



Town of Peterborough RENEWABLE ENERGY PLAN

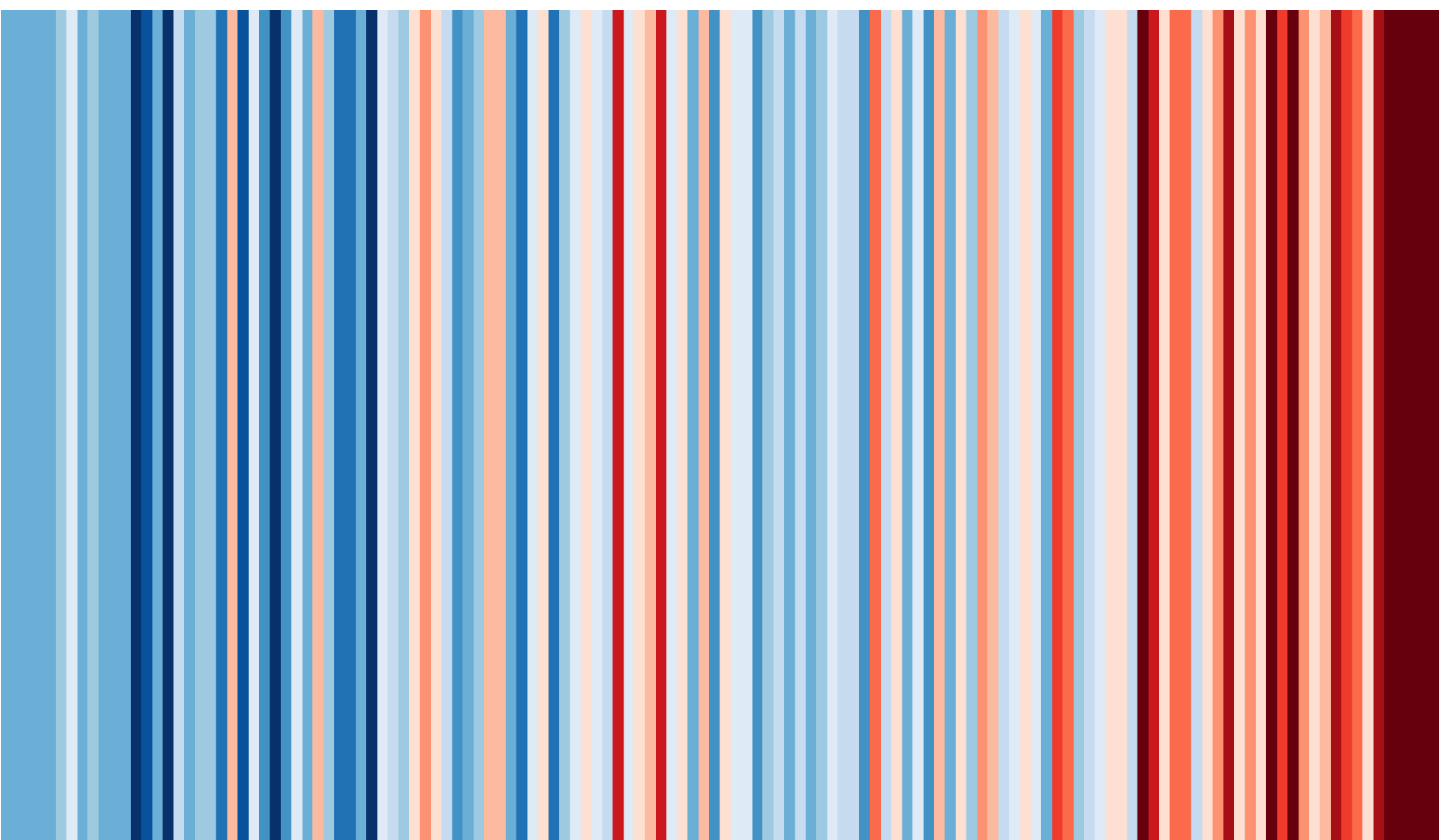
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Peterborough Renewable
Energy Plan Team
Supported by:



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← 1895

New Hampshire's Annual Temperature Trends

2021 →

Each stripe represents the temperature New Hampshire averaged over a year¹. Blue = Below Average Red = Above Average



SECTION

01

Introduction



The town of Peterborough has long been a leader in municipal sustainability efforts and renewable energy. While this Renewable Energy Plan is the most ambitious step in its commitment to reduce greenhouse gases, Peterborough has been working to lower carbon emissions since the 1990's. From large renewable energy projects to energy conservation policies, the town has earned a reputation of being at the forefront of sustainable development. Below are some highlights:

- The Town has upgraded its street lights twice, first with metal halide lights in 1999 and more recently, with highly efficient LEDs.
- As early as 2006, the town started replacing fossil fuel furnaces with lower emission wood pellet boilers. Such boiler systems currently provide heat in several municipal buildings including the Town House, the Highway Garage, the Police Department, the Library, and the Community Center.
- In 2007 the Select Board issued a 5% carbon reduction challenge and the staff finished up a study on policies that could result in lower energy use.
- The policy study led to the adoption of an Anti-Idling Policy.
- The town conducted an energy audit of the Town House and then made insulation improvements.
- After its new wastewater treatment plant (WWTP) became operational in 2012, the Town applied for a grant to build a 1MW solar array to provide electricity for the WWTP.
- The 1MW array came online in 2014, earning Peterborough the title, "Greenest Town in New Hampshire."
- In 2021, the newly renovated Library opened. The redesign included a 71.6 kW rooftop solar array, a wood chip boiler heating system, an adsorption chiller cooling system, a well insulated building envelope, lighting with daylight and occupancy sensors, and infrastructure to add EV chargers to the parking lot.
- ConVal High School installed a 300 kW rooftop solar array in 2021.
- The Town of Peterborough added EV charging to its new municipal downtown parking lot in 2022.

GHG EMISSIONS IN PETERBOROUGH

24,001

Metric tons CO₂e in
2021 from vehicle use

21,923

Metric tons CO₂e in
2021 from electricity
use

25,068

Metric tons CO₂e in
2021 from building
heating

614

Metric tons CO₂e in
2021 from solid
waste

Sources: see Peterborough GHG Inventory

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Peterborough's Commitment to Renewable Energy

At Peterborough's 2021 Town Meeting residents voted overwhelmingly (with 74% in favor) to pass a Warrant Article committing the town to transition to 100% renewable sources of electricity by 2030 and for all other energy needs by 2050. The Peterborough Renewable Energy Planning (PREP) Team was appointed by the Peterborough Select Board to research and write a general action plan to meet this goal.

PREP is made up of Peterborough citizen volunteers, many with years of experience in the energy field. They have spent the last year researching possible solutions to help Peterborough reach its goals. This plan is the product of the PREP team's efforts.

What Are GHGs?

A greenhouse gas (GHG) is a molecule in the atmosphere which does not react to light energy in the visible range, 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 GHGs Matter?

GHGs 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 GHGs?

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

How Large Are Community wide GHG Emissions?

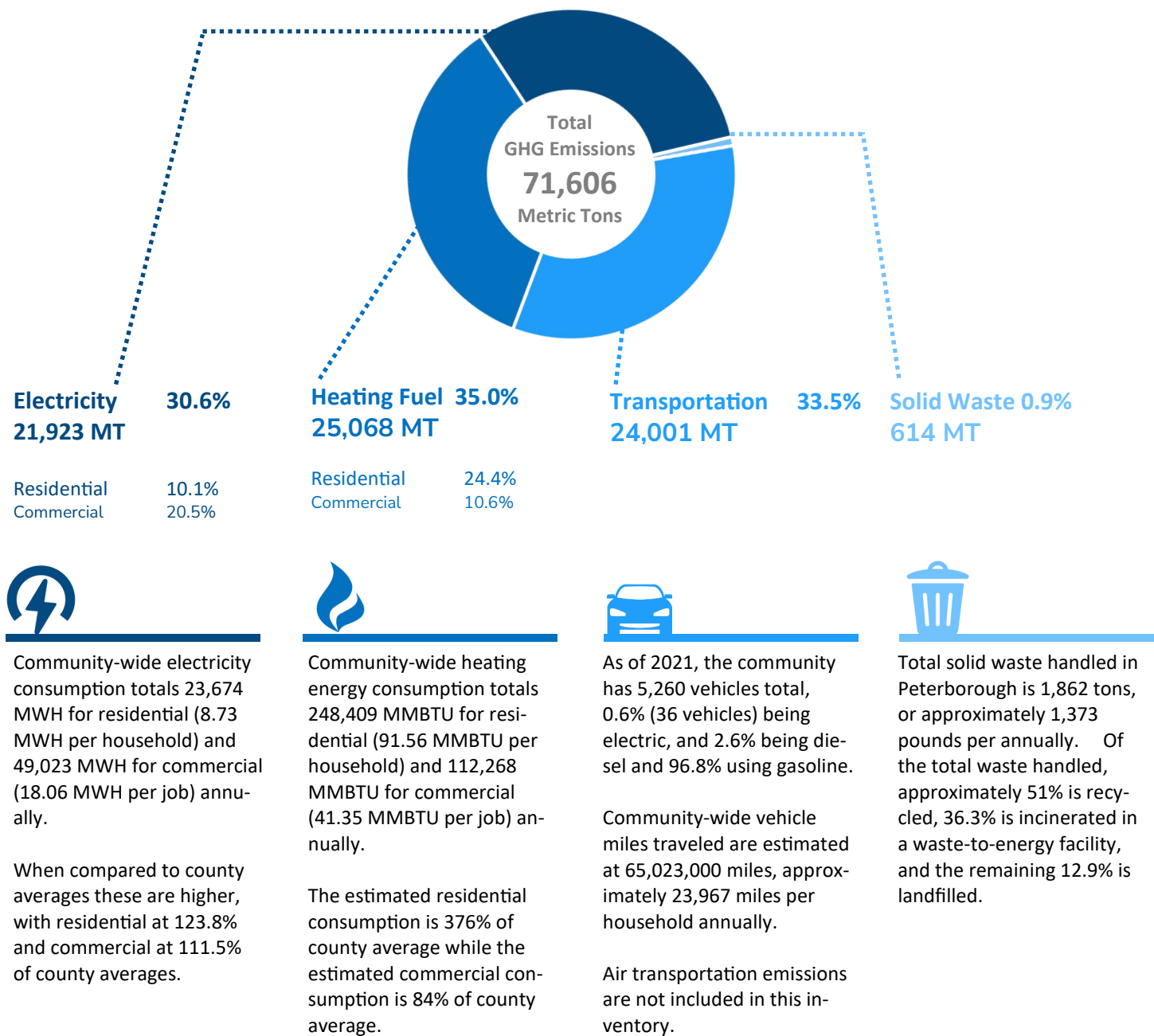
The community's total emissions for 2021 are equal to **1.4 Billion** cubic feet of man-made greenhouse gas. This volume of atmosphere is equal to a cube **1,120** feet on each face—seen here from approximately 1.5 miles away on Route 202



Peterborough GHG Emissions Overview

Community-wide GHG emissions for the Town of Peterborough amount to 71,606 Metric Tons for the year 2021.

The community’s population is 6,661 and the community supports 2,715 jobs. This means that on a per-capita basis, the town’s GHG emissions equal 10.75 Metric Tons.



The Plan

The Peterborough Renewable Energy Plan:

addresses

4 SECTORS

of community-wide focus

through

18 STRATEGIES

to achieve goals

supported by

108 ACTIONS

detailing steps to be
taken

over an

8-YEAR

Implementation
timeframe

Renewable Energy Plan as Living Plan

This Renewable Energy 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. As a “living plan,” the 2030 goals should be seen as a guiding constant and recognition should be given that initial implementation actions may not yet fully achieve long-term 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 plan goals.

Implementation is For Everyone

The causes and impacts of climate change are broad. Solving it must be equally broad. Some actions will need to be led by Town Select Board, Town departments, and/or the business community. In addition, there are some things that households and individuals can do to make an impact. Ultimately, achieving the visionary goals outlined in this plan will require engagement and a sense of responsibility not only by the Town of Peterborough leadership and staff, 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.

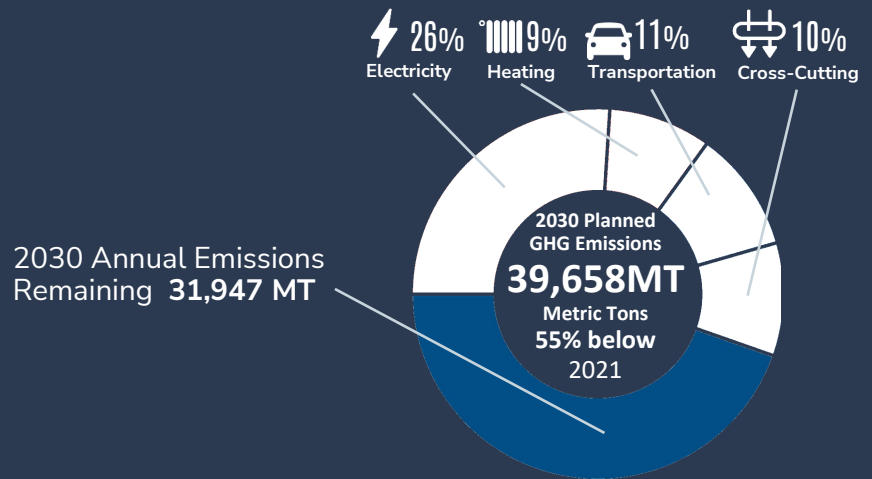
Next Steps and Implementation

This Peterborough Renewable Energy Plan is only the beginning of an on-going process to evaluate and advance the community’s overall renewable energy goals. The plan includes an Implementation and Cross Cutting Actions section providing detailed actions in a framework for launching, guiding, monitoring, and evaluating the execution of this plan.

Peterborough's Planned Carbon Reduction

Projected Town-wide GHG reductions from REP implementation

The strategies outlined in this plan are projected to eliminate 39,658 metric tons of GHG emissions annually by 2030. The chart to the right shows each sector's share of emission reductions.



Plan Framework

This plan is structured around a unifying framework organized by four community-wide sectors as outlined to the right. Each of these sector areas is described in a separate section with background considerations on the subject covered. Sectors have over-arching strategies established to meet 2030 goals and detailed actions for implementation.

Strategies: specific statements of direction that expand on the sustainability vision and GHG reduction goals and guide decisions about future public policy, community investment, and actions.

Actions: are detailed items that should be completed in order to carry out the vision and strategies identified in the plan.



Cross-Cutting

Cross-Cutting Actions are foundational or organizational recommendations that apply to some or all of the other sectors.



Electricity

Achieving 100% Renewable Electricity community-wide by 2030.



Heating

Reducing GHG emission associated with community-wide building heating.



Transportation and Land Use

Addressing GHG emissions from on and off-road vehicles and related land use policies.

Implementation and Cross-Cutting Actions



The first few years after plan adoption are critical to its success. Establishing roles 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 REP into Town operations, functions, and services. Ultimately, however, successful implementation of this Renewable Energy Plan will require the support and commitment of Peterborough residents and businesses.

Implementation Is For Everyone

The causes and impacts of climate change are broad. Solving it must be equally broad. Some actions will need to be led by the Town Select Board, Town departments, and/or the business community. In addition, there are steps that households and individuals can take to make an impact. Ultimately, achieving the visionary goals outlined in this plan will require engagement and a sense of responsibility not only by the Town of Peterborough leadership and staff, but by the community as well. It is critical for all to remain engaged and active, advancing and advocating for actions you feel are important.



Strategies as Minimum Goals

As aspirational goals, the Peterborough Renewable Energy Plan's strategies and goals should be understood as minimums. The intent, ideally, is that implementation of the plan will ultimately exceed the goals set forth in the plan.

Implementation Is a Journey

It is not possible at the beginning to have all of the detailed answers on decades' worth of actions. Both the Renewable Energy Plan and its implementation are a journey. Although the actions outlined in the REP are designed to demonstrate a pathway for Peterborough to achieve its climate goals, there is much uncertainty in predicting future technologies, costs, and regulations. For this reason, a full cost-benefit analysis of every action is not possible at this time.

We anticipate that refinement of detailed actions will occur while they are rolled out. Accordingly, actions are designed to provide guidance on intent but flexibility of details and design. Actions which may modify/create policy or ordinances or which may have Town expenses incurred should be anticipated to go through the typical Town process for approval.

Cross-Cutting Actions

This section includes Cross-Cutting Actions which are foundational recommendations that apply to multiple sectors. The following actions support the long-range implementation of the Renewable Energy Plan including: Building Internal Capacity, External Support, Funding, and Improved Energy Efficiency within the building sectors supporting the renewable energy transition.

Implementation Support Tools

To support the Town in its initial implementation phase, the paleBLUEDot team has created implementation support tools:

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 Peterborough Renewable Energy Plan. The examples can be found on the following webpage: <https://palebluedot.llc/peterborough-rep-policy-examples>

STRATEGIES

The strategies on the following pages guide our path in meeting our climate goals for the Implementation and Cross-Cutting Actions sector. Each strategy is supported by a series of detailed actions to be explored and undertaken in order to carry out the vision and goals.

Action Implementation

The following are the proposed strategies and detailed actions in support of this section.

Actions are anticipated to be implemented in three phases:*

Phase 1: action initiation anticipated within 0-3 years of REP approval

Phase 2 action initiation anticipated within 2-5 years of REP approval

Phase 3 within 3-7 years of REP approval

*Phasing will be established by the PREP Team in collaboration with Town staff and interested residents at initiation of plan implementation (see strategy CC1).

CC 1: Continue to Build Internal Capacity for Support of Renewable Energy Plan Implementation.

CC 2: Facilitate External Support Needed for Renewable Energy Plan Implementation.

CC 3: Maintain appropriate funding to support plan implementation.

CC 4: Support cost effective financing options for Peterborough residents and businesses seeking to invest in plan-compatible upgrades.

CC 5: Improve total municipal building electric energy efficiency by 15% by 2030 (electricity and heating/cooling; as 2030 nears, establish additional goals for 2040).

CC 6: Improve total Community-wide residential, commercial, educational, and industrial building energy efficiency by 15% by 2030 (electricity and heating/cooling; as 2030 nears, establish additional goals for 2040).

ACTIONS

CC 1:**Continue to Build Internal Capacity for Support of Renewable Energy Plan Implementation.**

CC 1-1	<p>Designate (or establish) and support Planning Assistant / Energy Coordinator staffing required to support the Renewable Energy Plan implementation through tasks such as:</p> <ul style="list-style-type: none"> • Facilitate discussion among large users to reduce emissions through business and industrial strategies. • Participate in technical resource programs as they are available through County, State, Federal, and non-profit provider partners. • Support Town of Peterborough department managers and staff as they implement plan actions within their service area or area of expertise. • Convene an internal Town Renewable Energy Action Team working group that meets regularly and provides updates on progress and success, identifies additional support or resources needed to advance actions of the plan, and collaboratively discusses strategies for more complex challenges. • Ensure the establishment and maintenance of a Peterborough Renewable Energy Action webpage supporting Renewable Energy Action Plan resources for the community. • Coordinate and organize volunteer groups and events. • Engage Town boards and commissions to ensure the Renewable Energy Action Plan is integrated into their work plans. • Seek and pursue funding opportunities
CC 1-2	<p>The Planning Assistant / Energy Coordinator, under the supervision of appropriate town staff, will work with staff and volunteer committee members to develop annual priorities and implementation workplans that specify implementation tasks, estimated necessary funding and staffing resources needed to support on-going plan implementation. Progress updates will be reported to the PREP team and Town Select Board annually.</p>
CC 1-3	<p>The Select Board shall establish clear guidance and direction for the participation in and support of the Renewable Energy Plan implementation actions by all Town of Peterborough departments. Encourage continuing education of municipal staff relevant to the Renewable Energy Plan, for example, encouraging planners to earn continuing education credits related to bicycle infrastructure.</p>
CC 1-4	<p>Establish clear direction that motions, resolutions, ordinances, or other legislation reviewed by the Town Select Board and commissions/committees that establish or modify policy or appropriations shall be accompanied by a Renewable Energy Plan Alignment Statement.</p>
CC 1-5	<p>Review Renewable Energy Plan implementation progress and impacts on a regular basis (1-2 year cycle). Periodically updating the community-wide and municipal operations GHG inventory will be considered. Strategies and actions should be reviewed for implementation progress and for continued appropriateness. Based on the review, adjust, add, and remove detailed Renewable Energy Plan actions as appropriate.</p>

ACTIONS

CC 2:

Facilitate External Support Needed for Renewable Energy Plan Implementation.

CC 2-1	<p>Task the current PREP Team to act as a primary community member body to support the implementation of the Renewable Energy Plan. Committee's annual work plans should include support of the implementation of the Plan; supporting Town staff in any relevant departments; receiving updates on Town sustainability projects and progress; being provided with opportunity to comment on identification of annual Plan implementation priorities and projects; and providing input on plan adjustments as needed.</p>
CC 2-2	<p>Establish a coordinated communication and education campaign including materials and outreach/activities supporting the communication and educational needs of each of the Plan sections. The campaign should also look to help Peterborough residents and businesses:</p> <ul style="list-style-type: none"> • Understand why change at the individual, community, Town, and business level needs to occur • Understand the environmental, public health, and social benefits of energy efficiency, renewable energy, active transportation, and electric vehicle use • Be informed about programs and offerings supporting the Renewable Energy Plan such as Energy Audits and Group Purchase campaigns. • Be informed about existing federal incentives, including tax incentives, grants, and funding that supports energy efficiency, renewable energy, fuel switching for heating and cooling systems, electric vehicles, and EV charging. • Know the advantages of enrollment in the Peterborough Community Power program • Know the advantages of renewable energy over fossil fuel energy • Know the advantages of electric, solar, and high efficiency wood pellet heating systems over fossil fuel systems • Know the advantages of EVs over combustion vehicles, including: the importance of zero emissions to public health, the contribution EVs make in reducing Climate Change, the lower operating and maintenance costs, the increased torque and performance, etc. • Take advantage of the Town's "one-stop" webpage, voluntary Net Zero Building Guide, voluntary Solar Ready Guide, and voluntary EV Ready Guide resources.
CC 2-3	<p>Establish, promote, and maintain a "one-stop" webpage to providing residents and businesses with relevant resources, incentives, access to the Town's relevant guides and checklists, information, and links supporting the goals of this Plan.</p>
CC 2-4	<p>Establish a Green Landlords / Bed and Breakfast (B&B) certification program promoting and recognizing residential (rental and B&B) and commercial leased property owners who implement actions in support of this Plan.</p>
CC 2-5	<p>Collaborate with other communities, industry, and State agencies to support the State adopting policies and regulations supporting the goals of this plan such as: incentives supporting energy efficiency, renewable energy fuel switching, and EV adoption; advanced energy efficiency codes; rapid adoption of renewable energy and energy storage; and grid modernization.</p>
CC 2-6	<p>The Town should partner with local businesses, contractors, and installers to offer workshops and training on energy efficiency, renewable energy, and fuel switching for residents and businesses.</p>
CC 2-7	<p>Partner with institutions and businesses within Peterborough to secure commitments to reduce energy consumption, adopt renewable energy, and reduce transportation-related greenhouse gas emissions in line with the goals of this Renewable Energy Plan. Promote and support organizations making commitments.</p>

ACTIONS

CC 3:**Maintain appropriate funding to support plan implementation,**

CC 3-1	Establish and maintain funding for staff dedicated to the implementation of the Renewable Energy Action Plan.
CC 3-2	Establish and maintain a Renewable Energy Plan Reserve Fund to support projects on an annual basis as per annual implementation plans.
CC 3-3	Utilize no-cost technical assistance offerings and participate in innovative utility programs as available.
CC 3-4	Explore additional sustainable funding, such as redesigning existing Town fees to progressive fee structures which align with the goals of the Renewable Energy Action Plan as well as State and Federal funds such as the Inflation Reduction Act.
CC 3-5	Explore establishing a new or use of an existing Guaranteed Energy Savings Program (or another option such as a tax-exempt bond or performance contracting) to finance all possible municipal energy efficiency and renewable energy projects.

CC 4:**Support cost effective financing options for Peterborough residents and businesses seeking to invest in plan-compatible upgrades.**

CC 4-1	Explore partnering with local financial institutions to create loan products to help residents and businesses finance energy efficiency upgrades, fuel switching upgrades, renewable energy installations, and electric vehicle purchases in line with the goals of this plan. Examples include Loan Loss Reserve Funds and Green Bank funds.
CC 4-2	Educate appraisers to become knowledgeable about the value of the green characteristics of residential and commercial buildings and businesses supporting their ability to perform Green Appraisals. By incorporating the value of energy-efficient and other “green” measures into building appraisals, tenants and building owners will see a higher return on investment.
CC 4-3	Explore establishing a privately funded Clean Energy Fund to provide incentives and support residents and businesses in financing energy efficiency upgrades, fuel switching upgrades, renewable energy installations, and electric vehicle purchases in line with the goals of this plan.
CC 4-4	Conduct a study to explore potential income qualified renewable energy and energy efficiency incentives supporting this plan. Based on study, identify and implement pilot incentive programs.
CC 4-5	Explore establishing a Renewable Energy TIF Policy, requiring on-site renewable energy for all projects receiving TIF financing. Explore establishment of a Renewable Energy TIF District specifically identifying TIF financing potential for properties receiving redevelopment which include on-site renewable energy.

ACTIONS

CC 5:

Improve total municipal building energy efficiency by 15% by 2030 (electricity and heating/cooling; as 2030 nears, establish additional goals for 2040).

CC 5-1	Introduce a policy that requires all municipal buildings to be benchmarked with the current Energy Score rating, the energy use intensity (kBtu/square foot) and the energy reduction goal. These benchmarks and goals shall also be posted on the Town's "one-stop" webpage. Encourage the Contoocook Valley School District to implement a similar policy.
CC 5-2	Finish converting all of the Town's building and site lights to LEDs.
CC 5-3	Conduct new energy audits for all municipal facilities to build on the work done in 2014. Establish an Energy Efficiency Plan by 2024 to outline strategies to achieve deep energy retrofit targets for all municipal buildings and implement improvements by 2030.
CC 5-4	Introduce a policy that requires all new and existing municipal buildings to meet or exceed a sustainability standard including an energy efficiency target. Require new and existing municipal buildings without solar PV installations in place or planned to install cool roof or green roofing. Introduce a policy to require all new municipal capital projects to use Town's voluntary Net Zero Energy Guide and Checklist and voluntary Solar Ready Guide and Checklist to support integration of sustainability measures supporting this plan. Encourage the Contoocook Valley School District to implement a similar policy.
CC 5-5	Continue development and implementation of energy management plans for water supply and wastewater treatment facilities and infrastructure.
CC 5-6	Conduct an occupancy and plug load energy efficiency study of primary Town-owned facilities and establish a "Plug Load and Occupancy Energy Efficiency Guide" outlining operational practices to advance the Town's energy efficiency goals for Town facilities. Provide training to all existing Town employees and provide on-going training to all new Town hires.

CC 6:

Improve total community-wide residential, commercial, educational, and industrial building energy efficiency by 15% by 2030 (electricity and heating/cooling; as 2030 nears, establish additional goals for 2040).

CC 6-1	Partner with established Energy Audit/Energy Efficiency Program (such as NHSaves) to establish or expand and promote residential or multifamily energy efficiency audit and upgrade programs, or establish a new program through Peterborough Community Power to implement an annual Energy Efficiency / Weatherization campaign to achieve significant residential energy efficiency improvements. Make the program accessible to all Peterborough residents, with a priority on low and moderate income households and buildings constructed before 1980. The program should offer building envelope tests, infrared thermal scanning, light weatherization projects, LED light bulb replacement. Additionally, offer building operations and behavioral suggestions, as well as track carbon, energy, and financial savings. Offer reduced participation costs for low income households. Program should explore including competitively selected energy efficiency contractors with discounted rates established for energy efficiency recommendations arising from energy audits. Goal: 75 households annually achieving a 15% decrease in energy consumption.
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ACTIONS

CC 6-2	Work with Eversource, NH Saves and other local partners to establish commercial/industrial energy efficiency audit and upgrade program. Develop specific energy efficiency programs for hard-to-reach segments of commercial properties (e.g., commercial rental, restaurants, affordable multifamily housing, schools). Program to have enhanced energy efficiency targets meeting Town of Peterborough plan goals. Program should explore including competitively selected energy efficiency contractors with discounted rates established for energy efficiency recommendations arising from energy audits. Goal: 25% of commercial/industrial buildings by 2030 achieving a 20% decrease in energy consumption per location.
CC 6-3	Establish a communication campaign to promote energy efficiency strategies (like use of LED light bulbs) programs, rebates, and incentives available to Peterborough households and businesses.
CC 6-4	Recommend use of a residential energy benchmarking (performance tracking and reporting) and labeling program for all homes listed for sale. Program examples include Vermont Home Energy Profile, HERS and ENERGY STAR Portfolio Manager.
CC 6-5	Recommend energy audits (working with NH Saves) and disclosure statements for all commercial buildings at the point of sale and at the building permitting process for renovations and expansions.
CC 6-6	Explore establishing a Building Energy Performance Standard ordinance. The building energy performance standard for all buildings over 10,000 square feet shall be no lower than the 65th percentile site energy use intensity (EUI) for buildings of each property type collected through benchmarking reported by ENERGY STAR Portfolio Manager.
CC 6-7	Develop one or more "Green Roof" / "Cool Roof" pilot projects to educate on and exhibit heat island mitigation strategies and measure potential for effectiveness. Identify Town building with low solar PV prioritization/feasibility for inclusion as pilot project location. Alternatively, pilot program could be advertised for submission by Town of Peterborough residents, businesses and neighborhoods for potential sites to be considered for pilot project selection. Preference should be given to sites serving low income or at risk communities with high energy efficiency impact potential.
CC 6-8	Based on pilot project findings, explore a Green/Cool Roof policy to promote and advance the development of green roofs and cool roofs on existing buildings and new construction where appropriate. Encourage rooftop garden / farm installations which advance food security.
CC 6-9	Explore establishing and promoting policy allowing outdoor clothesline use for all residential properties.
CC 6-10	Review and revise local lighting ordinances to support reduction of electricity use and achievement of Dark Sky Community certification.
CC 6-11	Explore adopting and promoting a voluntary green building stretch code including stretch energy efficiency requirements in line with Architecture 2030 goals by 2025. Make stretch code required for all municipal facility projects and all projects receiving \$50,000 or more in municipal tax abatement, financing or funding by 2028.
CC 6-12	Work with the Contoocook Valley School District to promote and support energy efficiency programs, renewable energy installations, and other strategies supporting this plan at all school district facilities and to promote these strategies through curricula with students and communication with families.
CC 6-13	Continue to plant trees along and within paved areas to minimize heat island effect, particularly in locations which can support reduced energy consumption in surrounding residential and or commercial buildings.

SECTION

03

Electricity



CURRENTLY IN PETERBOROUGH

30.6%

of townwide GHG emissions in 2021 are from this sector

72,697,000

kWh of electricity consumption in 2021

6.9%

On-site renewable energy generation townwide

Sources: see Peterborough GHG Inventory

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Electric energy use is a major contributor to greenhouse gas (GHG) emissions. The Electricity sector includes all residential, commercial, and industrial buildings. Greenhouse gas emissions from this sector come from **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 Peterborough community can also achieve climate resilience, and environmental, social, and economic benefits through enhancements to the built environment and renewable electricity generation.

Peterborough Energy Use Profile—Community Wide

Residential:

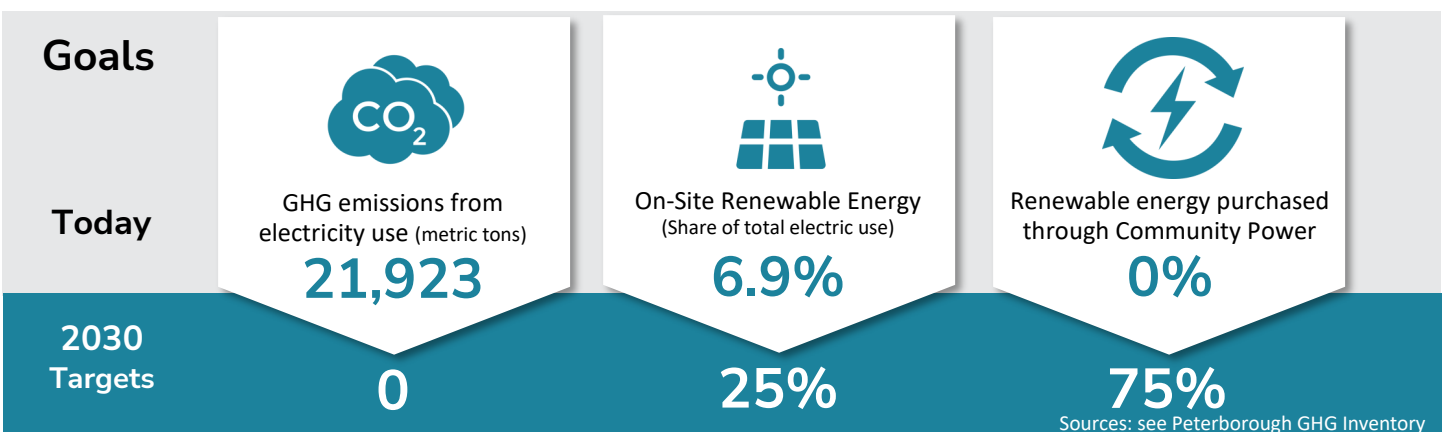
According to 2021 community wide data, the residential sector in Peterborough consumes nearly 23.67 million kWh annually. This is equal to 8,730 kWh per household, approximately 124% of the Hillsborough County average.

Commercial and Industrial:

The Peterborough commercial and industrial sector in 2021 consumed over 49 million kWh. This is equal to 18,060 kWh per job, approximately 112% of the Hillsborough County average.

Potential for Change in Peterborough

According to Town of Peterborough data, less than 3% of the Town's commercial building stock and less than 4.5% of the Town's housing stock was built in the last ten years. Meanwhile while nearly 57% of the commercial building stock and over 67% of the Town's housing stock is more than forty years old. Based on the age of the Town's building stock, significant renovations and new construction replacement projects may increase in the coming years. This means that a significant portion of the town's building infrastructure could be positively impacted and influenced through strategies that guide increased energy efficiency and increased renewable energy adoption.



STRATEGIES

The strategies on the following pages guide our path in meeting our climate goals for the Electricity sector. Each strategy is supported by a series of detailed actions to be explored and undertaken in order to carry out the vision and goals.

Action Implementation

The following are the proposed strategies and detailed actions in support of this section.

Actions are anticipated to be implemented in three phases:*

Phase 1: action initiation anticipated within 0-3 years of REP approval

Phase 2 action initiation anticipated within 2-5 years of REP approval

Phase 3 within 3-7 years of REP approval

*Phasing will be established by the PREP Team in collaboration with Town staff at initiation of plan implementation (see strategy CC1).

E1:

Increase adoption of high performance building construction technology, achieving 0.5% Net Zero households and commercial properties community-wide by 2030.

E2:

Increase on-site renewable energy from 6.9% to 25% of residential, commercial, educational, and industrial electric use by 2030.

E3:

Implement Community Power renewable energy purchasing, achieving at least 75% residential, commercial, educational, and industrial participation by 2030.

E4:

Increase on-site and locally generated renewable energy of Town operations' electricity consumption to 100% by 2030.

ACTIONS

E1:**Increase adoption of high performance building construction technology, achieving 0.5% Net Zero households and commercial properties community-wide by 2030.**

- | | |
|-------|---|
| E 1-1 | Establish a Net Zero Energy Building Guide providing building owners, renters, developers, designers, and contractors with detailed information on voluntary strategies to make new construction or significant renovation projects Net Zero Energy or Net Zero Energy ready. |
| E 1-2 | Launch a platform and training program to share best practices, providing training to owners, builders, and designers, and promote the Town's voluntary Net Zero Energy Guide and Checklist and voluntary Solar-Ready Guide and Checklist. Include distribution of guides and checklists through building permit forms and information. |
| E 1-3 | Explore establishing 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. 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 2028 with an anticipated average of 5 residential units annually (single family and/or multifamily units) by 2028. |

E2:**Increase on-site renewable energy from 6.9% to 25% of residential, commercial, educational, and industrial electric use by 2030.**

- | | |
|-------|---|
| E 2-1 | Establish a voluntary Solar Ready Guide and Checklist 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. |
| E 2-2 | Promote the economic benefits of the Town's exclusion of solar PV from property taxation. |
| E 2-3 | Establish a town information resource for residents and businesses seeking to generate their own renewable power. Include Town's voluntary Solar Ready Guide and Checklist. |
| E 2-4 | Coordinate and promote a residential Solar Group Purchase or "Solarize" Campaign regularly to help reduce the costs of solar installation through volume purchasing power (goal, 50 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. |
| E 2-5 | Identify the "Solar Top 20" commercial/industrial properties within the Town and produce detailed solar feasibility assessments for each site. 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 20" assessment effort could be repeated regularly, particularly through 2030. |

ACTIONS

- | | |
|-------|---|
| E 2-6 | Coordinate and promote a commercial Solar Group Purchase Campaign regularly to help reduce the costs of solar installation through volume purchasing power (goal, 500KW installed annually). Group purchase campaign could include/focus on properties identified in the "Solar Top 20" 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. |
| E 2-7 | Organize and conduct a hydroelectric feasibility assessment to determine the cost effective hydro power capacity capable of serving the electric needs of the town. The assessment should include identification of potential socio-environmental impacts and opportunities, as well as projected generation potential, costs, and economic payback as well as other co-benefit potentials. |
| E 2-8 | Amend ordinances to make solar installations easier, or establish a certification program for all new residential, multifamily and commercial construction. Explore establishing a "Solar-Ready" ordinance. Use Town's Solar Ready Guide and Checklist to support policy. |
| E 2-9 | Explore creation of an ordinance ensuring that all homeowners can install solar panels regardless of where they live, including condominiums. |

E3:

Implement Community Power renewable energy purchasing, achieving at least 75% residential, commercial, educational, and industrial participation by 2030.

- | | |
|-------|---|
| E 3-1 | Implement the Peterborough Community Power program with 100% renewable electricity supply by 2030. Renewable electricity supply to be provided through direct investment, renewable electricity purchases, and purchase of Renewable Energy Certificates (RECs), within New England (as close to Peterborough as possible). |
| E 3-2 | Establish a Peterborough Renewable Energy Purchase master plan to identify appropriate renewable energy procurement sources and strategies and to map a procurement timeline. |
| E 3-3 | Work with regional solar developers to offer Community Solar opportunities to residents, including renters and low/moderate income households. Explore issuing competitive Request for Proposals for Community Solar developments. Community solar agreements must allow Peterborough Community Power program to retain renewable energy credits (RECs) associated with the installation's energy generation. |
| E 3-4 | Explore creation of incentive program for Community Power participants to encourage investment in distributed renewable energy systems within the community which provides compensation for power and green attributes of net metered on-site renewable energy generation. |
| E 3-5 | Create Peterborough Community Power education and outreach materials clearly communicating the benefits of participation in Peterborough Community Power and promote and distribute to residences and businesses within the Town of Peterborough. |
| E 3-6 | Conduct an assessment of utility scale energy storage solution options and establish a Peterborough appropriate Energy Storage Implementation Plan and schedule based on findings. Assessment should include review of Renewable Electrolysis (liquid fuels derived from renewable electricity) and Resilient Bidirectional Charging (two-way charging allowing the flow of energy to the grid to charge the vehicle as well as from the vehicle battery back to the grid) options. |

ACTIONS

E4:

Increase on-site and locally generated renewable energy of Town operations' electricity consumption to 100% by 2030.

E 4-1

Conduct a Municipal Facility Renewable Energy Feasibility and Master Plan study to explore the feasibility of on-site solar and other renewable strategies for all Town facilities. Study should explore a range of ownership options including purchase and third party ownership (such as Power Purchase Agreements) and should include exploration of micro-grid and solar+storage options for improved facility resilience. Study should also identify strategies such as community solar subscriptions combined with Renewable Energy Credit purchases, to achieve renewable energy at sites determined to be inappropriate for on-site solar to achieve 100% on-site and locally generated renewable energy of Town operations by 2030.

E 4-2

Install renewable energy on all Town buildings and sites, where feasible based on the findings and recommendations of the Municipal Facility Renewable Energy Feasibility and Master Plan study by 2029. Explore implementation of micro-grid, solar+storage and other options for improved facility resilience. Explore including municipal facility solar purchases in community-wide commercial solar group purchase campaigns.

SECTION

04

Heating



CURRENTLY IN PETERBOROUGH

35%

of townwide GHG emissions in 2021 are from this sector

360,678

MMBTU of heating fuel consumption in 2021

1,928

Households using fossil fuels for heating systems in 2021.

Sources: see Peterborough GHG Inventory

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The heating energy sector is a major contributor to greenhouse gas (GHG) emissions. This 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 with the Electricity Sector, 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 Peterborough community can also achieve climate resilience, and environmental, social, and economic benefits through enhancements to the heating sector.

Peterborough Energy Use Profile—Community Wide

Residential:

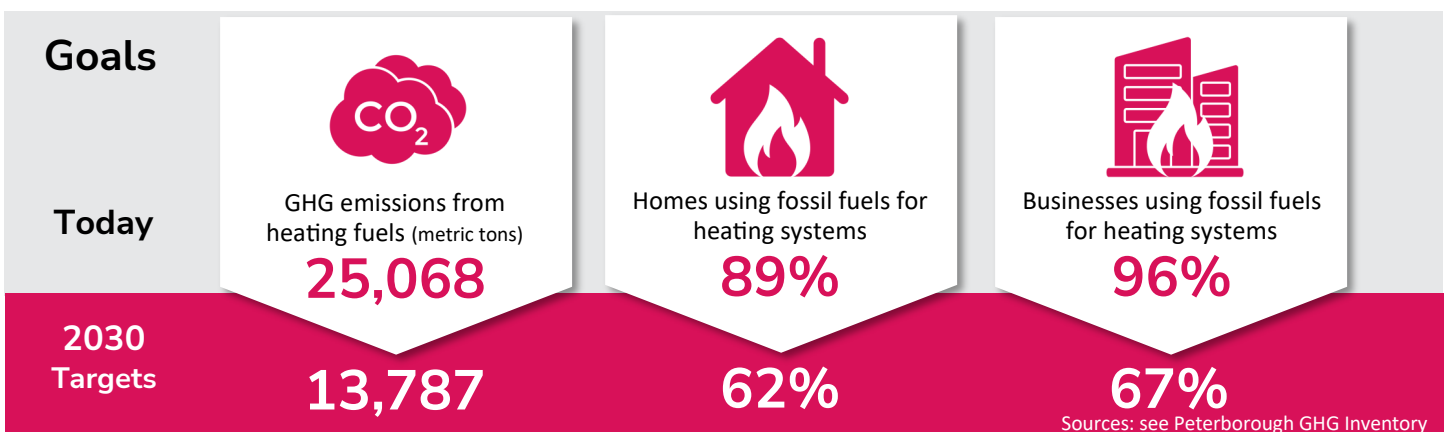
According to 2021 community wide data, the residential sector in Peterborough consumes over 248.4 Billion BTU's of heating fuel annually. This is equal to 91.6 Million BTU's per household.

Commercial and Industrial:

The Peterborough commercial and industrial sector in 2021 consumed nearly 103 Billion BTU's of heating fuel annually. This is equal to 41.3 Million BTU's per job, approximately 85% of the Hillsborough County average.

Potential for Change in Peterborough

According to Town of Peterborough data, less than 3% of the Town's commercial building stock and less than 4.5% of the Town's housing stock was built in the last ten years. Meanwhile while nearly 57% of the commercial building stock and over 67% of the Town's housing stock is more than forty years old. Based on the age of the Town's building stock, significant renovations and new construction replacement projects may increase in the coming years. This means that a significant portion of the town's building infrastructure could be positively impacted and influenced through strategies that guide increased energy efficiency and increased renewable energy adoption.



Sources: see Peterborough GHG Inventory

STRATEGIES

The strategies on the following pages guide our path in meeting our climate goals for the Heating sector. Each strategy is supported by a series of detailed actions to be explored and undertaken in order to carry out the vision and goals.

Action Implementation

The following are the proposed strategies and detailed actions in support of this section.

Actions are anticipated to be implemented in three phases:*

Phase 1: action initiation anticipated within 0-3 years of REP approval

Phase 2 action initiation anticipated within 2-5 years of REP approval

Phase 3 within 3-7 years of REP approval

*Phasing will be established by the PREP Team in collaboration with Town staff at initiation of plan implementation (see strategy CC1).

H1:

Achieve 30% residential, commercial, educational, and industrial building "fuel switching" from on-site fossil fuel combustion to no/very low emission heating systems by 2030 and 100% by 2040.

H2:

Explore feasibility of district heating systems for the community and implement options identified as effective and

H3:

Achieve 30% municipal building "fuel switching" from on-site fossil fuel combustion to electric and zero-emission heating systems by 2030 and 100% by 2040.

ACTIONS

H1:

Achieve 30% residential, commercial, educational, and industrial building "fuel switching" from on-site fossil fuel combustion to no/very low emission heating systems by 2030 and 100% by 2040.

H 1-1	Educate and encourage replacement of gas appliances, water heaters, and heating and cooling systems to solar thermal, electric and induction appliances and systems. Compile and make available resources for appliance information and relevant rebates and funding. Help target replacement opportunities by educating homeowners and businesses on the average lifespan of their traditional boilers and furnaces, and the warning signs for when such units should be replaced.
H 1-2	Highlight NHSaves incentives for wood pellet boilers for residential and commercial buildings' heating with wood to upgrade to a high-efficiency EPA-rated wood pellet furnace or heater.
H 1-3	Coordinate and promote a residential and small business "Fuel Switching and Energy Efficiency/Weatherization" group purchase campaign regularly to help reduce the costs of energy efficient electric heating systems and electric appliances such as air source heat pumps and ground source heat pumps and induction stoves as well as solar thermal and wood pellet heating systems through volume purchasing power (goal, 50 households and 10 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.
H 1-4	Collaborate with other communities and lobby the State to overturn SB 86 to enable communities to establish fossil fuel bans or policies as desired by the community.
H 1-5	Collaborate with NHSaves and other regional partnerships to create financial incentives for "fuel switching" of new and existing buildings including electrification, solar thermal, and high efficiency wood pellet systems. For example, rebates for heat pumps, panel upgrades, and electric appliances can promote the transition to electric energy use in homes and businesses. Facilitate access to funds to help individuals and businesses with transitioning to renewable thermal.
H 1-6	Organize public demonstrations of energy efficient electric thermal systems, solar thermal systems, and other renewable thermal systems. Demonstrations might include open houses of Peterborough residents or Peterborough businesses with example systems in place, a "Peterborough Renewable Energy Building tour," or a renewable energy fair.
H 1-7	Provide financial and promotional incentives for business owners to assess the potential for converting all or part of their space heating and cooling to efficient electric, solar thermal, or wood pellet systems. Explore partnering with State and local resources to establish a program offering free consultations.

ACTIONS

H2:

Explore feasibility of district heating systems for the community and implement options identified as effective and appropriate.

- | | |
|-------|--|
| H 2-1 | Conduct a District Heating and Co-Generation Feasibility Assessment to explore opportunities for district heating and co-generation meeting the goals of this plan in the downtown area and to identify areas within the Town with the potential for the installation of identified systems. District heating is a system for distributing heat generated in a centralized location through a system of pipes for residential and/or commercial heating. |
| H 2-2 | Implement district heating projects based on the District Heating and Co-Generation Feasibility Assessment. |

H3:

Achieve 30% municipal building "fuel switching" from on-site fossil fuel combustion to electric and zero-emission heating systems by 2030 and 100% by 2040.

- | | |
|-------|---|
| H 3-1 | Establish a policy requiring all municipally-owned buildings to be 100% electric (or zero on-site fossil fuel combustion). |
| H 3-2 | Establish a policy requiring all existing municipally-owned buildings to replace heating systems with 100% electric solar thermal or high efficiency wood pellet systems when required by end-of-life equipment replacement schedules. |
| H 3-3 | Work with regional energy partnerships to develop and implement a Fuel Switch Action Plan outlining a transition to electric, solar thermal, or high efficiency wood pellet systems with locally and sustainably sourced wood pellets for all Town facilities. Plan to 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. Goal: achieve 50% fuel switch by 2030 and 100% by 2040. |



SECTION

05

Transportation and Land Use



CURRENTLY IN PETERBOROUGH

33.5%

of townwide GHG emissions in 2021 are from transportation

65,023,000

Vehicle Miles Driven in 2021

36

Battery Electric vehicles currently registered

Sources: see Peterborough GHG Inventory

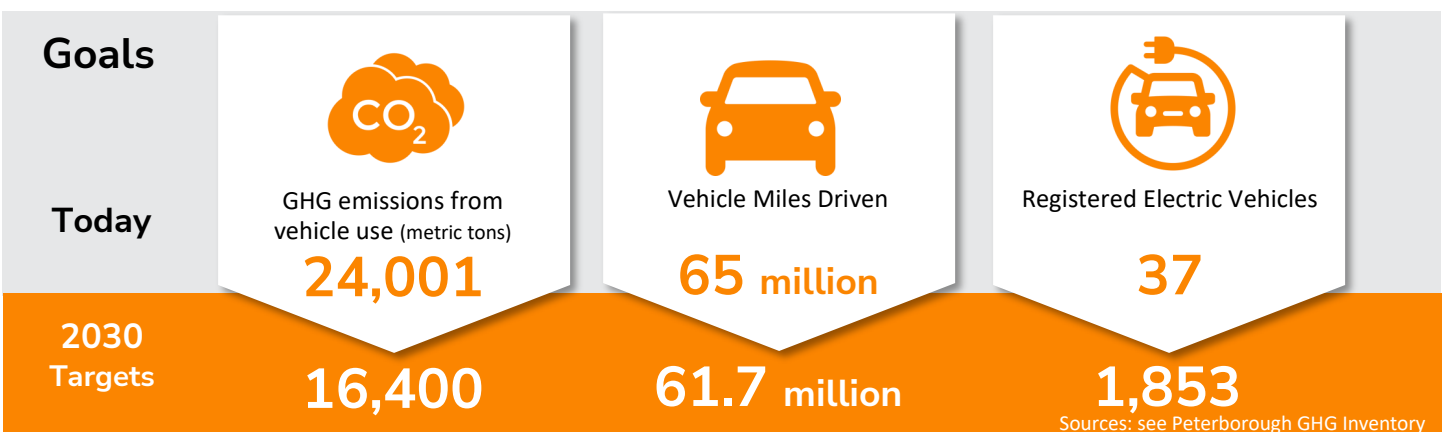
[Click here to return to TOC](#)

Moving ourselves and our goods and services from place to place is very energy intensive while the vehicles we use for that mobility are very material resource intensive. In addition to transportation vehicles, off-road equipment like construction, recreational and lawn equipment also consume significant amounts of fossil fuels for their operation. Off-road equipment have even higher GHG emission and overall air pollution rates per gallon of fuel consumed than on-road vehicles due to less efficient combustion and lower emission standards than on-road vehicles.

Equipment and transport systems have significant impacts on the environment, accounting globally for 20% to 25% of world energy consumption and carbon dioxide emissions. In Peterborough, the Transportation sector accounts for 33.5% of community wide GHG emissions and are projected to decrease as the transportation sector electrifies.

Many options exist for improving the sustainability of our transportation systems while improving quality of life and equity. Increasing shared transportation while decreasing use of single-occupancy vehicles significantly

reduces the environmental impacts of transportation. This change also can improve equity in mobility. Alternative transportation modes like bicycles, eBikes, and scooters can also increase opportunities for exercise while reducing air pollution. Lastly, studies indicate that recent advances in electric vehicles, car-sharing technologies and the potential for self-driving vehicles underline a much more sustainable usage of car assets that could remove up to 90% of the vehicles from the streets while enhancing mobility options.



STRATEGIES

The strategies on the following pages guide our path in meeting our climate goals for the Transportation and Land Use sector. Each strategy is supported by a series of detailed actions to be explored and undertaken in order to carry out the vision and goals.

Action Implementation

The following are the proposed strategies and detailed actions in support of this section.

Actions are anticipated to be implemented in three phases:*

Phase 1: action initiation anticipated within 0-3 years of REP approval

Phase 2 action initiation anticipated within 2-5 years of REP approval

Phase 3 within 3-7 years of REP approval

*Phasing will be established by the PREP Team in collaboration with Town staff at initiation of plan implementation (see strategy CC1).

TL 1:

Decrease community-wide vehicle miles traveled (VMT) by 5% by 2030 through increased biking, walking, shared mobility, and eMobility.

TL 2:

Increase battery electric vehicle (BEV) and plug-in hybrid (PHEV) utilization to 30% of community-wide rolling stock by 2030 (from 37 to approximately 1,853 vehicles community-wide).

TL 3:

Increase Average Population per Developed Acre with Sewer and Water by 5% by 2030.

TL 4:

Establish viable renewable diesel and/or biodiesel sources to serve community. Achieve 100% diesel consumption replacement with renewable diesel and/or biodiesel as technology allows. (Intended as bridge strategy towards electrification and more rapid reduction of fossil fuel use)

TL 5:

Convert municipal operations' gasoline and e10 gasoline vehicles and equipment within municipal fleet to EV's as technology allows with a goal of 100% by 2040.

ACTIONS

TL 1:

Decrease community-wide vehicle miles traveled (VMT) by 5% by 2030 through increased biking, walking, shared mobility, and eMobility.

TL 1-1	Establish a Complete Streets Policy, including criteria and review procedures for municipally funded projects.
TL 1-2	Enhance Complete Streets Plan to facilitate the creation of strong multi-modal transportation and connections within and between towns, establish complete streets guidance, provide a complete streets assessment to identify percentage of streets in compliance with Town's complete streets policy, establish Mobility Hub guidance, establish a plan for expansion of the bike path network, and identify prioritized active transportation projects with implementation timeline.
TL 1-3	Based on Multi-Modal and Complete Streets Plan, implement prioritized active transportation projects such as development of Mobility Hubs for enhanced mobility options such as rideshare, car share, and bike share
TL 1-4	Explore provision of public toilets and showers at key locations (for example: at a town center Mobility Hub) to support and encourage biking and walking into town and active transportation commuters.
TL 1-5	Explore how to modify zoning codes to establish minimum EV parking requirements.
TL 1-6	Collaborate with Monadnock employers to encourage and incentivize work-at-home adoption
TL 1-7	Install bike racks in downtown areas and shopping plazas
TL 1-8	Organize and promote an electric vehicle (EV) Group Purchase campaign regularly to partner with regional dealerships to offer limited-time discounted pricing on EVs to help reduce the costs of EV purchasing through volume purchasing power. Program should focus options to increase community equity. Group purchase could be coordinated with Town of Peterborough fleet vehicle purchases and/or in conjunction with the Town's Solar Group Purchase program(s).
TL 1-9	Explore working with SWRPC to pursue reliable Micro-transit and bus service connecting Peterborough Mobility Hubs with Keene, Nashua, and other regional communities to support decreased vehicle commuting.

ACTIONS

TL 2:

Increase battery electric vehicle (BEV) and plug-in hybrid (PHEV) utilization to 30% of community-wide rolling stock by 2030 (from 37 to approximately 1,853 vehicles community-wide).

TL 2-1	<p>Establish an Electric Vehicle Action Plan (EVAP) to guide access to chargers townwide on public and private property. In the EVAP:</p> <p>Explore alternative technologies like Smart Cable technology and streetlight/EV charger integration.</p> <ul style="list-style-type: none"> • Address barriers to charging in garage-free homes and rental properties. • Assess options to lower EV and EV charging implementation costs. • Recommend EV charging station requirement amendments to zoning ordinances to support the EVAP. • The EVAP should consider the EV charging needs of town residents and businesses as well as opportunities to support EV charging for travelers in ways that benefit both the community and the traveler. Place EV charging stations strategically to be convenient for tourists. • Establish an EV infrastructure master plan and implementation timeframe identifying EV charging station locations including at all primary municipal facilities.
TL 2-2	Install public EV charging infrastructure in accordance with the Electric Vehicle Action Plan (EVAP).
TL 2-3	Establish an EV Ready Ordinance requiring new developments to have wiring capacity to meet the needs of electric vehicle charging and the EV parking requirements of the Town's revised zoning codes.
TL 2-4	Maximize the community benefit of recently passed federal EV incentives by establishing an incentive supporting the purchase and/or installation of electric vehicle charging equipment. Incentive design should take into consideration the anticipated increase in electric demand and revenue generated through increased car electrification.
TL 2-5	Build public awareness of electric mobility options, including EV's and eBikes, through communications and Ride-And-Drive events.
TL 2-6	Solicit existing shared mobility service providers or establish a shared mobility program including EV car sharing, eBike sharing, and eScooter for the Peterborough area. Seek models or examples and run trials of local, neighborhood or apartment/housing development car and/or bike sharing.
TL 2-7	Simplify and clarify the permitting and inspection process for EV charger installations. Establish an EV charger permit template, an on-line application platform, and a utility notification protocol to streamline the process.
TL 2-8	Evaluate, monitor, and promote incentive programs to expand EV charger deployment on private property, including rebates and financing options (on-bill financing, etc.).
TL 2-9	Create a voluntary EV Ready Guide including information supporting EV charger technology, EV Fleet transition, and ADA compliant charger siting information.
TL 2-10	Update the Town's master plan to anticipate and reflect infrastructure needed to support the transportation electrification goals of this plan and to facilitate an easy installation process.

ACTIONS

TL 3:

Increase Average Population per Developed Acre with Sewer and Water by 5% by 2030.

TL 3-1	<p>Amend the zoning ordinance to allow higher density development. Amendments should include:</p> <ul style="list-style-type: none"> • Encourage buildings to be built to their allowable heights • Allowing projects to build out to approved densities • Considering opportunities for mixed land use
TL 3-2	<p>Encourage development of Accessory Dwelling Units to create additional affordable housing options compatible with residential neighborhoods. The Town's planning staff will assist residents in navigating ADU requirements.</p>
TL 3-3	<p>Conduct a Development Study to identify and prioritize available sites for redevelopment and infill development to advance town's walkability, bikeability, and multi-modal transportation vision.</p>
TL 3-4	<p>Use the findings of the Development Study to encourage high quality mixed use redevelopment on properties identified as conducive to redevelopment and infilling.</p>
TL 3-5	<p>Study and establish incentives for multi-unit and mixed use developments which result in increased density and improved mobility. Examples include:</p> <ul style="list-style-type: none"> • Alternative zoning/ordinance compliance • Fee waivers • Density bonuses • Investment prioritization • Development impact fees • Tax benefits
TL 3-6	<p>Issue competitive redevelopment Request for Proposals based on findings of Development Study to encourage high quality mixed use redevelopment on municipally controlled infill properties and existing surface parking lots within the downtown district. RFP's should focus on equity, affordability, livability, and compliance/support of Renewable Energy Plan goals.</p>

ACTIONS

TL 4:

Establish viable renewable diesel and/or biodiesel sources to serve community. Achieve 100% diesel consumption replacement with renewable diesel and/or biodiesel as technology allows. (Intended as bridge strategy towards electrification and more rapid reduction of fossil fuel use)

TL 4-1

Conduct a Peterborough Region No/Low Emission Diesel Vehicle Fuel Alternative Feasibility study to identify viable no/low emission 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 as well as renewable electrolysis.

TL 4-2

Based on the findings of the No/Low Emission Diesel Vehicle Fuel Alternative Feasibility study identify and engage partners to establish adequate renewable diesel and/or biodiesel supply chain for community.

TL 4-3

Based on the findings of the No/Low Emission Diesel Vehicle Fuel Alternative Feasibility study, establish a policy to convert all municipal operations' diesel fuel utilization to biodiesel and/or renewable diesel fuel by 2028.

TL 4-4

Establish communication and education campaign to encourage the use of no/low emission fuels for vehicles unable to be replaced with electric alternatives.

TL 5:

Convert municipal operations' gasoline and e10 gasoline vehicles and equipment within municipal fleet to EV's as technology allows with a goal of 100% by 2040.

TL 5-1

Adopt a policy requiring 100% of new light-duty Town fleet vehicles to be electric, or use no/low carbon alternative fuels by 2030, and 100% of new medium and heavy-duty Town fleet vehicle purchases to be electric, or use no/low carbon alternative fuel by 2040. In accordance with the policy, Town's purchasing/budget process to default to EV or no/low carbon alternative fuel vehicles with traditional internal combustion engine (ICE) requiring proof of need. Encourage the Contoocook Valley School District to implement a similar policy.

TL 5-2

Make a municipal fleet Electric Vehicle Transition Plan (EVTP) to achieve 100% conversion of all Peterborough municipal fleet vehicles and equipment to EVs by 2040. Include implementation recommendations to incorporate EV's through right-timing purchases with a planned vehicle-replacement schedule. Encourage the Contoocook Valley School District to make a similar plan.

TL 5-3


Introduce a policy to replace Town off-road and lawn equipment with electric and low-carbon fuel alternatives at the time of replacement with traditional internal combustion engine (ICE) as an option requiring proof of need.

TL 5-4

Explore Resilient Bidirectional Charging (two-way charging allowing the flow of energy from the grid to charge the vehicle as well as from the vehicle battery back to the grid) options, and potential to support energy storage needs and increase financial viability of EV fleet transition.



Supporting Research and Documents

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GHG Inventory and Renewable Energy Baseline Recommendations

To support the PREP planning team members, the paleBLUEdot team assembled the GHG Inventory and Renewable Energy Baseline Recommendations. This document includes 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 Renewable Energy Plan.

This document also provided a review of a wide range of community-wide metrics, data, and comparisons against regional peer communities for each of the Renewable Energy Plan sectors included in this report. The document also included preliminary sector specific draft strategic goal recommendations for the planning team to consider, discuss, and revise at the beginning of the planning team effort.

Click on the link below to access the document:
<https://view.publitas.com/palebluedot/peterborough-ghg-inventory-and-baseline-assessment/>

Peterborough Energy Action Warrant Article, Town Meeting 2021

At Peterborough's 2021 Town Meeting residents voted overwhelmingly (with 74% in favor) to pass a Warrant Article committing the town to transition to 100% renewable sources of electricity by 2030 and for all other energy needs by 2050. The Peterborough Renewable energy Planning (PREP) Team was appointed by the Peterborough Select Board to research and write a general action plan to meet this goal. This Warrant Article lays the foundation for this Renewable Energy Plan

Click on the link below to access the Warrant Article document:

<https://uploads.strikinglycdn.com/files/00640683-806c-44de-9676-05e27b0d5e1f/Warrant%20Article%2011.pdf?id=3868593>

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APPENDIX

B Abbreviations and Glossary of Terms



Abbreviations

BAU	Business as usual
BEV	Battery electric vehicle
BIPOC	Black, Indigenous, People of Color
C&D	Construction and demolition
CAP	Climate Action Plan
CE	Carbon Equivalent
CDP	Carbon Disclosure Project
CFC	Chlorofluorocarbons
CH ₄	Methane
CHP	Combined Heat and Power
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
CSG	Community Solar Garden
DOE	U.S. Department of Energy
EMS	Emergency medical services
EPA	U.S. Environmental Protection Agency
EV	Electric vehicle
EVSE	Electric vehicle supply equipment
FEMA	Federal Emergency Management Agency
FTE	Full-time equivalent
GCoM	Global Covenant of Mayors
GDP	Gross Domestic Product
GHG	Greenhouse gas
GWP	Global warming potential
HFC	Hydrofluorocarbons
IPCC	Intergovernmental Panel on Climate Change
kWh	Kilowatt-hour
LEV	Low emission vehicle
MWH	Megawatt hour – 1,000 Kilowatt-hours
MSW	Municipal Solid Waste
MT	Metric ton equivalent to 1,000 kg (also known as Metric Tonne)
MMT	Million Metric tons
MTCO ₂ e	Metric tons of carbon dioxide equivalent
N ₂ O	Nitrous Oxide
NO _x	Nitrogen Oxides
NZE	Net-Zero Emissions
O ₃	Ozone
ODS	Ozone Depleting Substances
PACE	Property Assessed Clean Energy
PFC	Perfluorocarbons
PHEV	Plug-in hybrid electric vehicle
PM _{2.5}	Particulate matter of 2.5 micrometer diameter or less
POC	People of Color
PPA	Power Purchase Agreement
PUB	Public Utilities Board

REC	Renewable Energy Credit
SO ₂	Sulfur Dioxide
SF ₆	Sulfur Hexafluoride
SULEV	Super ultra-low emission vehicle
t	Ton equivalent to 2,000 lbs (United States)
TOG	Total Organic Gasses
USGS	U.S. Geological Survey
VMT	Vehicle miles traveled
VHT	Vehicle hours traveled
ZEV	Zero emission vehicle



A

Action

Actions are detailed items that should be completed to carry out the vision and strategies identified in the plan.

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](#))

Adaptation

See "Climate Adaptation or Resilience"

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.

BAU

See "Business As Usual Forecast"

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](#))

BIPOC

"Black, Indigenous, and People of Color" this is a term specific to the United States, intended to center the experiences of Black and Indigenous groups as representative of or shaping the socio-economic dynamics experienced by all people of color.

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](#))

Blue Carbon

Carbon sequestered and stored by wetlands and other coastal ecosystems helping to mitigate the effects of climate change.

Business As Usual Forecast

The Intergovernmental Panel on Climate Change (IPCC) defines a

"business-as-usual" forecast as the level of emissions that would result if future development trends follow those of the past and no changes in policies take place. A BAU forecast assumes that no emission-reduction actions will be undertaken beyond those already in place, mandated by State or Federal policy, or committed to in the base year.

C

Climate and Sustainability Glossary of Terms

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 (CO₂)

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 (CO₂e)

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 Offsets

A carbon offset is a reduction or removal of emissions of carbon dioxide or other greenhouse gases made to compensate for emissions made elsewhere. Offsets are measured in metric tonnes of carbon dioxide-equivalent. Offsets are bought and sold to address direct and indirect emissions associated with an organization’s operations.

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 CO₂ 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 to reduce risks to valued assets. Adaptation is achieved through actions taken to increase resilience to climate change impacts by reducing vulnerability.

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 Migration

Movement of people due to the impacts of climate change on their livelihoods or erosion of quality of life, such as shifts in water availability and crop productivity, or to factors such as sea level rise or storm surge.

Climate Model

A quantitative method to simulate interactions of the important drivers of climate—including atmosphere, oceans, land, and ice—to develop projections of future climate.

Climate Scenario

A coherent, internally consistent, plausible description of possible climatic conditions

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.

Co-Benefit

Indirect benefits to the community (e.g., public health, economic, equity) caused by climate adaptation and mitigation strategies, actions, and policies.

Co-generation

Co-generation 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](#))

Community Choice Aggregation (CCA)

CCA programs, also known as “Municipal Power Aggregation” or “Community Power Aggregation”, allow local governments to procure power on behalf of their residents, businesses, and municipal accounts from an alternative supplier while still receiving transmission and distribution service from their existing utility provider. Typically, enabling legislation at the State level is required in order to assemble a CCA program for a community. See EPA’s CCA webpage for more: <https://www.epa.gov/green-power-markets/community-choice-aggregation>

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 utilization of the energy used. Public utilities may utilize 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 Power Aggregation

See “Community Choice Aggregation”

Community Solar / Community Solar Garden (CSG)

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](#))

Cool Roof

Roof surfaces designed to reflect radiation from the sun, reducing heat transfer into the building or the building’s surrounding area.

Cool Pavement

Pavement surfaces designed to reflect radiation from the sun, reducing heat transfer into the road’s surrounding area.

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. ([UNFCCC](#))

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](#))

District Heating

District heating is a system for distributing heat generated in a centralized location through a system of pipes for residential and/or commercial heating within a district of a community.

E

Eco-System Services

Contributions of ecosystems to human well-being. For example, ecosystems produce resources used by humans such as clean air, water, food, open space, flood control, climate mitigation, and other benefits.

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](#))

Energy Tariff

An Energy Tariff, or utility tariff, governs how an energy provider (electric or natural gas) charges the customer for their energy and natural gas usage. Electric and natural gas vendors must submit their tariffs to the government for approval.

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

Equity

The state or quality of being just and fair in the way people are treated. Equity recognizes that each person has different circumstances and allocates the exact resources and opportunities needed to reach an equal outcome. According to the World Health Organization, Equity is “the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically or geographically” while the US Center for Disease Control defines Equity as “when everyone has the opportunity to be as healthy as possible.” Within the context of climate change, climate equity means both protection from climate change and environmental hazards as well as access to climate resilience and environmental benefits for all, regardless of income, race, and other characteristics.

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). ([UNFCCC](#))

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

Fugitive emissions are unintentional leaks emitted from sealed surfaces, such as packings and gaskets, or leaks from underground pipelines resulting from corrosion or faulty connections.

G

Geologic Carbon Sequestration

It is the process of injecting CO₂ 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 CO₂. Research efforts to evaluate the technical aspects of CO₂ geologic sequestration are underway. ([USEPA4](#))

GHG

See “Greenhouse Gas”

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.

Climate and Sustainability Glossary of Terms

Greenhouse Gas

Greenhouse Gas (GHG) is any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, but are not limited to, water vapor, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrochlorofluorocarbons (HCFCs), ozone (O₃), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). ([UNFCC](#))

Greenhouse Gas Reduction

Actions taken to reduce the number and severity of potential future climate impacts compared to unchecked greenhouse gas emissions.

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.

Green Roof

A green roof is a layer of vegetation planted over a waterproofing system that is installed on top of a flat or slightly-sloped roof. Green roofs are also known as vegetative or eco-roofs. They fall into three main categories—extensive, intensive, and semi-intensive. Green roofs have been shown to decrease heat island contributions of buildings and decrease stormwater runoff while increasing overall vegetative land coverage.

Green wall

A green wall is similar to a green roof but applied to exterior wall surfaces.

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](#))

Groundwater

Water that occurs beneath the water table in soils and geologic formations that are fully saturated.



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](#))

Hazard

The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources.

Heat Island

A heat island is an urban or large-scale area characterized by temperatures higher than those of the surrounding due to human activities. The difference in temperature between urban and less-developed rural areas has to do with how well the surfaces in each environment absorb and hold heat. See also "Micro Heat Island"

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.

Impact

An effect of climate change on the structure or function of a system: for example, environmental consequences of climate change, such as extreme heat waves, rising sea levels, or changes in precipitation resulting in flooding and droughts.

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 (CH₄)

A hydrocarbon that is a greenhouse gas with a global warming potential most recently estimated at 25 times that of carbon dioxide (CO₂). 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 (MT), 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.

Micro Heat Island

Micro heat islands are smaller scale hot spots within developed areas which experience higher temperatures than surrounding areas due to how well the surfaces in the location absorb, reflect, and hold heat. These occur in areas such as poorly vegetated parking lots, non-reflective roofs and asphalt roads. Micro urban heat islands are strongly affected by micro climate factors and localized conditions of the built environment. See also “Heat Island”

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 Power Aggregation

See "Community Choice Aggregation"

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 Energy Metering, (NEM)

Net Energy Metering (NEM), also known as Net Metering, allows residential and commercial customers who generate their own electricity from solar power to sell the electricity they aren't using back into the grid. The NEM rate schedule (energy tariff) determines how much you are paid for the electricity you sold to the grid. Many states have passed net metering laws. In other states, utilities may offer net metering programs voluntarily or as a result of regulatory decisions. Differences between state legislation, regulatory decisions and implementation policies mean that the mechanism for compensating solar customers varies widely across the country.

Net Zero Emissions (NZE)

Refers to a community, business, institution, or building for which, on an annual basis, all greenhouse gas emissions resulting from operations are offset by carbon-free energy production. An NZE building or property is one which generates or offsets all energy consumed. If a 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,

Climate and Sustainability Glossary of Terms

bacteria, and blue-green algae; it is part of the nitrogen cycle. ([UNFCCC](#))

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 (N₂O)

A powerful greenhouse gas with a global warming potential of 298 times that of carbon dioxide (CO₂). 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 (O₃)**

Ozone, the triatomic form of oxygen (O₃), 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 (O₂). 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).

Phantom Load

Phantom load refers to the energy used by any appliance or electronic device (such as televisions, DVD players, microwaves and personal computers) that still uses electricity or "standby power" when turned off. An appliances that draws "phantom loads" means it is constantly drawing electricity.

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](#))

Plug Load

Plug loads refer to energy used by equipment that is plugged into an outlet. In an office, key plug loads include computer and monitors, printers, and copiers. Plug loads as a share of overall building energy use is higher in energy efficient buildings.

POC

"People of Color" or "Person of Color" is a general umbrella term that collectively refers to all non-white demographic groups.

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. ([UNFCCC](#))

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. ([UNFCCC](#))

Resilience

The ability to anticipate, prepare for, respond to, and recover quickly from climate change hazards with minimum damage to social well-being, the economy, and the environment.

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

Climate and Sustainability Glossary of Terms

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](#))

Strategy / Strategic Goal

Specific statements of direction that expand on the sustainability vision and GHG reduction goals and guide decisions about future public policy, community investment, and actions.

Sulfur Dioxide (SO₂)

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). ([UNFCCC](#))

Sulfur Hexafluoride (SF₆)

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 (CO₂). SF₆ 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 (CO₂) 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 CO₂ 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.

Climate and Sustainability Glossary of Terms

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/>

Vulnerability

The degree to which a system is susceptible to or unable to cope with, adverse effects of climate change. Vulnerability consists of the following:

- Exposure: The presence of people, ecosystems, or assets in places and settings that could be adversely affected by climate change impacts
- Sensitivity: The degree to which people,



ecosystems, or assets are affected by climate change

- Adaptive capacity: The ability of assets, systems or people to adjust to an adverse impact

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.

C Funding Memo

 [Click here to return to TOC](#)

This memo is intended to provide a starting point for the Town of Peterborough in identifying funding solutions for implementation of the Renewable Energy Plan initiatives. The optimal funding approach appropriate will fit well within the Town's existing revenue structure, resources, political opportunities, and limitations.

The following is an overview of a range of funding strategies including bonding, tax, municipal fee structures, federal grants, and strategies supporting the private sector.

Type of Funding	Explanation	Example Projects	Links
Green Bonds	Specifically targeted for funding environmentally and socially responsible projects in areas such as renewable energy, energy efficiency, clean transportation or responsible waste management.	<p>Where: District of Columbia Water and Sewer Authority along with institutional investors Goldman Sachs Urban Investment Group and Calvert Foundation,</p> <p>When: 2014</p> <p>What: Issued a tax-exempt Environmental Impact Bond that utilizes a performance-based contract between a public entity and the private sector where payment is based on performance of Green Infrastructure projects funded. The success of this program led to an expansion of their green bonds program in 2015 and 2016.</p>	<p>https://www.worldbank.org/en/news/feature/2021/12/08/what-you-need-to-know-about-ifc-s-green-bonds</p> <p>https://www.dwater.com/whats-going-on/news/dc-water-announces-successful-sale-350-million-green-century-bonds</p>
Climate Bonds	Use-of-proceeds bonds where the issuer promise to the investors that all the raised funds will only go to specified climate-related adaptation or mitigation programs and assets. ⁷	<p>Where: City of Hampton, VA along with Quantified Ventures in partnership with the Chesapeake Bay Foundation</p> <p>When: 2020</p> <p>What: Provided the City with a \$12 million bond to mitigate chronic flooding in the city. The bond is attached to three projects that will add storage capacity to alleviate the volume of stormwater in low- to moderate income communities.</p>	<p>https://www.climatebonds.net/files/files/Green%20City%20Playbook.pdf</p> <p>https://hampton.gov/CivicAlerts.aspx?AID=4714&ARC=9297</p>
Resiliency Bonds	Rebate structure that funds risk reduction by linking insurance premiums to resilience projects. These bonds create incentives for cities to invest in resilience, reducing human and financial costs of catastrophes as a result.	<p>Where: Various cities including the City of Norfolk, VA</p> <p>When: 2015</p> <p>What: The RE.invest initiative has partnered with a number of cities on a range of infrastructure projects to provide flood protection, using catastrophe modeling to estimate risk</p>	<p>https://gca.org/what-are-resilience-bonds-and-how-can-they-protect-us-against-climate-crises/</p> <p>https://www.refocuspartners.com/wp-content/uploads/pdf/RE.invest_Norfolk-City-Report.pdf</p>

Type of Funding	Explanation	Example Projects	Links
General Taxing and Fee Powers	Levy additional costs on undesired activities or consumption then reinvest funds in policy objectives	Where: City of Portland, OR	https://www.portland.gov/revenue/ces
		When: 2019	https://www.portland.gov/revenue/ces
		What: Created specific retail tax on larger retailers	https://www.portland.gov/revenue/ces
Excise Tax on Fuel	In lieu of a carbon tax, if not politically feasible, a fuel tax can also help raise funds for climate actions with the right support. This tax can be levied on energy providers which will likely pass onto consumers, providing additional incentive to reduce energy use and enhance energy savings potential of projects.	Where: Montgomery County, MD	
		When: 2022	https://www.montgomerycountymd.gov/finance/taxes/excise.html
		What: Raised a fuel tax on any person or entity transmitting or distributing energy into the County, including delivered fuels and electricity. While the County currently uses this funding for the General Fund (accounts for over 4% of revenue annually), a pending bill would use a small but significant portion of it towards climate actions.	
Carbon Tax	Add a cost through the Town's own utility to gas delivery and consumption, and allocate those costs to a fund for climate action. Such a tax could also be applicable across other Municipality energy consumption (buildings and transportation) for similar purposes, or extended to a subset of private consumers such as industry or other high uses.	Where: British Columbia, CA	https://www2.gov.bc.ca/assets/gov/taxes/sales-taxes/publications/mft-ct-005-tax-rates-fuels.pdf
		When: 2008	https://www2.gov.bc.ca/assets/gov/taxes/sales-taxes/publications/mft-ct-005-tax-rates-fuels.pdf
		What: Carbon tax applies to the purchase and use of fossil fuels and covers approximately 70% of provincial greenhouse gas emissions.	https://www2.gov.bc.ca/assets/gov/taxes/sales-taxes/publications/mft-ct-005-tax-rates-fuels.pdf

Type of Funding	Explanation	Example Projects	Links
Energy Improvement District	The EID is operated under a Board with bonding authority, providing a revenue option for specified public purpose projects. Such a district and bonding authority could be created for specific climate action activities, particularly those projects that align with bonded capital, i.e., infrastructure or revenue-generating projects. EIDs may be used to enter into contracts, to buy or lease energy facilities, to increase energy efficiency, and to make it easier and cheaper for energy efficiency and renewable energy businesses to operate in the community	Where: Bridgeport: CT	https://www.bridgeportct.gov/content/341307/347097/347109.aspx
		Where: 2020	https://www.bridgeportct.gov/content/341307/347097/347109.aspx
		What: Established an Energy Improvement District (EID) to promote the planning, development, and funding of energy-related development.	https://www.bridgeportct.gov/content/341307/347097/347109.aspx
Existing Tax Incremental Funds	Establish a policy to apply all future funds generated from Tax Incremental Funds to initiatives aligned with the sustainability or climate plan. For municipalities with existing Tax Incremental Funds set to sunset the funds generated by as they terminate may be used for initiatives aligning with the municipality's plan decreasing the need to increase rates elsewhere.	Where: Miami Beach, FL	https://www.miamibeachfl.gov/wp-content/uploads/2019/12/SFY-2020-24-Adopted-Capital-Budget-Book-Online-Version.pdf
		Where: 2022	https://www.miamibeachfl.gov/wp-content/uploads/2019/12/SFY-2020-24-Adopted-Capital-Budget-Book-Online-Version.pdf
		What: Establish policy to use \$100 million generated by a Tax Incremental Financing (TIF) district that is set to sunset in 2022 for underground stormwater projects.	https://www.miamibeachfl.gov/wp-content/uploads/2019/12/SFY-2020-24-Adopted-Capital-Budget-Book-Online-Version.pdf

Type of Funding	Explanation	Example Projects	Links
"Resilience Penny" Tax	Adopt a property tax increase of \$.01 per \$100 assessed value dedicated for sustainability and resilience efforts – a “resilience penny” increase. The revenue can be used to directly fund initiatives, or as a repayment source for bond issues. This strategy may be particularly well suited for communities which have not increased property tax rates in many years as it reflects the increased costs and demands placed on municipalities due to emerging resilience needs.	Where: Norfolk, VA	shorturl.at/hoBRU
		When: 2015	shorturl.at/hoBRU
		What: City adopted a \$.01 increase in property tax that generates about \$1.8 million a year applied to City sustainability and resilience initiatives.	shorturl.at/hoBRU

Municipal Fee Structures

The Town's revenue profile, like all municipalities, is diverse. Meanwhile, a number of the Town's planned projects—such as road and side walk improvement projects, building mechanical system replacements, vehicle purchases—inherently include aspects related to the initiatives and goals of the Climate Action Plan.

To the extent possible, starting with the largest expenditures, all investments should be evaluated and re-oriented to ensure they serve the Town's climate action policy goals. Future budgeting policy should incorporate a mechanism or review within the budgeting process to support the alignment of new capital budgets with the Town's climate action initiatives.

Additionally, many municipal fee structures may be redesigned to support enhanced revenue potential for the Town while also encouraging community choices which align with the plan's goals. These "progressive" fee structures may serve as a revenue-neutral approach to incentivizing residential and commercial investments that will result in reduced GHG emissions or improved resilience.

Type of Funding	Explanation	Example Projects	Links
Enhanced Stormwater Fees and Program Expansion	Depending on tax powers of the Municipality, a separate tax or fee could be levied on specific uses such as stormwater fees. The level of fees could be adjusted, or a temporary fee added, to fund additional climate actions - such as providing stormwater credits for installation of green infrastructure, green roofs, etc. This may involve a more aggressive application for state stormwater permits and fee collection capability.	Where: City of Minneapolis, MN	https://www.minneapolismn.gov/resident-services/utility-services/stormwater/ https://www.minneapolismn.gov/resident-services/utility-services/stormwater/residential-stormwater-credits/
		When: 2005	https://www.minneapolismn.gov/resident-services/utility-services/stormwater/ https://www.minneapolismn.gov/resident-services/utility-services/stormwater/residential-stormwater-credits/
		What: Created stormwater utility fee and stormwater credit system.	https://www.minneapolismn.gov/resident-services/utility-services/stormwater/

Type of Funding	Explanation	Example Projects	Links
Carbon Fund Ordinance	A Carbon Fund Ordinance establishes a Carbon Fee to be charged to all development projects. A municipality may make exceptions to the fund as appropriate for the community (for example, exemptions for single family residential alterations, new Accessory Dwelling Units, temporary buildings, and/or building area that is not used as conditioned space). The municipality may also establish the fund on a "sliding scale" providing for discounts and credits for projects meeting the community's energy goals. The goal of a Carbon Fund Ordinance is to encourage the implementation of renewable energy and/or energy efficiency in development projects. The money collected from the Carbon Fund Fee can then be used for community-wide	Where: City of Watsonville, CA	https://www.cityofwatsonville.org/1765/Carbon-Fund-Ordinance
		When: 2014	https://www.cityofwatsonville.org/1765/Carbon-Fund-Ordinance
		What: Carbon Fee charged to all development projects with proceeds used to support community-wide actions.	https://www.cityofwatsonville.org/1765/Carbon-Fund-Ordinance
Utility Franchise Fee Allocation	Establish a policy to expend franchise fee revenue on projects and initiatives associated with the municipality's sustainability or climate plan. Policy may also include an incremental increase in the franchise fee in support of the increased renewable energy and energy efficiency initiatives of the municipality. Alternatively, some municipalities are able to use the franchise fee negotiation to directly leverage increased renewable energy service from the electric utility provider (see City of Ann Arbor example: shorturl.at/myHK1)	Where: City of Minneapolis, MN	https://energynews.us/2017/09/12/utility-fee-increase-in-minneapolis-could-help-fund-efficiency-outreach/
		When: 2017	https://energynews.us/2017/09/12/utility-fee-increase-in-minneapolis-could-help-fund-efficiency-outreach/
		What: Increased its existing franchise fee on utility customers, directing the fee revenue toward initiatives to reduce energy bills and GHG emissions.	https://energynews.us/2017/09/12/utility-fee-increase-in-minneapolis-could-help-fund-efficiency-outreach/

Grants

There are a number of state and federal funding opportunities that support sustainability, resilience, and climate initiatives for local governments. Many of the grant opportunities seek to directly fund relative strategies like improved energy efficiency, renewable energy, low/no emission vehicle adoption and infrastructure, and climate resilience. In addition, a number of long-standing grants—like those from the US Department of Transportation, or the US EPA Brownfields Grant—do not fund sustainability and climate initiatives directly but can indirectly support these projects as the grant's goals are well aligned.

Grant funding can often be used to support the establishment of a municipal program, resource, or even staffing position. Unlike municipal tax or fee structure strategies, however, grants do not provide a long-term or permanent funding solution.



Federal Grants

Federal Government Justice40 Initiative

In January 2021, President Biden signed Executive Order 14008 – Tackling the Climate Crisis at Home and Abroad. The executive order established Justice40 as a whole-of-government approach to grant funding. Through this initiative, grants from the federal government are guided to ensure 40% of benefits flow to disadvantaged communities. For communities with one or more area designated as qualifying for Justice40 consideration are likely to have improved competitiveness for grant awards.

Consequently, grants may best be viewed as a project-specific funding source, or in conjunction with other funding strategies when supporting long-term initiatives.

This review is intended to illustrate a few high profile and important recent funding laws that have or will be resulting in significant grant opportunities of which municipalities with sustainability and climate plans can take advantage. The grant examples illustrated here are far from exhaustive. We recommend the municipality subscribe to new grant opportunities through Grants.gov and review availability on a regular basis:

<https://www.grants.gov/help/html/help/Connect/SubscribeToAllNewOpportunities.htm>

Explore the Climate and Economic Justice Screening Tool to determine if the Town of Peterborough may have Justice40 qualifying areas. The tool, created by the White House Council on Environmental Quality, uses publicly-available, nationally-consistent datasets to identify disadvantaged communities. To explore the tool's data go here:

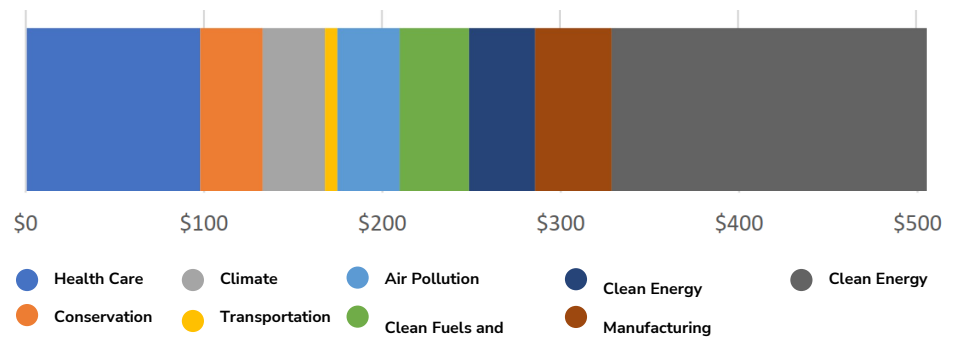
<https://screeningtool.geoplatform.gov>



Federal Grants

The Inflation Reduction Act (IRA) was signed into law by President Joe Biden on August 16, 2022. The law, as passed, authorizes \$391 billion in spending on energy and climate change. The funding priorities include investment in climate change mitigation and adaptation, incentives for renewable energy installations and manufacturing, electric vehicle infrastructure, and home energy efficiency.

The law represents the largest investment into addressing climate change in United States history. According to several independent analyses, the law is projected to reduce 2030 U.S. greenhouse gas emissions to 40% below 2005 levels. The chart below shows the breakdown of the IRA spending budget (in \$ billions):



IRA Funding For Municipalities

IRA funds that will support municipal sustainability and climate action includes:

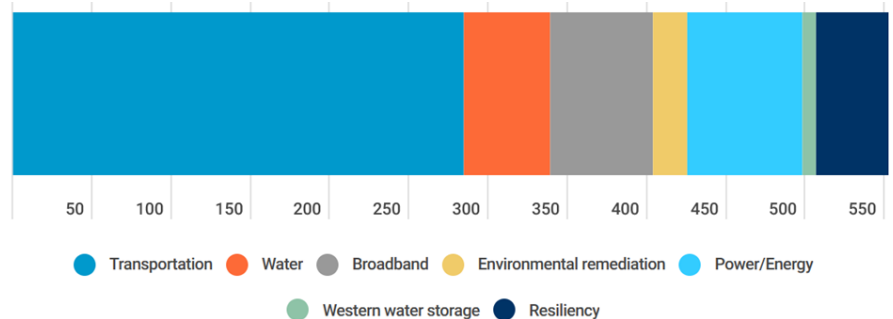
- **\$27 billion** to fund the Greenhouse Gas Reduction Fund, a national green bank to fund GHG reduction projects and to help municipalities start their own green banks.
- **\$250 million** in grants and technical assistance to support municipalities in implementing their sustainable procurement initiatives.
- **\$5 billion** for greenhouse gas air pollution reduction planning and implementation grants.
- **\$4.75 billion** in competitive implementation grants awarded to states, air pollution control agencies, municipalities, or tribes to reduce overall air pollution .
- **\$3 billion** in environmental and climate justice block grants for community-led air pollution remediation initiatives such as health risks from urban heat islands, extreme heat, wood heating system emissions, wildfire, and other climate resiliency and adaptation initiatives.
- **\$330 million** in grants to assist states and municipalities to support the adoption of latest building energy codes.
- **\$1.8 billion** in grants for construction projects to improve walkability, safety, and affordable transportation access.
- **\$1 billion** in rural energy grants supporting infrastructure and providing technical assistance.
- **\$500 million** in biofuel infrastructure and agriculture product market expansion grants.



Federal Grants

The Infrastructure Investment and Jobs Act (IIJA), aka Bipartisan Infrastructure Law (BIL), was signed into law by President Biden on November 15, 2021. The law authorizes \$1.2 trillion for transportation and infrastructure spending with \$550 billion of that figure going toward “new” investments and programs. Funding from the IIJA is expansive in its reach, addressing energy and power infrastructure,

all modes of transportation, water, environmental remediation, public lands, broadband and resilience. Some of the new programs funded by the bill could provide the resources needed to address a variety of infrastructure needs at the local level. The chart below shows the breakdown of the \$550 billion budgeted in the IIJA for new investments (in \$billions):



Current Federal Grant Programs Supporting Municipal Action (partial list)

US Department of Energy

Energy Efficiency & Conservation Block Grant Program

Cities, towns and villages with a population of at least 35,000 are eligible to apply to and receive grants directly from the U.S. Department of Energy (DOE). Funding is also available from this grant through state managed programs. Municipal efforts this grant can support include:

- Developing and implementing an energy efficiency and conservation strategy
- Conducting residential and commercial building energy audits
- Establishing financial incentive programs for energy efficiency improvements
- Developing and implementing energy efficiency and conservation programs for buildings and facilities
- Developing and implementing programs to conserve energy used in transportation (e.g. flex time for employees; satellite work centers; zoning guidelines or requirements that promote energy efficient development; infrastructure, such as bike lanes, pathways and pedestrian walkways; and synchronized of traffic signals)
- Developing and implementing building codes and inspection services to promote

building energy efficiency

- Developing, implementing and installing on or in any government building onsite renewable energy technology that generates electricity from renewable resources, such as solar and wind energy, fuel cells and biomass

US Department of Transportation Raise Discretionary Grants

The Rebuilding American Infrastructure with Sustainability and Equity, or RAISE Discretionary Grant program, is one of several ways communities can secure funding for projects under the Bipartisan Infrastructure Law’s competitive grant programs. The grant is available for planning and capital investments that support roads, bridges, transit, rail, ports, or intermodal transportation.



Federal Grants

Strengthening Mobility and Revolutionizing Transportation (SMART) grant program

The SMART Grants Program funds purpose-driven innovation to build data and technology capacity and expertise for state, local, and tribal governments.

The focus of the grant is to support demonstration projects focused on advanced smart community technologies and systems in order to improve transportation efficiency and safety. Eligible projects fall into a broad range of categories including Safety and reliability; equity and access; climate and resiliency; and technology integration. The grant has \$100 million appropriated annually for fiscal years (FY) 2022-2026.

example grant uses:

<https://www.transportation.gov/grants/smart/smart-illustrative-use-cases>

Surface Transportation Block Grant

The Surface Transportation Block Grant program (STBG) provides flexible funding that may be used by States and localities for projects to preserve and improve the conditions and performance on any federal-aid highway, bridge and tunnel projects on any public road, pedestrian and bicycle infrastructure, and transit capital projects, including intercity bus terminals.

Charging and Refueling Infrastructure Grant Program

The IIJA provides \$2.5 billion for competitive grants. The U.S. Department of Transportation will administer the competitive grants for installation of electric vehicle charging infrastructure, hydrogen fueling infrastructure, propane fueling infrastructure, or natural gas fueling infrastructure that is directly related to the charging or fueling of a vehicle. The competitive grants are divided into two categories, Community Charging and Corridor Charging. Eligible entities include state or political subdivision of a state, metropolitan planning organization, local

government, special purpose district or public authority with a transportation function, Indian tribe, and territory. Grants available under this program include:

Community Grants providing \$1.25 billion to install electric vehicle charging and alternative fuel in locations on public roads, schools, parks, and in publicly accessible parking facilities. These grants will prioritize rural areas, low-and moderate-income neighborhoods, and communities with low ratios of private parking, or high ratios of multiunit dwellings.

Corridor Charging

Corridor Grants providing \$1.25 billion to deploy publicly available electric vehicle charging and hydrogen/propane/natural gas fueling infrastructure along designated alternative fuel corridors.

Alternative Fuel Corridors

To be eligible for funding, EV infrastructure under the NEVI Program and the competitive Corridor Charging Grant Program must be located on a designated Alternative Fuel Corridor.

Strategies Supporting The Private Sector

Strategies focusing on support of sustainability and climate action within the private sector increase the depth of action within a community by leveraging public and private investments.

Type of Funding	Explanation	Example Projects	Links
Facilitating Private Investment in Community Projects	Property Assessed Clean Energy (PACE) programs allow a municipality to lend its tax collection enforcement power to a public funder, giving them additional assurance when lending for a specified purpose or investment. PACE has been used for energy upgrades in buildings, transportation upgrades, and resiliency investments. PACE for Commercial entities is a more straightforward program. Residential programs come with additional challenges due to lien priority and secondary mortgage market.	Where: Columbus, OH	https://www.columbus.gov/sustainable/cap
		When: 2020	https://www.columbus.gov/sustainable/cap
		What: The latest draft of the City of Columbus Climate Action Plan proclaims the City will receive \$250 million in average annual PACE investments to support its plan's goals, and to establish a green bank by 2025. ²¹	https://www.columbus.gov/sustainable/cap
Revolving Loan Fund	Supports energy project needs with projected cost savings, such as energy efficiency projects or where other fuel costs can be reduced. The fund will be replenished and used for additional projects over time, ideally, under an energy performance contract (working with a third party to manage energy use for savings). Funding will consider future reduced operations and maintenance, energy savings, insurance savings, and even certain non-energy benefits in the cost-savings analysis to determine project eligibility. However, tangible financial savings are required to replenish the fund.	Where: Montpelier, VT	
		When: 2018	https://www.vtenergydashboard.org/stories/montpelier-launches-revolving-loan-fund-for-energy-saving-projects
		What: Provided \$20,000 from its Reserve Fund as initial seed money for their Net Zero Revolving Loan Fund, with a \$10,000 match from their partners with Efficiency Vermont. The City tracks savings from sustainability projects and reinvests part of those savings for subsequent projects and pays marginal costs of energy improvements within larger capital projects.	

Strategies Supporting The Private Sector

Type of Funding	Explanation	Example Projects	Links
Green Bank	Green banks help fund improvements in buildings and transportation, as well as other resiliency measures such as flood prevention, essentially anything that could be categorized as a public benefit in the legislation. Green banks can come in various forms from a department within the state or municipality, or a separate nonprofit. ²⁴	<p>Where: Ann Arbor, MI</p> <p>When: 2021</p> <p>What: The City's Climate Action Plan intends to create a \$1 million loan loss reserve fund to provide credit enhancements for residents with lower credit scores and expand capacities to undertake energy efficiency and renewable energy improvements to low-income residents.</p>	<p>https://www.a2gov.org/departments/sustainability/Documents/A2Zero%20Climate%20Action%20Plan%20_3.0.pdf</p> <p>https://coalitionforgreencapital.com/</p>



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