlined in this section are intended to be achieved by 2030 (or earlier) unless otherwise noted.

Implementation of actions are anticipated to be initiated over 3 phases: phase 1 within 1-2 years, phase 2 within 2-5 years, and phase 3 within 3-7 years of CAP approval.

1. **Strategy CE 1:** Capture local economic potential of climate action.
2. **Strategy CE 2:** Increase workforce development and retention for the climate economy.
3. **Strategy CE 3:** Build marketplace climate resilience.
4. **Strategy CE 4:** Establish sustainable financing for the Town's climate action implementation.

Climate Economy

1 Strategy CE 1:
Capture local economic potential of climate action.

	Actions	Implementation Phase
CE 1-1	Conduct a Climate Economy Economic Development Assessment to identify economic development potential of climate adaptation, climate mitigation, and energy action planning. Collaborate with partners such as TRORC, GMEDC, and Vital Communities	1
CE 1-2	Promote Hartford as a car-free destination through informational campaigns for visitors. Start with car-free access to downtown WRJ as a way to mitigate parking demand. Collaborate with private sector to alleviate parking demand spikes around events (Glory Days, Northern State Plays, etc). Build basic infrastructure to support car-free access and evolve from there.	2

2 Strategy CE 2:
Increase workforce development and retention for the climate economy.

	Actions	Implementation Phase
CE 2-1	Develop job training programs focused on building resiliency- solar construction, weatherization, etc. HACTC program focus and apprentice programs. Pair with community retention efforts. Engage with local green jobs training providers to coordinate strategic planning and encourage programs to develop local workforce capacity and assess, train, and place local residents to perform energy retrofits, solar pv installations, and other green improvements.	1
CE 2-2	Create an Affordable Housing Master Plan to identify current and potential future need for affordable housing including scenarios anticipating climate immigration and migration potentials. Master plan should identify priority affordable housing locations which meet the Buildings and Energy, Transportation and Land Use, Climate Adaptation, Health and Safety, and other goals of this CAP plan. Direct/assist the planning commission to re-write the housing chapter to respond to these issues (climate migration and migration potentials)	2

Climate Economy

3 Strategy CE 3:
Build marketplace climate resilience.

	Actions	Implementation Phase
CE 3- 1	Execute a Circular and Climate Economy Market Feasibility Assessment to explore potential technologies and businesses which may be highly suited for success in Hartford and identify next step strategies for creation of new businesses or attraction of existing businesses to Hartford. Assessment to identify opportunities and pathways for increase in equity.	1
CE 3- 2	Foster small business and green business development, particularly those which increase renewable energy, climate mitigation and adaptation resources within the community. Explore expanding the Revolving Loan fund to prioritize businesses of these types. Collaborate with the private sector to offer effective incentives for the growth of local green businesses which can support the goals of this CAP.	2

4 Strategy CE 4:
Establish sustainable financing for the Town's climate action implementation.

	Actions	Implementation Phase
CE 4- 1	Capturing savings from Town facility energy efficiency, renewable energy projects, and fleet energy efficiency from all Town departments. Operational savings are to be directed to the Climate Action Reserve Fund, with the funds being used to implement carbon-reducing projects that align with the Climate Action Plan.	1
CE 4- 2	Explore creation of a Hartford Carbon Fund carbon offset program which enables investing in local or regional project carbon offsets. https://sfenvironment.org/carbon-fund	2
CE 4- 3	Explore creation of a Hartford Forest Credit program to fund local tree canopy increases, urban and rural tree maintenance, and provide carbon offset credits. https://www.cityforestcredits.org/	2

Section 10
Hartford Municipal Operations

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GHG Emissions

generated by Hartford municipal operations

548
Metric tons CO2e in 2019 from municipal fleet use.

686
Metric tons CO2e in 2019 from municipal building energy.

10
Metric tons CO2e in 2019 from municipal operations solid waste,

446
Metric tons CO2e in 2019 from municipal water and wastewater operations,

Hartford Municipal Operations

Municipal operations refer to the services provided to the businesses and residents of the Town of Hartford by the Town of Hartford government. These services include public safety, water, streets and many other direct and indirect supportive services. Town of Hartford municipal operations are provided through 11 departments.

As with the activities of residents and businesses town-wide, municipal operations produce greenhouse gas emissions. Heating and cooling municipal buildings, operating municipal vehicles and equipment, and waste generation among other aspects of operating a complex agency all produce emissions.

Municipal Operations Emissions Reduction Goal

In 2020, a ballot resolution. "Article 25", passed with 65% of the vote, requiring the Town to lead by example and that:

> **The operation and maintenance of the Town of Hartford's municipal infrastructure and equipment shall achieve carbon neutrality by 2027.**

What does carbon neutrality mean?

"Carbon neutrality" means annual zero net anthropogenic (human caused or influenced) CO2 emissions by a certain date. By definition, carbon neutrality means every ton of anthropogenic CO2 emitted is compensated with an equivalent amount of CO2 removed (e.g. via carbon sequestration). Here "carbon" refers to greenhouse gases (GHG) including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_20) released by the combustion of fossil fuels, land use change, and other human activity.

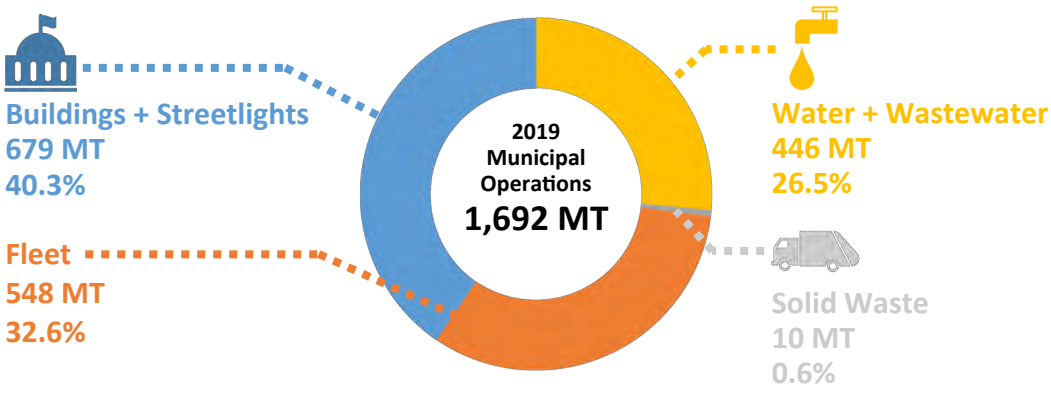
From a human caused GHG accounting perspective, Carbon Neutral looks like this:

GHG emissions
– Increased uptake of CO_2 (carbon sequestration)
+ Increased release of CO_2 (wastewater treatment, etc)
= 0

Carbon Neutrality can be achieved in several ways or a combination of them, including:

- Reducing emissions originating from fossil fuel combustion due to activities within the community.
- Generating excess renewable energy and providing it to consumers outside of the city.
- Purchasing carbon offsets, which are tradable units that represent abatement of greenhouse gas emissions.

2019 Municipal Operations GHG Emissions by Sector



Note: Municipal Operations GHG Emissions shown above are for Scope 1 and Scope 2 emissions and do not include Scope 3 emissions associated with purchased goods and services.

Hartford Municipal Operations

Mode Shift Targets Supporting Sector Goals

Sector goals are established to both support the Towns Climate Action Plan in creating a climate resilient community and to reduce Town Municipal Operation GHG emissions to achieve Carbon Neutrality by 2027:

	Building Energy Consumption	Facility Electrification	Electric Vehicles	Biodiesel Use
Today	137,432 MMBTU	0%	1.4%	0%
2027 Targets	**116,817**	**100%**	**100%**	**100%**

Strategies Supporting Sector Goals

1. **Strategy MO 1:** Improve total Municipal building energy efficiency by 15% Electricity and 15% Thermal Fuel by 2030.
2. **Strategy MO 2:** Achieve 100% Municipal building thermal "fuel switching" to reduce on-site fossil fuel use by 2027.
3. **Strategy MO 3**: Achieve 100% conversion of municipal operations gasoline and e10 gasoline fleet vehicles and equipment within municipal fleet to EV's by 2027. Achieve 100% conversion of all municipal fleet vehicles and equipment to EV's by 2040.
4. **Strategy MO 4:** Convert all remaining municipal operations diesel fuel utilization to no/low emission fuels by 2027.
5. **Strategy MO 5:** Achieve 100% organics landfill waste diversion, 10% increased recycling diversion, and 5% overall waste reduction for municipal operations by 2027.
6. **Strategy MO 6:** Purchase Carbon offsets for all remaining municipal operations emissions by 2027 (estimated at 240 Metric Tons annually).

Hartford Municipal Operations

Strategy MO 1:
Improve total Municipal building energy efficiency by 15% Electricity and 15% Thermal Fuel by 2030.

	Actions	Implementation Phase
MO 1-1	Introduce a policy that requires all new and existing municipal buildings to meet and maintain specific energy and resource efficiency standards (ENERGY STAR, LEED, Home Energy Score or other). Policy should include a prohibition of purchase of fosil fuel burning equipment including water and space heating. https://palebluedot.llc/hartford-cap-policy-examples	1
MO 1-2	Conduct an energy audit for all municipal facilities. Establish an Energy Efficiency Plan to outline strategies to achieve energy efficiency targets for all municipal buildings by 2027. Integrate the implementation of this plan with the Net Zero Capital Improvement Plan.	1
MO 1-3	Have Energy Coordinator work with the Dept. of Public Works to develop energy management plans for water supply and wastewater treatment facilities and infra-structure.	1
MO 1-4	Introduce a policy that requires all municipal buildings to be benchmarked with the current Energy Score rating, the energy use intensity (kBTU/sqft) and the energy reduction goal. These benchmarks and goals shall also be posted on the Town's website. https://palebluedot.llc/hartford-cap-policy-examples	1

Strategy MO 2:
Achieve 100% Municipal building thermal "fuel switching" to reduce on-site fossil fuel use by 2027.

	Actions	Implementation Phase
MO 2-1	Establish a policy requiring all municipally owned buildings to be 100% electric (or zero on-site fossil fuel combustion) by 2027. https://palebluedot.llc/hartford-cap-policy-examples	1
MO 2-2	Work with regional energy partnerships to develop and implement an Electrification Action Plan for all Town facilities. Include new and existing buildings, incorporate strategies to address electricity storage, and focus on highlighting any hurdles or solutions that would be applicable to the broader community.	1
MO 2-3	Establish a municipal facility Net Zero Capital Improvement Plan to outline fuel switching, and renewable energy strategies to achieve 100% fuel switching by all municipal buildings by 2027. Integrate the Energy Efficiency Plan findings with this plan to achieve net zero for all municipal buildings by 2027.	1

Hartford Municipal Operations

Strategy MO 3:

Achieve 100% conversion of municipal operations gasoline and e10 gasoline fleet vehicles and equipment within municipal fleet to EV's by 2027. Achieve 100% conversion of all municipal fleet vehicles and equipment to EV's by 2040.

	Actions	Implementation Phase
MO 3-1	Conduct a municipal fleet Electric Vehicle Transition Plan (EVTP). Effort to identify opportunities for electrifying, right-sizing, and improving overall efficiency of vehicles to meet CAP Goals. Include implementation recommendations to incorporate EV's through right-timing purchases with a planned vehicle-replacement schedule.	1
MO 3-2	Strategically increase Electric Vehicles within the Town's fleet based on EVTP. Update Town vehicle purchasing policy/budget process to default to electric vehicle or zero/low emission vehicle with traditional internal combustion engine (ICE) as option requiring proof of need with no viable zero/low emission alternative. Policy to require taking emissions/fuel reductions into account when purchasing vehicles/ equipment. Focus on small vehicles as well as large vehicles for alternative fuels. EV replacement to be prioritized for high mileage vehicles. Action to be coordinat-	1

Strategy MO 4:

Convert all remaining municipal operations diesel fuel utilization to no/low emission fuels by 2027.

	Actions	Implementation Phase
MO 4-1	Based on the findings of the No/Low Emission Diesel Vehicle Fuel Alternative Feasibility study (Action TL4-1), collaborate with existing fuel retailers to establish required supply chain to serve municipal operation diesel requirements for equipment and vehicles unable to be replaced with electric or zero/low emission alternatives.	1

Hartford Municipal Operations

5 Strategy MO 5:

Achieve 100% organics landfill waste diversion, 10% increased recycling diversion, and 5% overall waste reduction for municipal operations by 2027.

	Actions	Implementation Phase
MO 5-1	Town departments and public agencies, especially Public Schools, should lead by example and pilot organics diversion composting programs. Achieve 100% organics diversion by 2023.	1
MO 5-2	Establish a municipal operations zero waste plan to identify strategies to move the municipal operations toward zero-waste. Achieve an increase in recycling of 10% and a decrease of 5% in overall solid waste generated by 2027.	1

6 Strategy MO 6:

Achieve Carbon Neutral Municipal Operations by 2027.

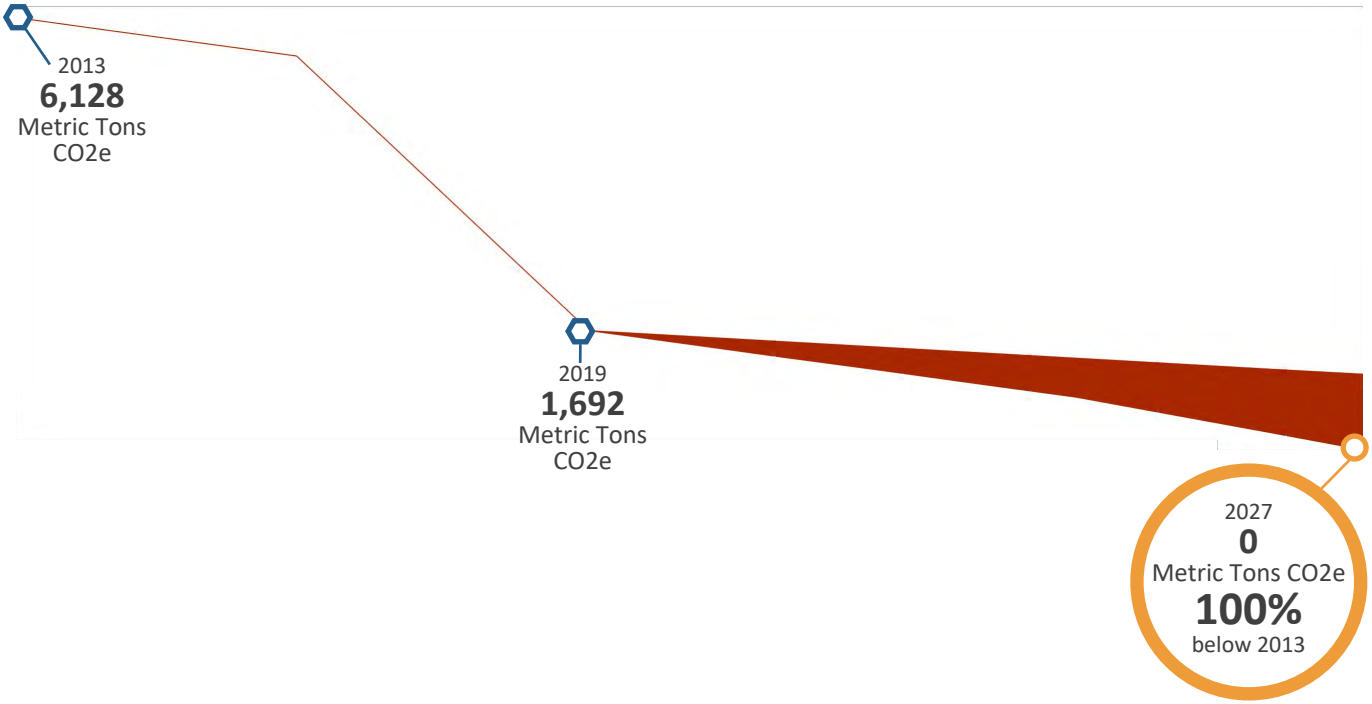
	Actions	Implementation Phase
MO 6-1	Develop a Municipal Operations Carbon Neutral Roadmap with a clear definition of Carbon Neutrality and establish boundaries, define measurements and metrics, establish tracking procedures and methodologies, identify implementation responsibilities, develop an annual tracking and reporting template	1
MO 6-2	Conduct a review of carbon offset procurement options and identify the most advantageous options for the Town of Hartford.	1
MO 6-3	Maintain annual or bi-annual Municipal Operations GHG Inventories to ensure tracking of progress towards Municipal Operations Carbon Neutral goal (including municipal vehicle fleet and all other municipal operations sectors). Beginning in 2025 use GHG inventory to determine required carbon offset level, if any, and procure offsets to ensure carbon neutrality.	2

Hartford Municipal Operations

Estimated Town Operations GHG Reductions Included in This Plan

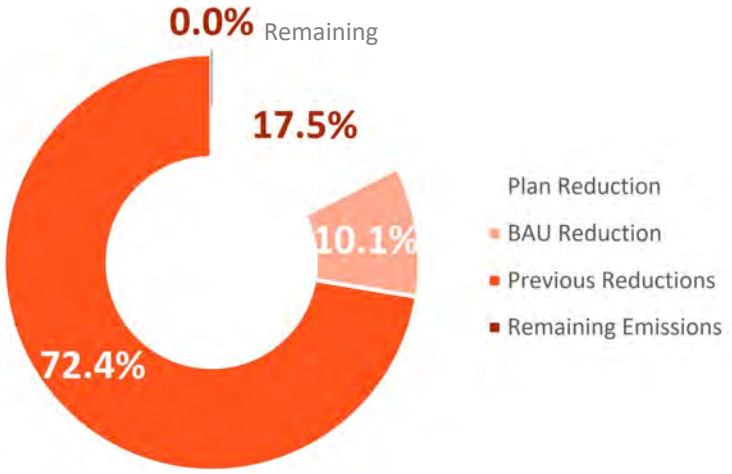
By 2027, the modeled emissions reductions associated with Town Operations reductions strategies and actions are projected to be 5,935 metric tons below 2013 levels and 1,499 metric tons below 2019 levels prior to purchase of carbon offsets (Strategy MO 6). It is projected that potentially 3.2% of Town Operations emissions may remain by 2027. These potentially remaining emissions include an estimated 191 metric tons of biogenic emission from municipal wastewater treatment and 2 metric tons from solid waste.

Hartford's Buildings and Energy Carbon Reduction Pathway



Breakdown of Town Municipal Operations GHG Emissions Reductions From 2013 to 2030

Total anticipated GHG emissions reductions by 2030 include emissions reductions which have already occurred since 2013, reductions which are anticipated within the Business-as-Usual forecast, and the reductions resulting from the strategies and actions included in this plan.



Section 11
Climate Action Implementation

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Climate Action Implementation

The first few years after plan adoption are critical to its success. Establishing roles, both internal and external, and identifying funding will help establish the implementation phase of the plan and ensure the community is on track to achieve its goals. This plan includes robust goals for significant GHG emission reductions and addressing climate resilience. This vision requires commitment and integration of the CAP into Town operations, functions, and services.

Implementation is For Everyone

Implementation actions are detailed items that should be completed in order to carry out the vision and strategies identified in the plan. Some actions will need to be led by Town Selectboard, Town departments, and/or the business community; and there are some things that households and individuals can do to make an impact. While many actions will require Town Selectboard to amend a policy there will be opportunities for businesses, organizations, households, and individuals to support the Town Selectboard policy changes and provide input on and feedback on those policies. Ultimately, achieving the visionary energy efficiency, renewable energy, alternative transportation, and climate resilience goals outlined in this plan will require engagement and a sense of responsibility not only by the Town of Hartford leadership and government, but by the community itself as well. It is critical for all to remain engaged and active, advancing and advocating for actions you feel are important.

General Implementation Recommendations

Foundational recommendations to support the long-range implementation of the CAP include Building Internal Capacity, External Support, and Funding:

Building Internal Capacity

Continuing to build internal capacity will be important to help establish the CAP as a priority integral to internal operations as well as fostering connections to community partners, businesses, and individuals through outreach, education, special projects, and service delivery.

1. Establish clear guidance and direction for the participation in and support of the CAP implementation actions by all Town of Hartford departments.
2. Establish a Town "CAP Team" comprised of staff representatives from all key Town departments. The Team may also include representation from allied entities including State departments, Ottauquechee Natural Resources Conservation District, and the Abenaki Nation. The task of the CAP Team shall be to meet regularly to support the initial and on-going prioritization and implementation of annual implementation actions and projects and to support reporting and progress updates.
3. Fund and support Climate Action / Energy staffing required to:
    - Facilitate discussion among large users to reduce emissions through business and industrial strategies.
    - Participate in technical resource programs as they are available through County, Regional, State, Federal, and non-profit provider partners.
    - Support Town of Hartford department managers and staff as they implement CAP actions within their service area or area of expertise.
    - Convene an internal Town of Hartford Climate Working Group that meets regularly and provides updates on progress and success, identifies additional support or resources needed to advance actions of the CAP, and collaboratively discusses strategies for more complex challenges.
    - Ensure the establishment and maintenance of a Town of Hartford Climate Action webpage supporting CAP resources for the community.
    - Coordinate and organize volunteer groups and events.
    - Engage Town boards and commissions (e.g., Climate Advisory Committee, Community Resilience Organization, Conservation Commission, Energy Commission, Parks and Recreation Commission, Planning Commission, Tree Board, Municipal Building Advisory Committee, etc.) to ensure the CAP is integrated into their work plans.

Building Internal Capacity (continued)

4. Review Climate Action Plan implementation progress and impacts on a regular basis (1-2 year cycle). Review should include development of an updated community wide and municipal operations GHG inventory. Strategies and actions should be reviewed for implementation progress and for continued appropriateness. Based on the review, adjust, add, and remove detailed CAP actions as appropriate.

External Support

Town staff and elected officials will not be able to implement this plan without robust support from community members and coordination with jurisdictional, institutional, and organizational partners.

1. Establish the Climate Advisory Committee (CAC) as the main citizen-body to support the implementation of the CAP. Committee's mission and scope of work should include support of the implementation of the Climate Action Plan, coordination with Town staff in all relevant departments, receiving updates on Town CAP projects and progress, and providing input on plan adjustments as needed.
2. Establish a designated Town Selectboard representative and CAC representative participant in the Town's internal Climate Working Group in support of CAP implementation.
3. Establish a coordinated communication and education campaign supporting the educational and informational actions included in each of the CAP sections. The campaign should also look to help community members:
    - Understand why change at the individual, community, Town, and business level needs to occur,
    - How to make those changes correctly, and
    - What the benefit/incentive to them might be, for example, articulating that switching to solar energy and or an electric bus fleet might help reduce bills
4. Establish jurisdictional partnerships that advance CAP strategies to advance and accelerate action. This can include government entities like the Abenaki Nation, Windsor County, Two Rivers—Ottauquechee Regional Commission, the State of Vermont, conservation districts, utilities like Green Mountain Power; institutions like Hartford School District and CCV Upper Valley; Hartford businesses, and community groups.
5. In support of advancing jurisdictional partnerships and regional climate action collaboration, facilitate collaborative action with surrounding communities. Explore potential of creating a climate action plan toolkit based on Hartford's Climate Action Plan to assist rapid and cost effective climate action planning in these communities through a collaborative process to arrive at community specific plans which also support collaborative regional action.
6. Establish regular communications and consultation with Indigenous knowledge-holders and culture-bearers (especially those from the local Abenaki Nation) by the CAP Team, Climate Advisory Committee and the Town of Hartford at large as part of the plan's implementation. Resources include The Vermont Commission on Native American Affairs, the Vermont Indigenous Heritage Center and the Winter Center for Indigenous Traditions (wcit@wintercenter-indigenous.org)

Funding

Funding the implementation of the CAP will require reallocation/reconsideration of existing Town funds, raising new Town funds, and identifying outside resources and funding opportunities. Some funds will need to be dedicated toward long-term support like staffing, while other funding will be on a project-by-project basis.

1. Establish and maintain funding for staff dedicated to the implementation of the CAP.
2. Establish and maintain a Climate Action Reserve Fund to support projects on an annual basis
3. Explore additional sustainable funding sources as per the detailed actions outlined in the Climate Economy section of the plan.
4. Utilize no-cost technical assistance offerings as available.

Climate Action Implementation

First Year Project Implementation

The establishment of the Town of Hartford Climate Action Reserve Fund and the initial FY22 funding allows the Town to make an immediate transition to detailed planning and implementation work following adoption of the CAP. The following are the recommended projects for immediate implementation and use of the FY22 Climate Action Reserve Funding*:

Climate Action Reserve Fund Projects FY22

CAP Action	Project	Preliminary Budget	Scope
MO 3-1	**Municipal Fleet Electric Vehicle Transition Plan (EVTP)** Conduct a municipal fleet Electric Vehicle Transition Plan (EVTP). Effort to identify opportunities for electrifying, right-sizing, and improving overall efficiency of vehicles to meet CAP Goals. Include implementation recommendations to incorporate EV's through right-timing purchases with a planned vehicle-replacement schedule.	**$16,000**	Municipal Operations
MO 6-1	**Municipal Operations Carbon Neutral Roadmap** Develop a Municipal Operations Carbon Neutral Roadmap with a clear definition of Carbon Neutrality and establish boundaries, define measurements and metrics, establish tracking procedures and methodologies, identify implementation responsibilities, develop an annual tracking and reporting template.	**$7,500**	Municipal Operations
MO 2-2	**Municipal Facility Net Zero Capital Improvement Plan** Establish a municipal facility Net Zero Capital Improvement Plan to outline fuel switching, and renewable energy strategies to achieve 100% fuel switching by all municipal buildings by 2027. Integrate the Energy Efficiency Plan findings with this plan to achieve net zero for all municipal buildings by 2027.	**$25,000**	Municipal Operations
MO 1-2	Conduct an energy audit for all municipal facilities. Establish an Energy Efficiency Plan to outline strategies to achieve energy efficiency targets for all municipal buildings by 2027. Integrate the implementation of this plan with the Net Zero Capital	(included with MO 2-2 above)	
BE 3-1	**Electrification and Energy Efficiency / Weatherization Group Purchase** Coordinate and promote a residential and small business "Electrification and Energy Efficiency/Weatherization" group purchase campaign annually (FY22 only included in funding) to help reduce the costs of energy efficient heating systems such as air source heat pumps and ground source heat pumps through volume purchasing power (goal, 150 households and 20 businesses annually). Program design to explore strategies to support local small business contractors such as being set up to enable small contractors to collaborate or having a competitive "marketplace" approach with more than one contractor to choose from. NOTE: Action may be implemented in combination with the renewable energy group purchase program action.	**$6,000**	Community-wide
BE 4-1	**Residential Solar Group Purchase** Coordinate and promote a residential Solar Group Purchase Campaign annually (FY22 only included in funding) to help reduce the costs of solar installation through volume purchasing power (goal, 80 households annually). Program design to explore strategies to support local small business solar installers such as being set up to enable small installers to collaborate or having a competitive "marketplace" approach with more than one installer to choose from. NOTE: Action may be implemented in combination with the electrification and energy efficiency group purchase program action.	**$6,000**	Community-wide

* Note: it is anticipated that the Town will begin implementation of other priority 1 actions as outlined in the Climate Action Plan sectors in addition to these first year projects receiving Climate Action Reserve Funding.

Climate Action Implementation

Climate Action Implementation Support Tools

To support the Town in its initial implementation phase, the paleBLUEdot team has created a number of tools including:

- Implementation and Monitoring Matrix
- Example Climate Action Policies and Ordinances
  The paleBLUEdot team has assembled example policies and ordinances supporting some of the strategies and actions included in the Hartford Climate Action Plan.
  The examples can be found on the following webpage:
  https://palebluedot.llc/Hartford-cap-policy-examples

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Section A1
GHG Forecast Assumptions

Town of Hartford
GHG Forecast Assumptions:

Demographics:

- **Population:** Total Population projections through 2030 are projected based on State of Vermont Agency of Commerce and Community Development projections for Hartford and Windsor County. Projections for 2040 and 2050 are reduced to 50% of the growth rate through 2030.
- **Households:** Total household counts through 2050 are projected based on population projections above, maintaining ratio of households to population.
- **Jobs:** Total commercial jobs through 2050 are projected based on Town's commercial job growth over last decade. Industrial jobs are projected using ½ of the commercial job growth rate.

Climate Data

- **Cooling Degree Days (CDD):** Projected climate changes for the region will include increased summer temperatures. The increase in temperatures will result in an increase, or variability, in air conditioning demand. The forecast calculates annual changes in air conditioning demand based on projections provided by the "Climate Explorer" tool developed by US NOAA in support of the National Climate Assessment work. https://crt-climate-explorer.nemac.org/
- **Heating Degree Days (HDD):** Projected climate changes for the region will include increased winter temperatures. The increase in temperatures will result in a decrease, or variability, in building heating demand. The forecast calculates annual changes in heating demand based on projections provided by the "Climate Explorer" tool developed by US NOAA in support of the National Climate Assessment work. https://crt-climate-explorer.nemac.org/

Electricity:

- **Residential:** Demand is based on a per household basis and modified based on the projected Cooling Degree Days for each year, assuming 15% of electricity is used for cooling (RCP 8.5 model). 50% of projected increased electrical vehicle usage is attributed to residential EV charging.
- **Commercial and Industrial**: Demand is based on a per job basis and modified based on projected cooling degree days for each year, assuming that 15% of commercial and 7.5% of industrial electricity is used for cooling. (RCP 8.5 model). 50% of projected increased electrical vehicle usage is attributed to commercial EV charging
- **All electricity emission factors** are calculated using estimated emissions factors for 2030, 2040, and 2050 based on current, known, supplier commitments. For electrical suppliers with unknown or unestablished emission commitments, and for electricity purchased from the SERC grid, electricity emission factors are calculated based on EPA forecasts (https://fas.org/sgp/crs/misc/R45453.pdf). Estimated emissions factors are reduced 5% by 2030, 10% by 2040, and 15% by 2050.

Heating Fuel:

- Residential: Demand is based on a per household basis and modified based on the projected Heating Degree Days for each year, assuming 75% of fuel is used for heating (RCP 8.5 model).
- Commercial and Industrial: Demand is based on a per job basis and modified based on projected heating degree days for each year, assuming that 40% of commercial and 20% of industrial fuel is used for heating (RCP 8.5 model).
- Heating fuel emissions factors are projected to be unchanged.

Transportation:

- Vehicle Miles Traveled is based maintaining existing VMT per household ratios with total number of households projected as outlined above.
- Vehicle fuel use is calculated based on US Energy Information Agency projected rolling stock average fuel efficiency projections, modified to 75% projected MPG to account for heavy duty vehicle MPG share (based on US Department of Transportation data on current light duty to average all vehicle MPG ratios)
  https://www.eia.gov/todayinenergy/detail.php?id=31332
- Total vehicle stock is based on per household projections maintaining existing average number of vehicles per household through 2030 (2.556) and then reducing the average vehicle per household 10% through 2050 (2.3).
- Electric Vehicle Adoption: Transportation emissions assume a reduction in fossil fuel based VMT emissions based on estimated adoption rates. 2020 EV rolling stock in Hartford is calculated based on pro rata share of State of Vermont EV data for Windsor County. Adoption rates for 2030 are based on based on Edison Institute's forecasts in "Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030". Adoption rates for 2040 and 2050 are based on a 0.5% and 1% annual increase in purchase rates from 2030 projections respectively. Existing vehicle stock is assumed to be replaced based on an average replacement lifespan of 12 years. (https://www.edisonfoundation.net/iei/publications/Documents/IEI_EEI%20EV%20Forecast%20Report_Nov2018.pdf
  https://berla.co/average-us-vehicle-lifespan/).

Solid Waste:

- Total Solid Waste handled is based on total number of households and maintaining existing volume per household and emissions factors per ton handled.

Wastewater:

- Total Wastewater handled is based on total number of households and maintaining existing volume per household and emissions factors per household.

Note:

GHG emissions forecasts are not predictions of what will happen, but rather modeled projections of what may happen given certain assumptions and methodologies. GHG forecasts in this report should be interpreted with a clear understanding of the assumptions that inform them and the limitations inherent in any modeling effort.

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Section A2
Glossary of Terms

A

Activity Data

Data on the magnitude of a human activity resulting in emissions or removals taking place during a given period of time. Data on energy use, metal production, land areas, management systems, lime and fertilizer use and waste arisings are examples of activity data. (IPCC)

Adaptive Capacity

The social, technical skills, and financial capacities of individuals and groups to implement and maintain climate actions.

Aerosols

A collection of airborne solid or liquid particles, with a typical size between 0.01 and 10 micrometer that reside in the atmosphere for at least several hours. Aerosols may be of either natural or anthropogenic origin. Aerosols may influence climate in several ways: directly through scattering and absorbing radiation, and indirectly by acting as cloud condensation nuclei or modifying the optical properties and lifetime of clouds. (IPCC2)

Afforestation

Planting of new forests on lands that historically have not contained forests. (IPCC2)

Air Pollutant

Any man-made and/or natural substance occurring in the atmosphere that may result in adverse effects to humans, animals, vegetation, and/or materials. (CARB)

Anthropogenic

The term "anthropogenic", in the context of greenhouse gas inventories, refers to greenhouse gas emissions and removals that are a direct result of human activities or are the result of natural processes that have been affected by human activities. (USEPA2)

Atmosphere

The gaseous envelope surrounding the Earth. The dry atmosphere consists almost entirely of nitrogen (78.1% volume mixing ratio) and oxygen (20.9% volume mixing ratio), together with a number of trace gases, such as argon (0.93% volume mixing ratio), helium and radiatively active greenhouse gases such as carbon dioxide (0.035% volume mixing ratio) and ozone. In addition, the atmosphere contains the greenhouse gas water vapor, whose amounts are highly variable but typically around 1% volume mixing ratio. The atmosphere also contains clouds and aerosols. (IPCC2)

B

Baseline Emissions

A baseline is a measurement, calculation, or time used as a basis for comparison. Baseline emissions are the level of emissions that would occur without policy intervention or without implementation of a project. Baseline estimates are needed to determine the effectiveness of emission reduction programs (also called mitigation strategies).

Base Year

The starting year for the inventory. Targets for reducing GHG emissions are often defined in relation to the base year.

Biogenic

Produced by the biological processes of living organisms. Note that we use the term "biogenic" to refer only to recently produced (that is non-fossil) material of biological origin. IPCC guidelines recommend that peat be treated as a fossil carbon because it takes a long time to replace harvested peat.

Biogeochemical Cycle
Movements through the Earth system of key chemical constituents essential to life, such as carbon, nitrogen, oxygen, and phosphorus. (NASA)

Biomass
Either (1) the total mass of living organisms in a given area or of a given species usually expressed as dry weight; or (2) Organic matter consisting of or recently derived from living organisms (especially regarded as fuel) excluding peat. Includes products, by-products and waste derived from such material. (IPCC1)

Biomass Waste
Organic non-fossil material of biological origin that is a byproduct or a discarded product. "Biomass waste" includes municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural crop byproducts, straw, and other biomass solids, liquids, and gases; but excludes wood and wood-derived fuels (including black liquor), biofuels feedstock, biodiesel, and fuel ethanol. Note: EIA "biomass waste" data also include energy crops grown specifically for energy production, which would not normally constitute waste. (EIA)

Black Carbon
Operationally defined aerosol species based on measurement of light absorption and chemical reactivity and/or thermal stability; consists of soot, charcoal and/or possible light absorbing refractory organic matter (Charlson and Heintzenberg, 1995, p. 401). (IPCC2)

C
Carbon Cycle
All parts (reservoirs) and fluxes of carbon. The cycle is usually thought of as four main reservoirs of carbon interconnected by pathways of exchange. The reservoirs are the atmosphere, terrestrial biosphere (usually includes freshwater systems), oceans, and sediments (includes fossil fuels). The annual movements of carbon, the carbon exchanges between reservoirs, occur because of various chemical, physical, geological, and biological processes. The ocean contains the largest pool of carbon near the surface of the Earth, but most of that pool is not involved with rapid exchange with the atmosphere. (NASA)

Carbon Dioxide (CO_2)
A naturally occurring gas, and also a by-product of burning fossil fuels and biomass, as well as land-use changes and other industrial processes. It is the principal anthropogenic greenhouse gas that affects the Earth's radiative balance. It is the reference gas against which other greenhouse gases are measured and therefore has a Global Warming Potential of 1. (IPCC2)\

Carbon Dioxide Equivalent (CO_2e)
A metric used to compare emissions of various greenhouse gases. It is the mass of carbon dioxide that would produce the same estimated radiative forcing as a given mass of another greenhouse gas. Carbon dioxide equivalents are computed by multiplying the mass of the gas emitted by its global warming potential.

Carbon Disclosure Project (CDP)
An international organization that administers a platform for organizations and cities to publicly disclose their environmental impacts, such as climate risk. CDP is one of the approved disclosure platforms utilized by GCoM.

Carbon Emissions
The release of carbon dioxide into the atmosphere. Primary human sources of the release of carbon dioxide occur from burning oil, coal, and gas for energy use.

Carbon Equivalent (CE)
A metric measure used to compare the emissions of the different greenhouse gases based upon their global warming potential. Carbon equivalents can be calculated from to carbon dioxide equivalents by multiplying the carbon dioxide equivalents by 12/44 (the ratio of the molecular weight of carbon to that of carbon dioxide). The use of carbon equivalent is declining in GHG inventories.

Carbon Intensity
The amount of carbon by weight emitted per unit of energy consumed. A common measure of carbon intensity is weight of carbon per British thermal unit (Btu) of energy. When there is only one fossil fuel under consideration, the carbon intensity and the emissions coefficient are identical. When there are several fuels, carbon intensity is based on their combined emissions coefficients weighted by their energy consumption levels. (EIA)

Carbon Neutrality
"Carbon neutrality" means annual zero net anthropogenic (human caused or influenced) CO2 emissions by a certain date. By definition, carbon neutrality means every ton of anthropogenic CO2 emitted is compensated with an equivalent amount of CO2 removed (e.g. via carbon sequestration).

Carbon Sinks
A forest, ocean, or other natural environment viewed in terms of its ability to absorb carbon dioxide from the atmosphere.

Carbon Sequestration
This refers to the capture of CO_2 from the atmosphere and its long term storage in oceans (oceanic carbon sequestration), in biomass and soils (terrestrial carbon sequestration) or in underground reservoirs (geologic carbon sequestration).

Chlorofluorocarbons (CFCs)
Greenhouse gases covered under the 1987 Montreal Protocol and used for refrigeration, air conditioning, packaging, insulation, solvents, or aerosol propellants. Because they are not destroyed in the lower atmosphere, CFCs drift into the upper atmosphere where, given suitable conditions, they break down ozone. These gases are being replaced by other compounds, including hydrochlorofluorocarbons and hydrofluorocarbons, which are greenhouse gases covered under the Kyoto Protocol. (IPCC3)

Circular Economy
An alternative to a traditional linear economy (make, use, dispose) in which an economy is a regenerative system where resource input and waste are minimized. This is achieved through long-lasting product design, repair, reuse, remanufacturing, and recycling. Circular economy strategies are often cited as systems level approaches to reducing waste generation through product and system design.

Climate
Climate in a narrow sense is usually defined as the "average weather" or more rigorously as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These relevant quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. (IPCC2)

Climate Adaptation or Resilience
The capacity of a natural environment to prevent, withstand, respond to, and recover from a disruption. The process of adjusting to new climate conditions in order to reduce risks to valued assets.

Climate Change
Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. (IPCC2)

Climate Hazard
An extreme climate event or condition that can harm human health, livelihoods, or natural resources. It can include abrupt changes to the climate system such as extreme precipitation, storms, droughts, and heat waves.

Climate Risk
The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk results from the interaction of vulnerability and hazard. (IPCC):

Climate Vulnerability
Is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate change and variation to which a system is exposed, its sensitivity, and its capacity to adapt. Vulnerability = potential impact (sensitivity x exposure) – adaptive capacity (IPCC):

Climate Vulnerability Assessment
A report used to identify and define the risks posed by climate change and inform adaptation measures needed to combat climate change. Reports can be about a wide range of fields including food security, poverty analysis, and extreme weather events.

Cogeneration
Cogeneration is an industrial structure, installation, plant, building, or self-generating facility that has sequential or simultaneous generation of multiple forms of useful energy (usually mechanical and thermal) in a single, integrated system. (CARB)

Combined Heat and Power (CHP)
Combined heat and power is the simultaneous production of both electricity and useful heat for application by the producer or to be sold to other users with the aim of better utilisation of the energy used. Public utilities may utilise part of the heat produced in power plants and sell it for public heating purposes. Industries as auto-producers may sell part of the excess electricity produced to other industries or to electric utilities. (IPCC)

Community Solar
Solar facilities shared by multiple community subscribers who receive credit on their electricity bills for their share of the power produced. Community solar allows members of a community to share the benefits of solar power on their property without installing it on their own property. Electricity generated by the community solar farm typically costs less than the price from utility companies.

Complete Streets
A "complete street" is a design approach that requires streets to be designed to support safe, convenient and comfortable travel and access for users of all ages and abilities regardless of their mode of transportation.

Consistency
Consistency means that an inventory should be internally consistent in all its elements over a period of years. An inventory is consistent if the same methodologies are used for the base and all subsequent years and if consistent data sets are used to estimate emissions or removals from sources or sinks. (IPCC)

Continuous Emission Monitor (CEM)
A type of air emission monitoring system installed to operate continuously inside of a smokestack or other emission source. (CARB)

Criteria Air Pollutant
An air pollutant for which acceptable levels of exposure can be determined and for which an ambient air quality standard has been set. Examples include: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, and PM10 and PM2.5. The term "criteria air pollutants" derives from the requirement that the U.S. EPA must describe the characteristics and potential health and welfare effects of these pollutants. The U.S. EPA and CARB periodically review new scientific data and may propose revisions to the standards as a result. (CARB)

D
Deforestation
Those practices or processes that result in the change of forested lands to non-forest uses. This is often cited as one of the major causes of the enhanced greenhouse effect for two reasons: 1) the burning or decomposition of the wood releases carbon dioxide; and 2) trees that once removed carbon dioxide from the atmosphere in the process of photosynthesis are no longer present and contributing to carbon storage. (UNFCC)

Distillate Fuel Oil
A general classification for one of the petroleum fractions produced in conventional distillation operations. It includes diesel fuels and fuel oils. Products known as No. 1, No. 2, and No. 4 diesel fuel are used in on-highway diesel engines, such as those in trucks and automobiles, as well as off-highway engines, such as those in railroad locomotives and agricultural machinery. Products known as No. 1, No. 2, and No. 4 fuel oils are used primarily for space heating and electric power generation. (EIA)

E
Emissions
The release of a substance (usually a gas when referring to the subject of climate change) into the atmosphere. (USEPA1)

Emission Factor
A coefficient that quantifies the emissions or removals of a gas per unit activity. Emission factors are often based on a sample of measurement data, averaged to develop a representative rate of emission for a given activity level under a given set of operating conditions. (IPCC)

Emission Inventory
An estimate of the amount of pollutants emitted into the atmosphere from major mobile, stationary, area-wide, and natural source categories over a specific period of time such as a day or a year. (CARB)

Emission Rate
The weight of a pollutant emitted per unit of time (e.g., tons / year). (CARB)

Environmental Justice
The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies

Estimation
Estimation is the assessment of the value of an unmeasurable quantity using available data and knowledge within stated computational formulas or mathematical models.

F
Fluorocarbons
Carbon-fluorine compounds that often contain other elements such as hydrogen, chlorine, or bromine. Common fluorocarbons include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). (UNFCC)

Flux
Either (1) Raw materials, such as limestone, dolomite, lime, and silica sand, which are used to reduce the heat or other energy requirements of thermal processing of minerals (such as the smelting of metals). Fluxes also may serve a dual function as a slagging agent. (2) The rate of flow of any liquid or gas, across a given area; the amount of this crossing a given area in a given time. (e.g., "Flux of CO2 absorbed by forests"). (IPCC)

Fossil Fuel
Geologic deposits of hydrocarbons from ancient biological origin, such as coal, petroleum and natural gas.

Fuel Combustion
Fuel combustion is the intentional oxidation of materials within an apparatus that is designed to provide heat or mechanical work to a process, or for use away from the apparatus. (IPCC)

Fugitive Emissions
Emissions that are not emitted through an intentional release through stack or vent. This can include leaks from industrial plant and pipelines. (IPCC)

G
Geologic Carbon Sequestration
It is the process of injecting CO_2 from a source, such as coal-fired electric generating power plant, through a well into the deep subsurface. With proper site selection and management, geologic sequestration could play a major role in reducing emissions of CO_2. Research efforts to evaluate the technical aspects of CO_2 geologic sequestration are underway. (USEPA4)

Global Warming
Global warming is an average increase in the temperature of the atmosphere near the Earth's surface and in the troposphere, which can contribute to changes in global climate patterns. Global warming can occur from a variety of causes, both natural and human induced. In common usage, "global warming" often refers to the warming that can occur as a result of increased emissions of greenhouse gases from human activities. Also see Climate Change (USEPA1)

Global Warming Potential (GWP)
An index, based upon radiative properties of well-mixed greenhouse gases, measuring the radiative forcing of a unit mass of a given well-mixed greenhouse gas in the present-day atmosphere integrated over a chosen time horizon, relative to that of carbon dioxide. The GWP represents the combined effect of the differing times these gases remain in the atmosphere and their relative effectiveness in absorbing outgoing thermal infrared radiation. The Kyoto Protocol is based on GWPs from pulse emissions over a 100-year time frame. (IPCC2)

GCOM Global Covenant of Mayors:
GCoM is the largest global alliance for city climate leadership, built upon the commitment of over 10,000 cities and

local governments. The alliance's mission is to mobilize and support climate and energy action in communities across the world.

Green Streets
A "green street" is a stormwater management approach that incorporates vegetation, soil, and engineered systems to slow, filter, and cleanse stormwater runoff from impervious surfaces.

Greenhouse Effect
Trapping and build-up of heat in the atmosphere (troposphere) near the earth's surface. Some of the heat flowing back toward space from the earth's surface is absorbed by water vapor, carbon dioxide, ozone, and several other gases in the atmosphere and then reradiated back toward the earth's surface. If the atmospheric concentrations of these greenhouse gases rise, the average temperature of the lower atmosphere will gradually increase. (UNFCC)

Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories:
A robust, transparent and globally-accepted framework that cities and local governments can use to consistently identify, calculate and report on city greenhouse gas emissions.

Greenhouse Gas
Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, but are not limited to, water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrochlorofluorocarbons (HCFCs), ozone (O_3), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). (UNFCC)

Green Infrastructure
An approach to managing precipitation by reducing and treating stormwater at its source while delivering environmental, social, and economic benefits. Stormwater runoff can carry trash, bacteria, and other pollutants and is a major cause of water pollution in urban areas.

Gross Domestic Product (GDP)
The sum of gross value added, at purchasers' prices, by all resident and non-resident producers in the economy, plus any taxes and minus any subsidies not included in the value of the products in a country or a geographic region for a given period, normally one year. It is calculated without deducting for depreciation of fabricated assets or depletion and degradation of natural resources. (IPCC3)

H

Halocarbons
A collective term for the group of partially halogenated organic species, including the chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), halons, methyl chloride, methyl bromide, etc. Many of the halocarbons have large Global Warming Potentials. The chlorine and bromine-containing halocarbons are also involved in the depletion of the ozone layer. (IPCC2)

Hydrocarbons
Strictly defined as molecules containing only hydrogen and carbon. The term is often used more broadly to include any molecules in petroleum which also contains molecules with S, N, or O An unsaturated hydrocarbon is any hydrocarbon containing olefinic or aromatic structures. (IPCC)

Hydrofluorocarbons (HFCs)
Compounds containing only hydrogen, fluorine, and carbon atoms. They were introduced as alternatives to ozone depleting substances in serving many industrial, commercial, and personal needs. HFCs are emitted as by-products of industrial processes and are also used in manufacturing. They do not significantly deplete the stratospheric ozone layer, but they are powerful greenhouse gases with global warming potentials ranging from 140 (HFC-152a) to 11,700 (HFC-23). (USEPA1)

I

ICLEI Local Governments for Sustainability:
A membership organization for local governments to pursue reductions in carbon pollution and improvements in advancing sustainable urban development. ICLEI's members and team of experts work together through peer exchange, partnerships and capacity building to create systemic change for urban sustainability.

Intergovernmental Panel on Climate Change
The IPCC was established jointly by the United Nations Environment Programme and the World Meteorological Organization in 1988. The purpose of the IPCC is to assess information in the scientific and technical literature related to all significant components of the issue of climate change. The IPCC draws upon hundreds of the world's expert scientists as authors and thousands as expert reviewers. Leading experts on climate change and environmental, social, and economic sciences from some 60 nations have helped the IPCC to prepare periodic assessments of the scientific underpinnings for understanding global climate change and its consequences. With its capacity for reporting on climate change, its consequences, and the viability of adaptation and mitigation measures, the IPCC is also looked to as the official advisory body to the world's governments on the state of the science of the climate change issue. For example, the IPCC organized the development of internationally accepted methods for conducting national greenhouse gas emission inventories. (USEPA1)

K

Kilowatt Hour (kWh):
A measure of electrical energy equivalent to a power consumption of 1,000 watts for one hour.

Kyoto Protocol
The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1997 in Kyoto, Japan, at the Third Session of the Conference of the Parties (COP) to the UNFCCC. It contains legally binding commitments, in addition to those included in the UNFCCC. Countries included in Annex B of the Protocol (most Organisation for Economic Cooperation and Development countries and countries with economies in transition) agreed to reduce their anthropogenic greenhouse gas emissions (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride) by at least 5% below 1990 levels in the commitment period 2008 to 2012. The Kyoto Protocol entered into force on 16 February 2005. (IPCC2)

L

Land Use and Land Use Change
Land use refers to the total of arrangements, activities and inputs undertaken in a certain land cover type (a set of human actions). The term land use is also used in the sense of the social and economic purposes for which land is managed (e.g., grazing, timber extraction and conservation). Land use change refers to a change in the use or management of land by humans, which may lead to a change in land cover. Land cover and land use change may have an impact on the surface albedo, evapotranspiration, sources and sinks of greenhouse gases, or other properties of the climate system and may thus have a radiative forcing and/or other impacts on climate, locally or globally. (IPCC2)

Living Streets
A "living street" combines the concepts of complete streets and green streets while putting additional focus on quality of life aspects for City residents.

LULUCF
Acronym for "Land Use, Land Use Change and Forestry", a category of activities in GHG inventories.

M

Megawatt Hour (MWH):
A measure of electrical energy equivalent to a power consumption of 1,000,000 watts for one hour.

Methane (CH_4)
A hydrocarbon that is a greenhouse gas with a global warming potential most recently estimated at 25 times that of carbon dioxide (CO_2). Methane is produced through anaerobic (without oxygen) decomposition of waste in landfills, flooded rice fields, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion. The GWP is from the IPCC's Fourth Assessment Report (AR4).

Metric Ton
The tonne (t) or metric ton, sometimes referred to as a metric tonne, is an international unit of mass. A metric ton is equal to a Megagram (Mg), 1000 kilograms, 2204.6 pounds, or 1.1023 short tons.

Million Metric Tons (MMT)
Common measurement used in GHG inventories. It is equal to a Teragram (Tg).

Mitigation:
Actions taken to limit the magnitude or rate of long-term global warming and its related effects. Climate change mitigation generally involves reductions in human emissions of greenhouse gases.

Mobile Sources
Sources of air pollution such as automobiles, motorcycles, trucks, off-road vehicles, boats, and airplanes. (CARB)

Mode Share
The percentage of travelers using a particular type of transportation. Modal share is an important component in developing sustainable transport within a city or region because it reveals the level of utilization of various transportation methods. The percentage reflects how well infrastructure, policies, investments, and land-use patterns support different types of travel.

Model
A model is a quantitatively-based abstraction of a real-world situation which may simplify or neglect certain features to better focus on its more important elements. (IPCC)

Municipal Solid Waste (MSW)
Residential solid waste and some non-hazardous commercial, institutional, and industrial wastes. This material is generally sent to municipal landfills for disposal. (USEPA1)

N
Natural Sources
Non-manmade emission sources, including biological and geological sources, wildfires, and windblown dust. (CARB)

Net-zero Emissions (NZE)
Building A building or property that generates or offsets all energy consumed. If the City develops a NZE building code, this definition will have to be refined to provide additional guidance on calculating emissions and offsets to achieve net-zero emissions.

Nitrogen Fixation
Conversion of atmospheric nitrogen gas into forms useful to plants and other organisms by lightning, bacteria, and blue-green algae; it is part of the nitrogen cycle. (UNFCC)

Nitrogen Oxides (NO_x)
Gases consisting of one molecule of nitrogen and varying numbers of oxygen molecules. Nitrogen oxides are produced in the emissions of vehicle exhausts and from power stations. In the atmosphere, nitrogen oxides can contribute to formation of photochemical ozone (smog), can impair visibility, and have health consequences; they are thus considered pollutants. (NASA)

Nitrous Oxide (N_2O)
A powerful greenhouse gas with a global warming potential of 298 times that of carbon dioxide (CO_2). Major sources of nitrous oxide include soil cultivation practices, especially the use of commercial and organic fertilizers, manure management, fossil fuel combustion, nitric acid production, and biomass burning. The GWP is from the IPCC's Fourth Assessment Report (AR4).

O
Ozone (O_3)
Ozone, the triatomic form of oxygen (O_3), is a gaseous atmospheric constituent. In the troposphere, it is created both naturally and by photochemical reactions involving gases resulting from human activities (smog). Tropospheric ozone acts as a greenhouse gas. In the stratosphere, it is created by the interaction between solar ultraviolet radiation and molecular oxygen (O_2). Stratospheric ozone plays a dominant role in the stratospheric radiative balance. Its concentration is highest in the ozone layer. (IPCC2)

Ozone Depleting Substances (ODS)
A compound that contributes to stratospheric ozone depletion. Ozone-depleting substances (ODS) include CFCs, HCFCs, halons, methyl bromide, carbon tetrachloride, and methyl chloroform. ODS are generally very stable in the troposphere and only degrade under intense ultraviolet light in the stratosphere. When they break down, they release chlorine or bromine atoms, which then deplete ozone. (IPCC)

P
Perfluorocarbons (PFCs)
A group of human-made chemicals composed of carbon and fluorine only. These chemicals (predominantly CF_4 and C_2F_6) were introduced as alternatives, along with hydrofluorocarbons, to the ozone depleting substances. In addition, PFCs are emitted as by-products of industrial processes and are also used in manufacturing. PFCs do not harm the stratospheric ozone layer, but they are powerful greenhouse gases: CF_4 has a global warming potential (GWP) of 7,390 and C_2F_6 has a GWP of 12,200. The GWP is from the IPCC's Fourth Assessment Report (AR4).

Photosynthesis
The process by which plants take carbon dioxide from the air (or bicarbonate in water) to build carbohydrates, releasing oxygen in the process. There are several pathways of photosynthesis with different responses to atmospheric carbon dioxide concentrations. (IPCC2)

Point Sources
Specific points of origin where pollutants are emitted into the atmosphere such as factory smokestacks. (CARB)

Power Purchase Agreement (PPA)
A power purchase agreement (PPA), or electricity power agreement, is a contract between two parties; one party generates electricity (the seller) and the other party looks to purchase electricity (the buyer). Individual customers and organizations may enter into PPAs with individual developers or may join together to seek better prices as a group. PPAs can allow longer term commitments to renewable energy as well as a form of “direct” investing in new renewable energy generation.

Property-Assessed Clean Energy (PACE)

A program created for financing energy efficiency and renewable improvements on private property. Private property can include residential, commercial or industrial properties. Improvements can include energy efficiency, renewable energy and water conservation upgrades to a building.

Process Emissions
Emissions from industrial processes involving chemical transformations other than combustion. (IPCC)

R

Radiative Forcing
A change in the balance between incoming solar radiation and outgoing infrared (i.e., thermal) radiation. Without any radiative forcing, solar radiation coming to the Earth would continue to be approximately equal to the infrared radiation emitted from the Earth. The addition of greenhouse gases to the atmosphere traps an increased fraction of the infrared radiation, reradiating it back toward the surface of the Earth and thereby creates a warming influence. (UNFCC)

Reforestation
Planting of forests on lands that have previously contained forests but that have been converted to some other use. (IPCC2)

Regeneration
The act of renewing tree cover by establishing young trees, naturally or artificially - note regeneration usually maintains the same forest type and is done promptly after the previous stand or forest was removed. (CSU)

Renewable Energy
Energy resources that are naturally replenishing such as solar, wind, hydro and geothermal energy.

Renewable Energy Credits (RECs)
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 renewable energy resource. The single largest category of reductions in Evanston's emissions has been through the purchase of RECs.

Residence Time
Average time spent in a reservoir by an individual atom or molecule. Also, this term is used to define the age of a molecule when it leaves the reservoir. With respect to greenhouse gases, residence time usually refers to how long a particular molecule remains in the atmosphere. (UNFCC)

Reservoir
Either (1) a component or components of the climate system where a greenhouse gas or a precursor of a greenhouse gas is stored; or (2) Water bodies regulated for human activities (energy production, irrigation, navigation, recreation etc.) where substantial changes in water area due to water level regulation may occur. (IPCC)

Respiration
The process whereby living organisms convert organic matter to carbon dioxide, releasing energy and consuming molecular oxygen. (IPCC2)

Retro-commissioning
The systematic process to improve an existing building's performance ensuring the building controls are running efficiently and balancing the designed use and the actual use of the building.

Ride-share
The practice of sharing transportation in the form of carpooling or vanpooling. It is typically an arrangement made through a ride-matching service that connects drivers with riders.

S

Scope 1:
Scope 1 includes emissions being released within the city limits resulting from combustion of fossil fuels and from waste decomposition in the landfill and wastewater treatment plant.

Scope 2:
Scope 2 includes emissions produced outside the city that are induced by consumption of electrical energy within the city limits.

Scope 3:
Scope 3 includes emissions of potential policy relevance to local government operations that can be measured and reported but do not qualify as Scope 1 or 2. This includes, but is not limited to, outsourced operations and employee commute.

Short Ton
Common measurement for a ton in the United States. A short ton is equal to 2,000 lbs or 0.907 metric tons. (USEPA1)

Sink
Any process, activity or mechanism that removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas or aerosol from the atmosphere. (IPCC2)

Social Cost of Carbon
The social cost of carbon is a measure of the economic harm from climate change impacts, expressed as the dollar value of the total damages from emitting one ton of carbon dioxide into the atmosphere.

Solar Radiation
Electromagnetic radiation emitted by the Sun. It is also referred to as shortwave radiation. Solar radiation has a distinctive range of wavelengths (spectrum) determined by the temperature of the Sun, peaking in visible wavelengths. (IPCC2)

Source
Any process, activity or mechanism that releases a greenhouse gas, an aerosol or a precursor of a greenhouse gas or aerosol into the atmosphere. (IPCC2)

Stationary Sources
Non-mobile sources such as power plants, refineries, and manufacturing facilities which emit air pollutants. (CARB)

Sulfur Dioxide (SO_2)
A compound composed of one sulfur and two oxygen molecules. Sulfur dioxide emitted into the atmosphere through natural and anthropogenic processes is changed in a complex series of chemical reactions in the atmosphere to sulfate aerosols. These aerosols are believed to result in negative radiative forcing (i.e., tending to cool the Earth's surface) and do result in acid deposition (e.g., acid rain). (UNFCC)

Sulfur Hexafluoride (SF_6)
A colorless gas soluble in alcohol and ether, slightly soluble in water. A very powerful greenhouse gas with a global warming potential most recently estimated at 22,800 times that of carbon dioxide (CO_2). SF_6 is used primarily in

electrical transmission and distribution systems and as a dielectric in electronics. This GWP is from the IPCC's Fourth Assessment Report (AR4).

T

Terrestrial Carbon Sequestration

It is the process through which carbon dioxide (CO_2) from the atmosphere is absorbed by trees, plants and crops through photosynthesis, and stored as carbon in biomass (tree trunks, branches, foliage and roots) and soils. The term "sinks" is also used to refer to forests, croplands, and grazing lands, and their ability to sequester carbon. Agriculture and forestry activities can also release CO_2 to the atmosphere. Therefore, a carbon sink occurs when carbon sequestration is greater than carbon releases over some time period. (USEPA3)

Therm:

A unit of measure for energy that is equivalent to 100,000 British Thermal units, or roughly the energy in 100 cubic feet of natural gas. Often used for measuring natural gas usage for billing purposes.

Total Organic Gases (TOG)

Gaseous organic compounds, including reactive organic gases and the relatively unreactive organic gases such as methane. (CARB)

Transparency

Transparency means that the assumptions and methodologies used for an inventory should be clearly explained to facilitate replication and assessment of the inventory by users of the reported information. The transparency of inventories is fundamental to the success of the process for the communication and consideration of information. (IPCC)

Trend

The trend of a quantity measures its change over a time period, with a positive trend value indicating growth in the quantity, and a negative value indicating a decrease. It is defined as the ratio of the change in the quantity over the time period, divided by the initial value of the quantity, and is usually expressed either as a percentage or a fraction. (IPCC)

U

Urban Tree Canopy

Describes the makeup and characteristics of trees within the urban environment.

V

VMT Vehicle Miles Traveled:

A unit used to measure vehicle travel made by private vehicles, including passenger vehicles, truck, vans and motorcycles. Each mile traveled is counted as one vehicle mile regardless of the number of persons in the vehicle.

Vision Zero:

Vision Zero is a strategy to eliminate all traffic fatalities and severe injuries, while increasing safe, healthy, equitable mobility for all. https://visionzeronetwork.org/

W

Water Vapor

The most abundant greenhouse gas; it is the water present in the atmosphere in gaseous form. Water vapor is an important part of the natural greenhouse effect. While humans are not significantly increasing its concentration, it contributes to the enhanced greenhouse effect because the warming influence of greenhouse gases leads to a positive water vapor feedback. In addition to its role as a natural greenhouse gas, water vapor plays an important

role in regulating the temperature of the planet because clouds form when excess water vapor in the atmosphere condenses to form ice and water droplets and precipitation. (UNFCC)

Weather
Atmospheric condition at any given time or place. It is measured in terms of such things as wind, temperature, humidity, atmospheric pressure, cloudiness, and precipitation. In most places, weather can change from hour-to-hour, day-to-day, and season-to-season. Climate in a narrow sense is usually defined as the "average weather", or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. A simple way of remembering the difference is that climate is what you expect (e.g. cold winters) and 'weather' is what you get (e.g. a blizzard). (USEPA1)

Z

Zero Emission Vehicles (ZEV)
A vehicle that does not emit harmful emissions during operation. Harmful emissions can have a negative impact on human health and the environment. Electric (battery-powered) cars, electric trains, hydrogen-fueled vehicles, bicycles, and carriages are considered to produce zero emissions.

Zero Waste
The conservation of all resources by means of responsible production, consumption, reuse, and recovery of products, packaging, and materials without burning and with no discharges to land, water, or air that threaten the environment or human health.

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Section A3
Supporting Research

Supporting Research

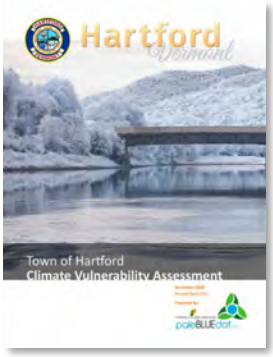
Climate Action Baseline Study

To support the Town of Hartford Climate Action Plan planning team members, the paleBLUEdot team assembled the Draft Hartford Carbon Neutral Pathways and Strategic Goals. This document provided a review of a wide range of community wide metrics, data, and comparisons against regional peer communities for each of the climate action plan sectors included in this report. The document also included preliminary sector specific draft strategic goal recommendations for the Climate Action Plan planning team to consider, discuss, and revise at the beginning of the planning team effort.

Click on the link below or scan the QR code to access the document:
https://view.publitas.com/palebluedot/hartford-carbon-neutral-pathways-and-strategic-goals/

Climate Vulnerability Assessment

At the beginning of the Climate Action Planning effort, the paleBLUEdot team developed a Climate Vulnerability Assessment for the Town of Hartford. The assessment included the identification of vulnerable populations within the community and possible impacts and risks associated with projected climate change for the region. paleBLUEdot mapped the vulnerable populations within the Town as well as existing town infrastructure and resources which may be capable of supporting climate adaptation strategies. These assessments provided a basis for understanding vulnerabilities and resources which supported the decision making process needed for identifying and prioritizing climate adaptation measures to be included in the final Climate Action Plan. The Assessment focused on Town-Wide vulnerabilities with a particular focus on climate vulnerable populations to ensure all populations benefit from proposed implementation measures.



Click on the link below or scan the QR code to access the document:
https://view.publitas.com/palebluedot/hartford-climate-vulnerability-assessment-111820/

Supporting Research

Community Wide GHG Inventory

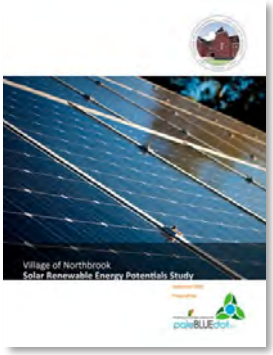
paleBLUEdot compiled a Community Greenhouse Gas Inventory. The assessment included collection of raw data and calculation of greenhouse gas emissions for each of the primary emissions sectors included in this Climate Action Plan. The inventory included both community-wide emissions as well as municipal operations. The report included community-wide emissions comparisons against communities within the State and region.

Click on the link below or scan the QR code to access the document:
https://view.publitas.com/palebluedot/hartford-greenhouse-gas-inventory/

Community Wide Solar Energy Potentials Study

In support of development of effective renewable energy goalsetting and to establish strategies addressing renewable energy development, paleBLUEdot conducted a Community-Wide solar pv potentials study including economic and environmental benefits. This effort included:

1) Collect Town-wide satellite data (NREL, NOAA, and NASA data).
2) Determine building roof stock characteristics and solar suitable buildings, calculate total suitable areas by roof configuration/orientation.
3) Calculate total rooftop solar capacity and annual energy generation by roof configuration/orientation.
4) Identify cost efficient annual energy generation potential.
5) Research solar market at national, State and regional levels. Identify low, medium, and high solar market absorption rates and Village-wide solar pv goals.
6) Identify environmental and economic benefit of solar including economic development and job creation potential. (NREL JEDI model)
7) Develop Town-Wide Renewable Solar Energy Potentials report.



Click on the link below or scan the QR code to access the document:
https://view.publitas.com/palebluedot/hartford-renewable-potentials-study/

click here to return to TOC

Section A4
Cumulative Potential Cost Savings

Summary of Estimated Cumulative Savings of Modeled Reductions

Town of Hartford

Notes

Transportation

VMT Reductions (public transit, bike, walk, etc)

Formula:

Cumulative vehicle miles saved x Average vehicle operation cost per mile = Gross VMT savings

	VMT saved (year 10)	8,076,066
	Cumulative vehicle miles saved:	36,342,297
1	Average vehicle operating cost per mile:	$0.688
	Gross VMT savings	**$25,003,500**

1 Savings per VMT based on AAA estimates https://exchange.aaa.com/automotive/driving-costs/#.YGUQZD9OlPY , https://www.slashgear.com/aaa-says-it-costs-about-74-cents-per-mile-to-drive-23496316/ https://www.thesimpledollar.com/save-money/is-it-really-cheaper-to-ride-the-bus/

EV and Alt Fuel Conversions

Formula:

Cumulative VMT converted to EV/alt fuel x Average vehicle operation cost savings per mile = Gross EV VMT savings

	VMT converted to EV/Alt fuel (year 10)	18,785,163
	Cumulative VMT converted to EV/alt fuel	84,533,236
3	Average cost savings per mile:	$0.103
	Gross EV VMT savings	**$8,692,834**

3 Savings per VMT converted from ICE to EV https://www.energy.gov/eere/electricvehicles/saving-fuel-and-vehicle-costsSavings per VMT converted from ICE to EV https://www.energy.gov/eere/electricvehicles/saving-fuel-and-vehicle-costs

Potential Total Cumulative Transportation Cost Savings

Formula:

Gross VMT savings - Increased spending on public transit + Gross EV VMT savings = Potentail Total Cumulative Transportation Cost Savign

Gross VMT savings	$25,003,500
Gross EV VMT savings	$8,692,834
Potentail Total Cumulative Transportation Cost Savigns	**$33,696,335**

Summary of Estimated Cumulative Savings of Modeled Reductions

Town of Hartford

Notes

Energy - Ressidential

Residential Savings - grid electricity to solar

Formula:

Cumulative kWh converted to solar x Average cost savings per kWh = Residential solar savings

	Residential kWh converted (year 10)	3,022,275
	Cumulative residential kWh converted	13,600,238
3	Average solar cost savings per kWh	$0.084
	Residential solar savings	**$1,147,860**

Residential Savings - electrical energy efficiency

Formula:

Cumulative kWh saved from energy efficiency x Average cost per kWh = Residential electrical energy efficiency savings

	Residential kWh saved (year 10)	10,074,250
	Cumulative residential kWh saved	45,334,125
4	Average cost per kWh	$0.169
	Residential electrical energy efficiency savings	**$7,652,400**

4 Energy efficiency savings per kWh saved based on average electricity cost per kWh: https://www.electricitylocal.com/

Residential Savings - natural gas energy efficiency

Formula:

Cumulative therms saved from energy efficiency x Average cost per therm = Residential natural gas energy efficiency savings

	Residential therms saved (year 10)	94,627
	Cumulative residential therms saved	425,823
5	Average cost per therm	$34.040
	Residential electrical energy efficiency savings	**$14,495,002**

5 Energy efficiency savings for natural gas is based on average natural gas cost per therm https://naturalgaslocal.com/

Residential Savings - increased electrical expenditures from fuel switching

Formula:

(Cumulative increased kWh from fuel switching + Cummulative increased kWh from electric vehicle charging) x Average cost per kWh = Residential increased electrical costs

	Residential increased kWh from fuel switching (year 10)	27,733,354
4	Average cost per kWh	$0.169
	Residential increased electrical costs	**-$21,066,256**

Potential Total Cumulative Residential Energy Cost Savings

Formula:

Residential solar savings + Residential community solar savings + Residential electrical efficiency savings + Residential natural gas energy efficiency savings - Residential increased electrical costs = Potential Total Cumulative Residential Energy Savings

Residential solar savings	$1,147,860
Residential electrical efficiency savings	$7,652,400
Residential natural gas energy efficiency savings	$14,495,002
Residential increased electrical costs	-$21,066,256
Potentail Total Cumulative Residential Energy Savings	**$2,229,006**

Summary of Estimated Cumulative Savings of Modeled Reductions

Town of Hartford

Notes

Energy - Commercial

Commercial Savings - grid electricity to solar

Formula:

Cumulative kWh converted to solar x Average cost savings per kWh = Commercial solar savings

	Commercial kWh converted (year 10)	3,872,925
	Cumulative residential kWh converted	17,428,163
3	Average solar cost savings per kWh	$0.068
	Commercial solar savings	**$1,187,729**

Commercial Savings - electrical energy efficiency

Formula:

Cumulative kWh saved from energy efficiency x Average cost per kWh = Commercial electrical energy efficiency savings

	Commercial kWh saved (year 10)	15,491,700
	Cumulative commercial kWh saved	69,712,650
4	Average cost per kWh	$0.136
	Commercial electrical energy efficiency savings	**$9,501,834**

4 Energy efficiency savings per kWh saved based on average electricity cost per kWh: https://www.electricitylocal.com/

Commercial Savings - natural gas energy efficiency

Formula:

Cumulative therms saved from energy efficiency x Average cost per therm = Commercial natural gas energy efficiency savings

	Commercial therms saved (year 10)	89,645
	Cumulative commercial therms saved	403,402
5	Average cost per therm	$34.040
	Commercial electrical energy efficiency savings	**$13,731,790**

5 Energy efficiency savings for natural gas is based on average natural gas cost per therm https://naturalgaslocal.com/

Commercial Savings - increased electrical expenditures from fuel switching

Formula:

(Cumulative increased kWh from fuel switching + Cummulative increased kWh from electric vehicle charging) x Average cost per kWh = Commercial increased electrical costs

	Commercial increased kWh from fuel switching (year 10)	26,273,098
4	Average cost per kWh	$0.136
	Commercial increased electrical costs	**-$16,114,605**

Potential Total Cumulative Commercial Energy Cost Savings

Formula:

Commercial solar savings + Commercial community solar savings + Commercial electrical efficiency savings + Commercial natural gas energy efficiency savings - Commercial increased electrical costs = Potentail Total Cumulative Commercial Energy Savings

Commercial solar savings	$1,187,729
Commercial electrical efficiency savings	$9,501,834
Commercial natural gas energy efficiency savings	$13,731,790
Commercial increased electrical costs	-$16,114,605
Potentail Total Cumulative Commercial Energy Savings	**$8,306,749**

Summary of Estimated Cumulative Savings of Modeled Reductions

Town of Hartford

Notes

Solid Waste - Residential

Residential savings - Food Waste Reduction

Formula:

Cumulative tons of food waste reduced and diverted	**x**	**Average cost savings per ton**	**= Residential food waste savings**
Residential food waste reduced (year 10)		491	
Cumulative residential food waste reduced		2,207	
6 Average cost savings per ton reduced		$2,469	
Residential food waste savings		**$5,449,950**	

6 Value per ton of residential food waste avoided is based on average for Prevent and Recover strategies by ReFED "A ROADMAP TO

Potential Total Cumulative Residential Solid Waste Reduction Cost Savings

Residential food waste savings	**$5,449,950**

Notes

Solid Waste - Commercial

Commercial savings - Food Waste Reduction

Formula:

Cumulative tons of food waste reduced and diverted	**x**	**Average cost savings per ton**	**= Commercial food waste savings**
Commercial food waste reduced (year 10)		600	
Cumulative residential food waste reduced		2,698	
8 Average cost savings per ton reduced		$494	
Commercial food waste savings		**$1,332,210**	

8 Values for commercial food waste are estimated at 20% of residential (retail) rates by ReFED "A ROADMAP TO REDUCE U.S. FOOD

Potential Total Cumulative Solid Waste Savings

Formula:

Residential Food Waste Savings + Commercial Solid Waste Savings + Commercial Food Waste Savings = Potentail Total Cumulative Solid Waste Savings

Residential Food Waste Savings	$5,449,950
Commercial Solid Waste Savings	$0
Commercial Food Waste Savings	$1,332,210
Potentail Total Cumulative Solid Waste Savings	**$6,782,160**

Prepared by:

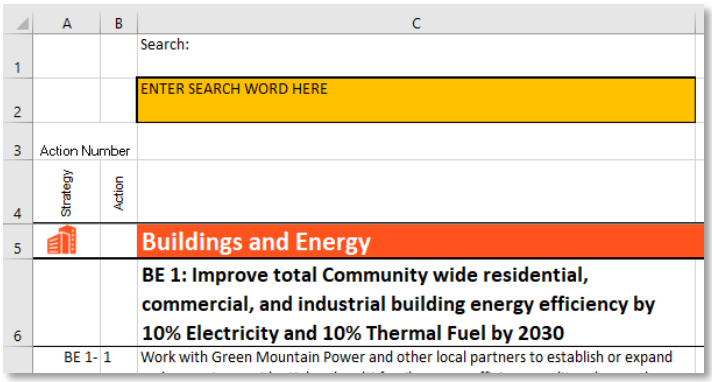
making change personal
paleBLUEdot LLC

2515 White Bear Ave, A8
Suite 177
Maplewood, MN 55109

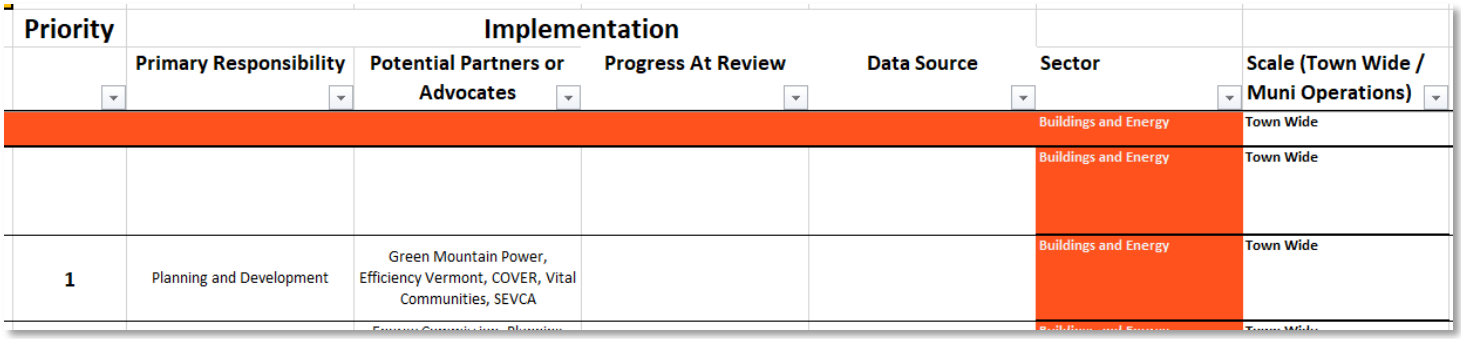
Contact:
Ted Redmond
tredmond@paleBLUEdot.llc

CAP Implementation Matrix
Instructions

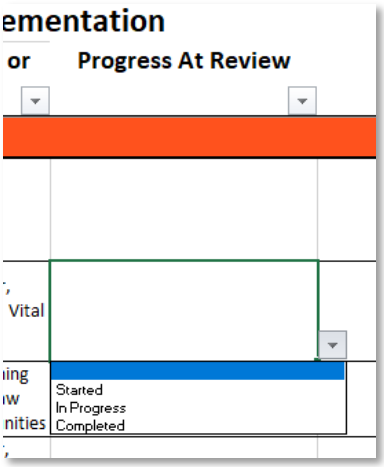
Search Strategies and Actions by Keyword:
Use the gold search box to search for keyword or phrase. Strategies with that word are highlighted in green.



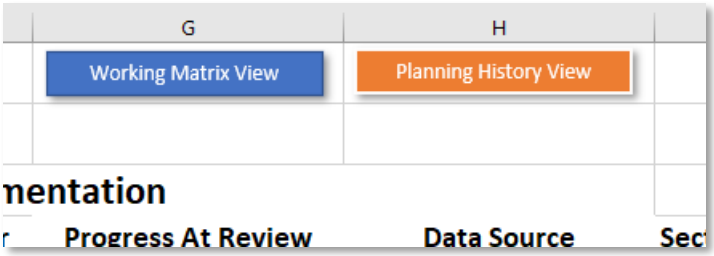
Use Filters
Collapse the list of items by using the "down arrow" filter buttons. Filter by "priority", "primary responsibility", "potential partners", "progress at review", "data source", "sector", and "scale (community-wide / Muni Operations)



Report Implementation Progress:
The progress of implementation for each action can be reported in "Progress At Review" column. Select the cell desired and then click on the "down arrow" that appears and then select the level of progress (blank—not yet started, "Started", "In Progress", or "Completed".



View Peer Communities and Planning Team Comments:
Find peer communities who have similar actions in their climate action plans as well as planning team comments, action criteria review from the CAP Planning process by clicking on the orange "Planning History View" button. Return to the simplified view of just the implementation matrix click on the blue "Working Matrix View" button.



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Action Number			Priority	Implementation			
Strategy	Action			Primary Responsibility	Potential Partners or Advocates	Progress At Review	Data Source
		Buildings and Energy					
		BE 1: Improve total Community wide residential, commercial, and industrial building energy efficiency by 10% Electricity and 10% Thermal Fuel by 2030					
BE 1-	1	Work with Green Mountain Power and other local partners to establish or expand and promote a residential and multi-family energy efficiency audit and upgrade program similar to Xcel Energy's "Home Energy Squad Visits". Target 200 households per year (https://www.homeenergysquad.net/)	**1**	Planning and Development	Green Mountain Power, Efficiency Vermont, COVER, Vital Communities, SEVCA		
BE 1-	2	Establish a policy or ordinance requiring landlords to provide an energy disclosure, a statement of previous occupants' energy usage and expenses, when advertising and leasing properties. https://palebluedot.llc/hartford-cap-policy-examples	**1**	Selectboard	Energy Commission, Planning Commission, Vermont Law School, SEVCA, Vital Communities		
BE 1-	3	Work with Green Mountain Power and other partner organizations to establish and promote building retro commissioning program to identify energy efficiency upgrades and operation and maintenance practices that improve affordability, comfort, indoor air quality and energy efficiency in all commercial and multifamily buildings. Goal 40 businesses commissioned annually	**1**	Planning and Development	Green Mountain Power, Efficiency Vermont, Vital Communities, Vermont Businesses for Social Responsibility, Hartford Area Chamber of Commerce, SEVCA, Vermont Landlord Association		
BE 1-	4	Partner with Efficiency VT and other energy efficiency programs to develop, implement and moderate energy efficency programs serving hard-to-reach segments of commercial properties (e.g., commercial rental, restaurants, large scale manufacturing, offices, affordable multifamily housing)	**1**	Planning and Development	Efficiency Vermont, Vital Communities, Vital Communities, SEVCA, Vermont Businesses for Social Responsibility, Hartford Area Chamber of Commerce, Vermont Landlord Association, Habitat for Humanity		
BE 1-	5	Work with partner organizations to promote building retrocommissioning and operation and maintenance practices that improve affordability, comfort, indoor air quality and energy efficiency in all commercial and multifamily buildings.	**1**	Planning and Development	Green Mountain Power, Efficiency Vermont, Vital Communities, Vermont Businesses for Social Responsibility, Hartford Area Chamber of Commerce, Vermont Landlord Association		
BE 1-	6	Work with school district to encourage and support energy efficiency programs, geothermal energy and solar energy installations at all school district facilities and to promote these strategies through curricula with students and communications with families.	**1**	Planning and Development	Hartford School District, Energy Commission, Efficiency Vermont, BALE, local solar installers		
BE 1-	7	Develop and adopt a rental housing energy efficiency policy by 2025 requiring single family and multi-family rental housing properties to meet minimum energy efficiency level to qualify for rental licensing. Program to include an energy efficiency rating system (ENERGY STAR or HERS) or a Town "Green Landlords" certification program based on the energy efficiency of their rental units. Example program: https://bouldercolorado.gov/plan-develop/smartregs. https://palebluedot.llc/hartford-cap-policy-examples	**2**	Selectboard	Energy Commission, Planning Commission, Vermont Law School, SEVCA, Vital Communities, Vermont Landlords Association		
BE 1-	8	Establish new incentives and expand and promote existing incentives for energy and efficiency, weatherization, energy storage, renewable energy, and water efficiency (e.g. expedited permitting, rebates, property tax incentives, utility programs, etc) for all public and private buildings. Re-instate impact fees and increase impact fees over 5 years and add rebates for projects that meet Town CAP objectives for increased building efficiency and greenspace.	**2**	Selectboard	Energy Commission, Green Mountain Power, Efficiency Vermont, State of Vermont		
BE 1-	9	Establish a Cool Roof policy to promote and advance the development of cool roofs on existing buildings and new construction. For information on cool roofs: https://cutt.ly/in3Q7M2 https://palebluedot.llc/hartford-cap-policy-examples	**2**	Selectboard	Energy Commission, Green Mountain Power, Efficiency Vermont, State of Vermont		
BE 1-	10	Create a motivational program that provide incentives based on energy use reduction in addition to demand reduction (e.g., initiate a competition and offer prizes/incentives based on energy use reduction by groups of residents, schools, businesses, municipal buildings, etc)	**3**	Planning and Development	Green Mountain Power, Energy Commission, Hartford School District, TRORC, Vital Communities		
BE 1-	11	Explore introducing an energy audit at the home point-of-sale or through the building permitting process, while making the audit an entry-point into all available efficiency products and services.	**3**	Planning and Development	Planning Commission, Energy Commission, Fire Department, local Realtors, Vermont Builders and Remodelers Association		
		BE2: Increase Net Zero buildings within the community to 5% of building stock by 2030.					
BE 2-	1	Complete the pilot Net Zero / Net Zero Ready new construction program initiated in 2019.	**1**	Planning and Development	Municipal Building Advisory Committee, Energy Commission		
BE 2-	2	Establish a Net Zero Ready ordinance for new commercial buildings, multi-family residential buildings, and residential subdivision construction that improves energy efficiency and supports increased adoption of net zero construction techniques. Ordinance should include a "solar ready" requirement. Collaborate with the four core towns to establish similar ordinances/policies. Reach for best practices such as Living Building Challenge, Architecture 2030, LEED, Passive House, net zero, etc. for new residential, commercial, and municipal buildings. Goal: achieve ordinance and compliance by 2025 with an anticipated average of 15 new single family residents annually and 17 multi-family untis annually by 2026 (based on permit history from 2017 through 2020). https://palebluedot.llc/hartford-cap-policy-examples	**1**	Selectboard	Planning Commission, Energy Commission, Vermont Law School, AIA Vermont, local Realtors, Vermont Builders and Remodelers Association		
BE 2-	3	In support of the Town's net zero and net zero ready program, conduct a study of costs and options for financing mechanisms for achieving Hartford community wide net zero goals.	**1**	Planning and Development	Energy Commission, Efficiency Vermont, Vermont Technical College, Community College of Vermont, Vermont Builders and Remodelers Association, local Realtors, AIA Vermont, consultant		
BE 2-	4	Establish a Net Zero Energy Building Guide providing building owners, renters, developers, designers, and contractors with detailed information on strategies to make new construction or significant renovation projects Net Zero Energy or Net Zero Energy ready. https://view.publitas.com/palebluedot/bloomington-net-zero-energy-building-guide/	**1**	Planning and Development	Energy Commission, Efficiency Vermont, Vermont Technical College, Community College of Vermont, Vermont Builders and Remodelers Association, local Realtors, AIA Vermont, Net Zero Ready Guide consultant		
BE 2-	5	Continue town's initiative to promote net zero and net zero ready program, resources, and information educating community members on building/renovation strategies, costs, and financing options. Include education and promotion of use of Green Appraisals (i.e. what is a green appraisal? Their value and why you should get one? When and how do you get one? Etc)	**1**	Planning and Development	Energy Commission, Efficiency Vermont, Vermont Technical College, Community College of Vermont, Vermont Builders and Remodelers Association, local Realtors, AIA Vermont, Net Zero Ready Guide consultant		
BE 2-	6	Develop standard deep retrofit specifications and incentives for existing residential building owners to reduce the carbon footprint of the building to zero.	**2**	Planning and Development	Selectboard, Green Mountain Power, Energy Commission, Efficiency Vermont, Vermont Technical College, Community College of Vermont, Vermont Builders and Remodelers Association, local Realtors, AIA Vermont, Net Zero Ready Guide consultant		
BE 2-	7	Build market demand for net-zero energy buildings through incentives, education, demonstration projects, partnerships and recognition.	**2**	Planning and Development	Selectboard, Green Mountain Power, Energy Commission, Efficiency Vermont, Vermont Technical College, Community College of Vermont, Vermont Builders and Remodelers Association, local Realtors, AIA Vermont, Net Zero Ready Guide consultant		
		BE 3: Achieve 30% residential, commercial and industrial building thermal "fuel switching" (to renewable source) to reduce on-site fossil fuel use by 2030.					

BE 3- 1	Coordinate and promote a residential and small business "Electrification and Energy Efficiency/Weatherization" group purchase campaign annually to help reduce the costs of energy efficient heating systems such as air source heat pumps and ground source heat pumps through volume purchasing power (goal, 150 households and 20 businesses annually). Program design to focus on improved equity (residential and commercial) in its implementation and explore strategies to support local small business contractors such as being set up to enable small contractors to collaborate or having a competitive "marketplace" approach with more than one contractor to choose from. NOTE: Action may be implemented in combination with the renewable energy group purchase program action.	**1**	Planning and Development	Green Mountain Power, Efficiency Vermont, Vital Communities, Vermont Businesses for Social Responsibility, Hartford Area Chamber of Commerce, SEVCA, Vermont Landlord Association, Habitat for Humanity
BE 3- 2	Implement a policy or sales license requiring fuel dealers to report sales within Hartford annually. https://palebluedot.llc/hartford-cap-policy-examples	**1**	Selectboard	Energy Commission, Planning and Development, Energy Commission, Efficiency Vermont
BE 3- 3	Deploy an incentive program for electrification for switching building space heating and water heating from fossil fuel-based to electric. Collaborate with Green Mountain Power and other regional partnerships to create financial incentives to electrify new and existing buildings. For example, rebates for electric heat pumps, panel upgrades, and electric appliances can encourage the transition to electric energy use in homes and businesses.	**2**	Selectboard	Energy Commission, Planning and Development, Green Mountain Power, Efficiency Vermont
BE 3- 4	Adopt regulations to require all-electric buildings for new construction and major remodels/redevelopment by 2027. Options such as building code updates orordinances should be explored as tools for transitioning new construction to all-electric. https://palebluedot.llc/hartford-cap-policy-examples	**2**	Selectboard	Energy Commission, Planning Commission, Planning and Development, Vermont Law School, Green Mountain Power, Efficiency Vermont
	BE 4: Increase on-site distributed renewable energy from 3% to 15% of Residential and Commercial electric use by 2030.			
BE 4- 1	Coordinate and promote a residential Solar Group Purchase Campaign annually to help reduce the costs of solar installation through volume purchasing power (goal, 80 households annually). Program design to focus on improved equity (residential and commercial) in its implementation and explore strategies to support local small business solar installers such as being set up to enable small installers to collaborate or having a competitive "marketplace" approach with more than one installer to choose from. NOTE: Action may be implemented in combination with the electrification and energy efficiency group purchase program action.	**1**	Planning and Development	Group Purchase Campaign consultant/coordinator, Energy Commission, Green Mountain Power, Vital Communities, SEVCA, Habitat for Humanity
BE 4- 2	Identify the "Solar Top 50" commercial/industrial properties within the Town and produce detailed solar feasibility assessments for each site. Assessments should focus on Hartford's Hierarchy of Suitabiliy and on the State's preferred siting locations (e.g. parking lot and rooftop solar PV capacity). Assessments to include potential solar generation and economic performance and return on investment estimates, information on financing and ownership models, and next step resources. Provide solar assessment reports to properties and conduct an informational workshop to assist building owners and businesses in understanding the assessments and next step potential. "Solar Top 50" assessment effort could be repeated annually, particularly through 2025.	**1**	Planning and Development	Solar feasibility consultant/coordinator, Energy Commission, Green Mountain Power, Vital Communities, SEVCA, local solar installers
BE 4- 3	Coordinate and promote a commercial Solar Group Purchase Campaign annually to help reduce the costs of solar installation through volume purchasing power (goal, 860KW installed annually). Group purchase campaign could include/focus on properties identified in the "Solar Top 50" assessment effort and should include both direct purchase/ownership as well as 3rd party ownership options like Solar Lease and Power Purcahse Agreements. Program design to explore strategies to support local small business solar installers and strategies to support local workforce development.	**1**	Planning and Development	Group Purchase Campaign consultant/coordinator, Energy Commission, Green Mountain Power, Vital Communities, SEVCA