APPENDIX A

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
CO2	Carbon dioxide
CO2e	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
MTCO2e	Metric tons of carbon dioxide equivalent
N_2O	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
PM2.5	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 effectsof 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

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

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

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

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

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

Carbon Equivalent (CE)
A metric measure used to compare the emissions of the different greenhouse gases based upon their global warming potential. Carbon equivalents can be

calculated from to carbon dioxide equivalents by multiplying the carbon dioxide equivalents by 12/44 (the ratio of the molecular weight of carbon to that of carbon dioxide). The use of carbon equivalent is declining in GHG inventories.

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

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

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

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

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

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

Climate Adaptation or Resilience
The capacity of a natural environment to prevent, withstand, respond to, and recover from a disruption. The process of adjusting to new climate conditions 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. (UNFCC)

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

District Heating
District heating is a system for distributing heat generated in a centralized location through a system of pipes for residential and/and 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). (UNFCC)

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

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

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

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

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.

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 (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrochlorofluorocarbons (HCFCs), ozone (O_3), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). (UNFCC)

Greenhouse Gas Reduction
Actions taken to reduce the number and severity of potential future climate impacts compared to un-checked 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 (CH_4)
A hydrocarbon that is a greenhouse gas with a global warming potential most recently estimated at 25 times that of carbon dioxide (CO_2). Methane is produced through anaerobic (without oxygen) decomposition of waste in landfills, flooded rice fields, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion. The GWP is from the IPCC's Fourth Assessment Report (AR4).

Metric Ton
The tonne (t) or metric ton (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, bacteria, and blue-green algae; it is part of the nitrogen cycle. (UNFCC)

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

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

O

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

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

P

Perfluorocarbons (PFCs)
A group of human-made chemicals composed of

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

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. (UNFCC)

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

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

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

Renewable Energy Credits (RECs)

A market-based instrument that represents the property rights to the environmental, social and other non-power attributes of renewable electricity generation. RECs are issued when one megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid from a renewable energy resource. The single largest category of reductions in Evanston's emissions has been through the purchase of RECs.

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

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

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

Sulfur Hexafluoride (SF_6)
A colorless gas soluble in alcohol and ether, slightly soluble in water. A very powerful greenhouse gas with a global warming potential most recently estimated at 22,800 times that of carbon dioxide (CO_2). SF_6 is used primarily in electrical transmission and distribution systems and as a dielectric in electronics. This GWP is from the IPCC's Fourth Assessment Report (AR4).

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

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

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

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

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

U
Urban Tree Canopy
Describes the makeup and characteristics of trees within the urban environment.

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

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

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.

APPENDIX C

Funding Memo

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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.	**Where**: District of Columbia Water and Sewer Authority along with institutional investors Goldman Sachs Urban Investment Group and Calvert Foundation,	https://www.worldbank.org/en/news/feature/2021/12/08/what-you-need-to-know-about-ifc-s-green-bonds
		When: 2014	
		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.	https://www.dcwater.com/whats-going-on/news/dc-water-announces-successful-sale-350-million-green-century-bonds
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]	**Where**: City of Hampton, VA along with Quantified Ventures in partnership with the Chesapeake Bay Foundation	https://www.climatebonds.net/files/files/Green%20City%20Playbook.pdf
		When: 2020	
		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.	https://hampton.gov/CivicAlerts.aspx?AID=4714&ARC=9297
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.	**Where**: Various cities including the City of Norfolk, VA	https://gca.org/what-are-resilience-bonds-and-how-can-they-protect-us-against-climate-crises/
		When: 2015	
		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	https://www.refocuspartners.com/wp-content/uploads/pdf/RE.invest_Norfolk-City-Report.pdf

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 subsect 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 Increment Funds	Establish a policy to apply all future funds generated from Tax Increment Funds to initiatives aligned with the sustainability or climate plan. For municipalities with existing Tax Increment 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 Increment 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 $0.01 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 Watsonvill, 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 communit-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.

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

Federal Grants

Federal Government Justice40 Initiative

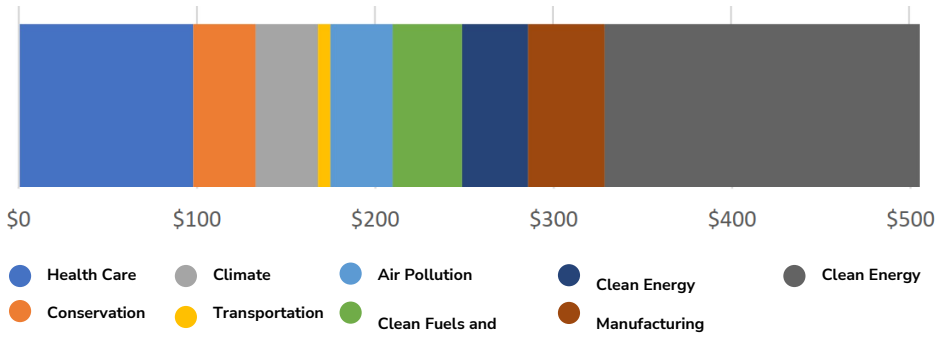
In January 2021, President Biden signed Executive Order 14008 – Tackling the Climate Crisis at Home and Abroad. The executive order established Justice40 as a whole-of-government approach to grant funding. Through this initiative, grants from the federal government are guided to ensure 40% of benefits 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.

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):



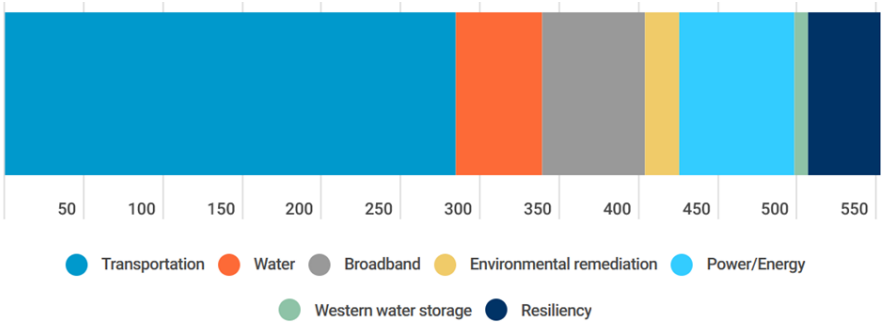
IRA Funding For Municipalities

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]	**Where**: Ann Arbor, MI	https://www.a2gov.org/departments/sustainability/Documents/A2Zero%20Climate%20Action%20Plan%20_3.0.pdf
		When: 2021	
		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.	https://coalitionforgreencapital.com/

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