CHARLOTTESVILLE
Acting on Climate Together

March 2023

CLIMATE ACTION PLAN
A Plan for Reducing Greenhouse Gas Emissions

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PREFACE

HOW TO READ THIS PLAN

This Plan is a strategic framework for how Charlottesville can reach its goal of carbon neutrality by the year 2050. It was prepared by the Climate Protection Program, within the Department of Public Works' Environmental Sustainability Division, in conjunction with other City departments and with input from the public.

ABBREVIATIONS & DEFINITIONS

Key terminology and technical references are noted as **bolded words** throughout this document. Their abbreviations and definitions are included as part of the Appendix.

CHAPTERS 1 - 4

Chapters 1 thru 4 provide background information, context, and overarching guidance. The opening chapter briefly summarizes climate change and greenhouse gases, looks at Charlottesville's emissions profile, and lists past climate actions the City has taken. Chapter 2 tells the story of why and how this Plan was developed. Though we introduced the City's emissions profile in the first chapter, Chapter 3 goes into much greater depth, detailing where emissions come from in the City and possible scenarios for reducing them. Chapter 4, titled "Guides for Action" explains the guiding principles and community-centered values that serve to shape both this plan and the next steps of implementation. One of the most central guides is the intersectional opportunities of climate action and equity. To that end, there is a section on equity in Chapter 4 as well as subsections addressing equity considerations throughout many of the following chapters.

CHAPTERS 5 - 7

Chapters 5 thru 7 present strategies and key actions aimed at reducing the amount of greenhouse gases Charlottesville releases into the atmosphere. These chapters are the majority of this plan. Each chapter is divided into subsections that list specific strategies and key actions intended to be implemented in the next one to three years. Chapter 5 is focused on strategies and actions that the community and City will work on together or in parallel. Chapter 6 is dedicated to strategies and actions that fall under the direct jurisdiction of the City Government and are connected to emissions from its municipal operations. Chapter 7, entitled "Charlottesville Leading by Example," presents ways the City can further support emissions reductions through leadership and beyond its municipal operations.

CHAPTERS 8 - 10

Chapters 8 and 9 address strategies for removing emissions from the atmosphere (also referred to as drawdown) and actions that fall outside of Charlottesville's greenhouse gas inventory and measurable reduction goals but are nevertheless important to include in this plan. The final chapter, Chapter 10, covers the implementation of the Plan and looks to next steps.

ACKNOWLEDGEMENTS

This plan document was possible due to the support, dedication, and involvement of hundreds of Charlottesville community members, Charlottesville community organizations, multiple Charlottesville City Councils, staff of the City of Charlottesville, and other local institutional and local government partners.

This plan was drafted by the City's Environmental Sustainability and Climate Program staff including:

- Kristel Riddervold, Environmental Sustainability Division Manager
- Susan Elliott, Climate Program Manager
- Emily Irvine, Climate Program Specialist
- Megan Finney, Climate Program Summer Associate
- Kirk Vizzier, Energy Management Program Coordinator

Plan development was supported by:

- The University of Virginia Institute for Engagement and Negotiation
- Launch! Consulting
- Kim Lundgren Associates, Inc. (KLA)
- Hive Creative Group

CHAPTER 1 – INTRODUCTION

CLIMATE CHANGE + GREENHOUSE GASES

Climate change refers to long-term changes in temperature and weather patterns, such as a place becoming hotter, colder, drier, and/or wetter over time. In recent decades, climate change has accelerated, primarily due to greenhouse gas emissions from human activity. Human impact on the environment is evident in the increasingly destructive and unpredictable weather patterns that negatively affect our community. This document, a Climate Action Plan (CAP), is a framework that outlines specific strategies and key actions for Charlottesville to reduce its greenhouse gas emissions in alignment with its reduction goals.

Greenhouse gases (GHGs) are gases in the Earth's atmosphere that trap heat and warm the planet. GHGs include but are not limited to water vapor, carbon dioxide, methane, nitrous oxide, and fluorinated gases. The right proportion of GHGs keep our planet warm enough to support life. When there are too many GHGs in the atmosphere, too much heat is trapped, and the overall average temperature rises. Human activity, such as burning fossil fuels, has caused a dramatic increase in GHGs, and the trend has rapidly increased in recent years.

Cities have a vital role to play in reducing the amount of GHGs being released into the atmosphere and in the transition to a resilient and low-or-no carbon future. In Charlottesville, we are preparing for the impacts of climate change to reduce community **vulnerability** and strengthen the City's **resilience** against adverse impacts from climate change while also continuing to reduce our GHG emissions. Effectively preparing for and responding to this crisis requires our community to adopt policies that make the response to climate change integrated into the planning, operation, and development of our community.

ATMOSPHERIC CARBON DIOXIDE (1960-2021)

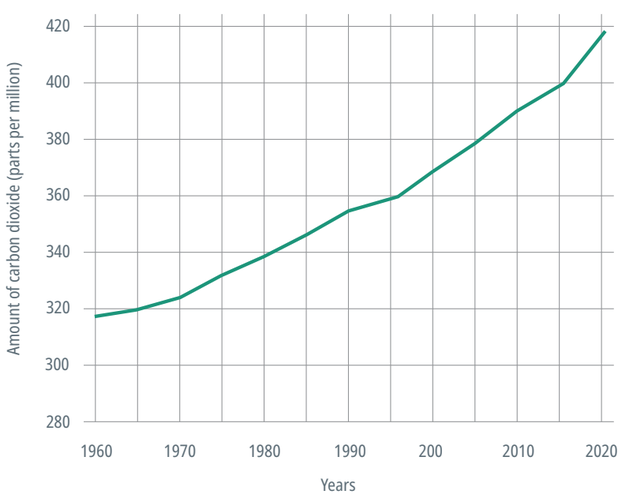


Figure 1: NOAA Climate.gov image, based on data from NOAA Global Monitoring Lab

ABOUT CHARLOTTESVILLE

The City of Charlottesville, founded in 1762, is located in Central Virginia in Albemarle County, approximately 100 miles southwest of Washington, D.C. and 70 miles northwest of Richmond, Virginia. The City of Charlottesville acknowledges the Monacan People as the Indigenous custodians of the land where the City sits. According to US Census Bureau data, Charlottesville is 10.24 square miles and has a population of approximately 48,000 people living in 18,500 households. Situated within the upper Piedmont Plateau at the foothills of the Blue Ridge Mountains and at the headwaters of the Rivanna River, the City is autonomous and entirely independent of any county or any other political subdivision.

In Charlottesville, almost 60% of GHG emissions come from energy used to power, heat, and cool our government buildings, schools, homes, businesses, streetlights, and traffic signals. Approximately 30% of GHG emissions also come from the fuels used to power our vehicles, the City vehicle fleet, transit buses, school buses, and landscaping/mobile equipment. The remaining emissions come from waste, such as organic matter like food, leaves, and brush that are sent to the landfill.

2019 CHARLOTTESVILLE GREENHOUSE GAS EMISSION INVENTORY

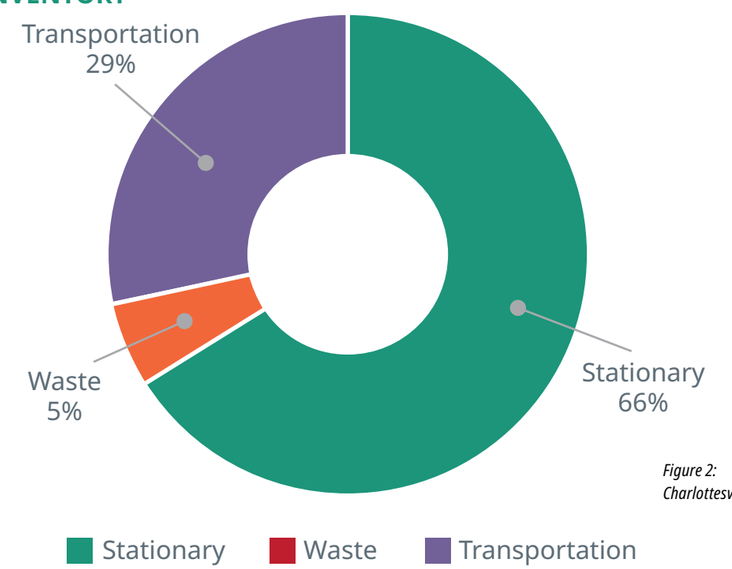


Figure 2: Charlottesville Emissions by Sector

1998 2009 2013 2017 2020 2022

CHARLOTTESVILLE'S HISTORY OF CLIMATE POLICY COMMITMENTS AND ACTIONS

Charlottesville has a steady history of commitments and actions related to protecting our climate. While we cannot capture all actions within the City that relate to and support climate, below is sampling of key events that illustrates an evolving focus and integration of climate-related policy and activities. Items in **bold font followed by an *** indicate a policy commitment. All other items are activities pursued as part of ongoing programs.

Climate-related Policy Commitments and Actions

1998: **TJPDC Regional Sustainability Accords***

2002: City Environmental Division established

2003: **Environmental Sustainability Policy issued***

1st hybrid vehicle in the City municipal fleet

2006: **US Mayors Climate Protection Agreement***

1st Energy Savings Performance Contract completed

2007: **Comprehensive Plan with Energy/Climate Goals; update in 2013, 2018 and 2021***

2008: 1st GHG Inventory effort (2000 baseline & 2006 data Reduced tax rate for Energy Efficiency Building

Home Energy Conservation Program started

Green Building Policy adopted*

1st City LEED certified building – Downtown Transit Station (6 subsequent projects have achieved LEED certification)

Green roof installed on City Hall

Citizens Committee on Environmental Sustainability established (transitioned in 2012 to committee focused on climate action planning)

City Climate Protection Program established*

2009: Local Energy Alliance Program (LEAP) established with strong City involvement and grant support

Spark!50 campaign with the Virginia Energy Project and the LEAP Transition Team; targeted Charlottesville Gas customers and generated leads for the Home Performance with Energy Start program

Reduced permit fees for green roofs (defined as being vegetative or solar roofs)*

Energy Efficiency and Conservation Block Grant funding used to support residential energy audits and interest rate buy down program for energy efficiency and renewables projects

Charlottesville City Council Vision (including A Green City)*

Charlottesville's 1st Urban Forest Management Plan published

2010: 1st Solar municipal PV system installed on CHS; 7 additional systems subsequently installed

2011: Better Business Challenge (delivered by Better World Betty in 2011, 2013, and 2016 with City sponsorship); 2017-19 Challenge delivered by the Community Climate Collaborative (C3)

2012: Energize!250 campaign with LEAP; goal of completing 250 Home Energy Reviews in celebration of Charlottesville's 250 anniversary

2nd GHG Inventory effort (updated 2000 & 2006, added 2009 and 2011)

Local Climate Action Planning Process (LCAPP) Report (process launched in 2009)

1st Program Support Agreement (PSA) with LEAP; subsequent annual agreements executed

Energy Efficiency and Renewables Revolving Loan Program established (converted to the Clean Energy Commercial Loan Fund in 2014; funding added in 2018)

Initial GHG emission reduction goals identified*

1st EVs and EV chargers in the City's Municipal Fleet

2013: EV Charging Mini-Grant Program

2014: Participation in the 2-year Georgetown University Energy Prize as the Energize!Charlottesville campaign Hybrid-diesel transit buses introduced

1st Solarize Charlottesville campaign (delivered by LEAP, supported by City); campaigns have regularly continued through 2022

Charlottesville Gas started providing support to LEAP for Home Energy Check Ups

2015: **Complete Streets Policy adopted***

Supported Community-led Transition Streets Project which organized small groups of neighbors to support each other as they implemented at-home sustainability changes

City Council Resolution supporting Virginia's participation in the Regional Greenhouse Gas Initiative (RGGI)*

Bicycle and Pedestrian Master Plan

2016: 1st year reporting as part of the Carbon Disclosure Project (CDP) – a global reporting platform

2017: **Global Covenant of Mayors for Climate & Energy Commitment and "We Are Still In"***

SolSmart Awards (Bronze, Silver); including adopting a Zoning Ordinance amendment*

Clean Energy Initiatives included in City's annual legislative packet for the Commonwealth's General Assembly (subsequently, there has been continued and expanded content)

2018: Energy Smart Home Rebates established

Home Energy Challenge Campaign (delivered by C3; City sponsorship)

Began collecting GHG emissions inventory data annually, starting with data from 2016

Adjusted GHG inventory data to GPC protocol standards, including updating 2011 inventory

2019: Adopted new GHG emission reduction goals (2030 & 2050) aligned with scientifically based targets*

Launched Climate Action Together (City, County, UVA regional coordination initiative)

Charlottesville City Schools (CCS) passed Energy and Water Performance Resolution*

City adopted internal Energy and Water Management Policy*; established program and implementation team

Revised Standards and Design Manual included an Environment and Sustainability Chapter*

Charlottesville Gas Energy Efficiency Program (CGEEP) for income-qualified residents established

2020: Initiated Climate Action Plan effort

Streetlight audit initiated

Charlottesville Map of Solar Rooftop Potential published

CAT fare free transit service offered; to be offered through June 2026

Climate Adaptation Planning initiated with a Climate Risk and Vulnerability Assessment (CRVA)

Initiated project with Code for Charlottesville to develop a GIS-based LED Streetlight replacement analysis tool

2021: **City Council Resolution endorsing letter for HB1965 regarding No/Low Emission Vehicles***

EV DC Fast Charging Stations available in Water Street Parking Garage

Middle School Climate Activity Kits (delivered by C3; City sponsorship); repeated in 2022

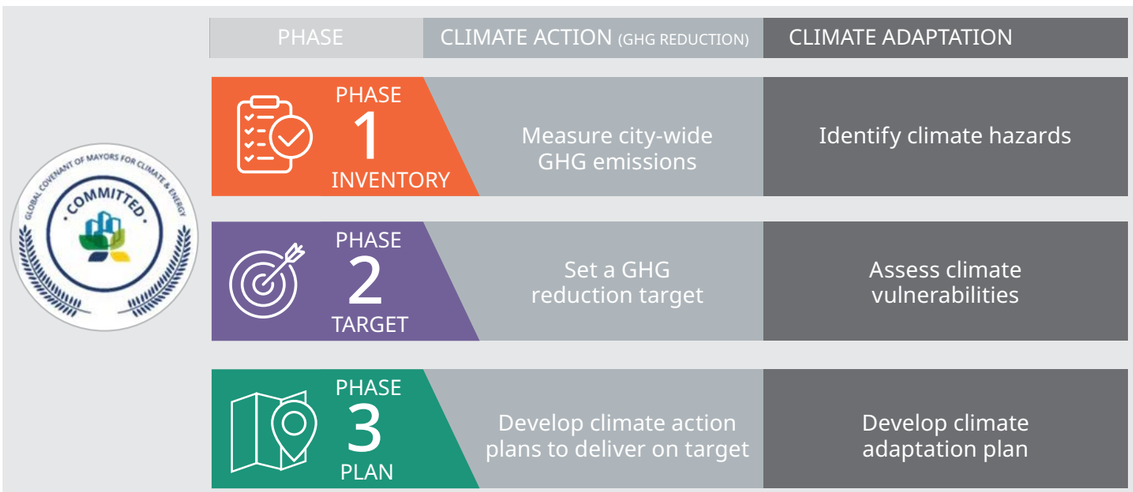
2022: Community Engagement on Climate Action Plan re-started

2nd Energy Savings Performance Contract effort initiated; Technical Energy Audits completed

CHAPTER 2 – ABOUT THIS PLAN

POLICY DIRECTIVE

The City of Charlottesville (the City) first committed to actively reducing GHGs by joining the U.S. Mayors Climate Protection Agreement in 2006. The City restated this commitment by joining the Global Compact of Mayors (now renamed as the Global Covenant of Mayors for Climate and Energy). By joining the Global Covenant of Mayors, Charlottesville committed to multiple actions, including adopting a science-based GHG emission reduction target and developing a Climate Action Plan aimed at achieving those reductions.



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Charlottesville GHG Emissions Reductions Targets

- **45% by 2030**
- **Carbon Neutral by 2050**

Charlottesville City Council | July 1, 2019

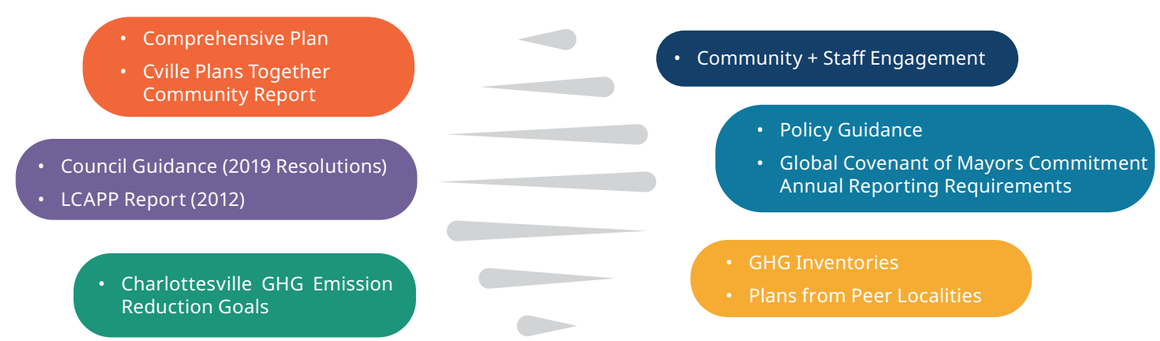
PLAN DEVELOPMENT PROCESS

Development of this plan was led by the City of Charlottesville's Climate Protection Program within the Environmental Sustainability Division of the Department of Public Works. A multi-layered approach was used to inform the plan including community input, alignment with other locality plans, review of climate action plans from peer communities across the nation, Commonwealth, and local region (including Albemarle County and the University of Virginia), and City and other local government staff knowledge, expertise, and background. Community input took the form of focus groups, large group meetings, listening sessions, and an online survey. City staff also incorporated community feedback provided as part of the City's Comprehensive Plan Update process (adopted in November 2021) and recommendations provided directly from citizens and local organizations.

Since the initiation of the Climate Action Plan development process in the fall of 2020, the City has actively engaged with community members through a variety of means:

October 19, 2020:	City Council Agenda Item: Climate Action Plan Process Briefing
November 17, 2020:	Stakeholder Session with Cville100
December 14 & 15, 2020:	Community Workshops (2 Sessions)
December 16, 2020:	Stakeholder Session with Climate and Environmental Organizations
December 17, 2020:	Stakeholder Session with Property Managers and Renewable Energy & Energy Efficiency Service Providers
January 19, 2021:	City Council Agenda Item: Update on the Climate Action Plan Development Process
February 2, 2021:	Initial meeting of the Climate Action Liaison Committee (met 10 times between February 2021 and June 2022)
February 8, 2021:	Community Conversation on Equity
April 14, 2022:	Presentation to Charlottesville NOW
April 18, 2022:	City Council Work Session: Climate Action Plan – Preliminary Content
April 20 – May 20, 2022:	Community Survey
June 17, 2022:	News Flash: New Climate Planning Materials Available
August 4 & 10, 2022:	Listening Sessions (2 sessions) aimed at providing an intentional space for voices in our community who are not traditionally involved in climate conversations
August 17, 2022:	Community Town Hall / Workshop

WHAT INFORMS A CLIMATE ACTION PLAN?



PLAN STRUCTURE AND FOCUS

This plan's content, focus, and development process were informed by several driving factors. Following the City's Global Covenant of Mayors for Climate and Energy commitment, this plan's foundational aim is to provide a pathway to achieving Charlottesville's adopted GHG emissions reduction goals, which are focused on emissions accounted for in Charlottesville's GHG inventories. While there are actions that can be taken locally that affect upstream emissions, such as emissions from supply chains, emissions reductions in those areas are not included in Charlottesville's GHG inventory calculations and should be considered additional to actions that contribute to meeting our reduction goals. More detail about Charlottesville's GHG emissions and sources is provided later in this document.

With Charlottesville's adopted GHG emissions reduction goals targeting the years 2030 and 2050, this plan identifies near term actions that will move Charlottesville towards success in the 2030 goal as well as position it towards advancing long term needs for 2050. Additionally, there is a changing policy, regulatory, and funding landscape within which we are working as is evidenced by the 2022 Infrastructure Investment and Jobs Act **(IIJA)** and the 2022 Inflation Reduction Act **(IRA)** that were adopted during the development of this plan. As such, this plan is structured to be strategic in nature identifying core strategies for GHG emissions reductions, key actions to be completed within the next 1-3 years, and priority areas for implementation.

Per Charlottesville's commitment to the Global Covenant of Mayors, the City is also developing a Climate Adaptation Plan. Strategies in this document that address both mitigation and adaptation are indicated by this icon:

MITIGATION is reduction or elimination of actions and behaviors that contribute to climate change, for example reducing GHG emissions.

ADAPTATION is changing human systems and behaviors to better withstand the effects of the changing climate, for example increasing greenspace to better absorb increased rainfall.

To fully define the focus of this plan, it is important to distinguish between emissions reduction – or **mitigation** – measures and **adaptation** measures. This document is intended to outline strategies and actions to reduce GHG emissions. Many of the measures described in this plan will have co-benefits that contribute to adaptation and community resiliency, but do not explicitly address those concerns. Per the City's commitment to the Global Covenant of Mayors, a specific Climate Adaptation Plan is forthcoming. The underlying Climate Vulnerability and Risk Assessment report that supports the development of an Adaptation Plan will be available in early 2023. The three top climate hazards identified for Charlottesville are Extreme Heat (hotter and longer heat waves), Increased Intensity of Precipitation, and Changing Seasonal Patterns.

This structure also acknowledges that success will be based on actions by both the Charlottesville community and the City of Charlottesville government. In some cases, actions will clearly fall under the purview of the local government to lead. In other cases, actions could be led or accomplished by community members and organizations, in parallel by the community and government, or through actions completed in partnership. The structure of this plan enables us to all move in the same direction and focus our efforts on achieving the key action milestones, **outcome indicators**, and guidelines for implementation that reflect priorities and values of Charlottesville.

Along with confirming this plan's focus on meeting Charlottesville's adopted GHG reduction goals, City Council provided additional direction for the plan in form of two resolutions. These resolutions direct the plan to:

- Front Load Reductions – pursue steeper reductions in the near term
- Identify Sub-Goals by Sector and by Strategy in the Climate Action Plan
- Address Equity Specifically in Goals and the Climate Action Plan
- Identify Measurement Frequency & Accountability Mechanisms
- Address Funding and Financing Options to Enable and Support Private Sector Action
- Include strategies that address:
  - Further enabling private financial sector investment in energy performance upgrades for commercial properties in the City of Charlottesville through adoption of a Commercial Property Assessed Clean Energy (C-PACE) financing program
  - Effective funding programs and models for increased residential energy performance, including programs that are compatible with affordable housing and owner or renter-occupied housing
  - The feasibility of integrating zero emission vehicles into the municipal fleet and supporting increased community adoption of zero emission vehicles
  - Working in conjunction with regional partners to implement seamless programs and services to increase ease of participation for Charlottesville organizations and residents

PLAN REPORTING AND UPDATES

A strong desire was expressed by the community, City Council, and staff for this plan to support active progress on GHG emissions reductions and to include regular points of accountability. Additionally, City staff recognizes the importance of metrics and outcome measurements for both benchmarking and accountability. To that end:

- This plan is intended to be a living document, with the ability to be updated periodically as changing conditions and opportunities warrant.
- This plan is intended to be fully reviewed and updated as needed at least every 5 years, with an initial full review being conducted within its first 3 years to allow for any necessary updates to be incorporated in advance of the City's next Comprehensive Plan five-year update (anticipated to be in 2026).
- Action Items identified in the plan are intended to be completed within the next 1-3 years.
- This plan proposes annual updates to reflect progress made by the City and the Charlottesville community – including updating and replacing any completed Key Actions and incorporating newly identified progress metrics.
- Some **outcome indicator** metrics have been included in this plan with the opportunity to be further developed.
- Sub-Goals and priority focus areas are identified in the plan and can be incorporated into implementation initiatives for measurement.

As a continuing part of the City's Global Covenant of Mayors commitment, the City reports annually on its progress through the online **CDP** platform, which includes reporting on both completion of the plan as well as subsequent progress. This reporting includes the City's regular GHG Inventories, which track all emissions within the City's jurisdictional boundary. After this plan is adopted, additional metrics to track progress towards reduction goals will be developed as part of the implementation phase.

CHAPTER 3 – CHARLOTTESVILLE GHG EMISSIONS AND TARGETS

GHG INVENTORY SUMMARY

The compilation of data related to activities in Charlottesville that produce GHGs, and the calculation of the amount of GHGs from the activity data, is referred to as a GHG Emission Inventory. Charlottesville considers its GHG emissions in two ways: the Community-wide GHG Emissions Inventory and the Municipal GHG Emissions Inventory. There is some overlap between these two inventories, as much of the municipal emissions are included in the community-wide Inventory. The University of Virginia compiles its own emissions inventories, and its emissions are not included in Charlottesville's inventories.

The City's website hosts a single webpage where information on its GHG Emissions Inventories is provided. This webpage, charlottesville.gov/emissions, includes datasets, charts and graphs of recent GHG emission inventories, and reports from earlier efforts to periodically calculate Charlottesville's GHG emissions.

CHARLOTTESVILLE COMMUNITY GHG EMISSIONS BY YEAR

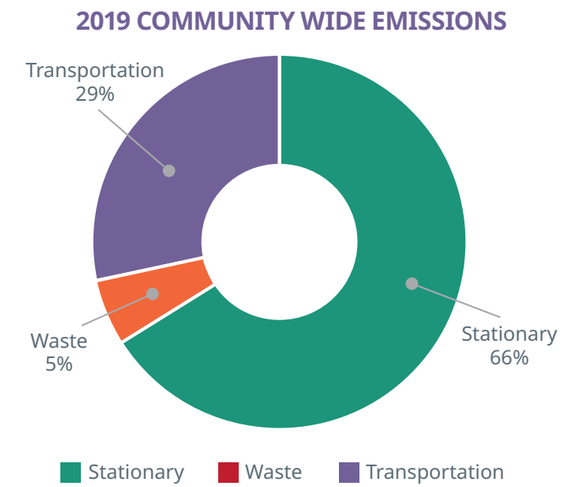
	CO_2e (MT)				
Sector	**2011**	**2016**	**2017**	**2018**	**2019**
Transportation & Mobile Sources	128,835	92,648	92,218	90,938	91,205
Solid Waste	24,694	16,302	16,687	16,721	16,425
Water & Wastewater	-	271	271	271	271
Commercial Energy*	170,003	128,838	117,652	115,046	101,688
Industrial Energy	372	195	190	208	200
Residential Energy	135,405	108,393	100,986	107,699	96,389
Process & Fugitive Emissions	-	13,555	12,857	15,078	
Total	**453,309**	**355,203**	**340,861**	**345,961**	
% change from 2011	-	-23%	-26%	-25%	-30%

* The Commercial Energy Sector includes Municipal and Non-Municipal Government energy consumption

Figure 3: Charlottesville's emissions have dropped 30% since the 2011 GHG Inventory, 2/3 of the way towards Charlottesville's 2030 45% reduction goal.

CHARLOTTESVILLE'S COMMUNITY-WIDE GHG EMISSIONS INVENTORY

In accordance with the Global Covenant of Mayors commitment, Charlottesville follows the Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories (**GPC**) to calculate its emissions. Inventories are then submitted through an online reporting platform, CDP.net, as part of Charlottesville's annual reporting commitment. The inventory is then reviewed for compliance with the GPC requirements.



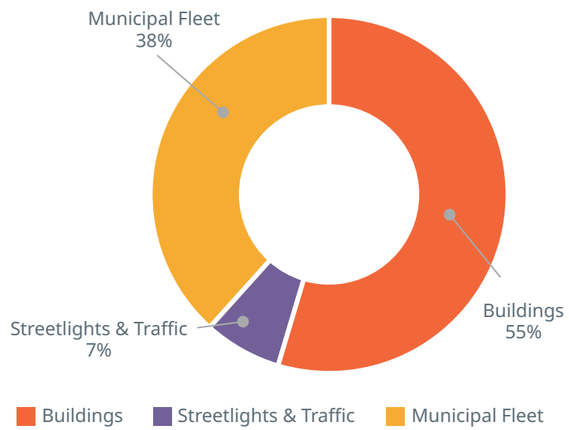
The community-wide inventory represents the emissions produced by activities conducted within the City boundaries, which are distinct from the Albemarle County and University of Virginia boundaries. The majority of Charlottesville's emissions (~95%) come from the following three areas:

- Stationary Energy Use (Buildings & Energy)
  - Sectors Included: residential, commercial, industrial, municipal government (i.e. City of Charlottesville government and schools), and non-municipal government
  - Is calculated from:
    - amount of electricity and natural gas provided by utilities
    - US Census data on the number of households using wood, propane, and fuel oil for residential heating
  - Note: electricity for charging electric vehicles would be included for all sectors except for municipal government
- Transportation & Mobile Sources (fuel use)
  - Sectors Included: all on-road transportation and passenger rail (Amtrak) within the city boundaries
  - Is calculated from:
    - Virginia Department of Transportation data of vehicle counts and projected Vehicle Miles Traveled (VMT) by vehicle classification
    - EPA National Default Vehicle Fuel Efficiency & Emission Factors
    - Data available from Amtrak
  - Note: emissions from passenger rail represent less than 0.07% of the total transportation emissions in Charlottesville. Over 99% are from on-road vehicles using gasoline or diesel.
- Solid Waste
  - Sectors Included: waste from all sectors sent to the landfill or composted
  - Is calculated from:
    - Thomas Jefferson Planning District Commission (**TJPDC**) Regional Solid Waste Report data
  - Note: only composted green waste is included here. 'Green waste' indicates materials such as food scraps, leaves, and yard cuttings.

CHARLOTTESVILLE'S MUNICIPAL GHG EMISSIONS INVENTORY

Because the City of Charlottesville has direct control over its own operations, buildings, vehicles, and equipment, and because leading by example is a value of our community and an expectation for the City government, Charlottesville tracks its municipal GHG emissions inventory in addition to its community-wide inventory.

2019 MUNICIPAL EMISSIONS

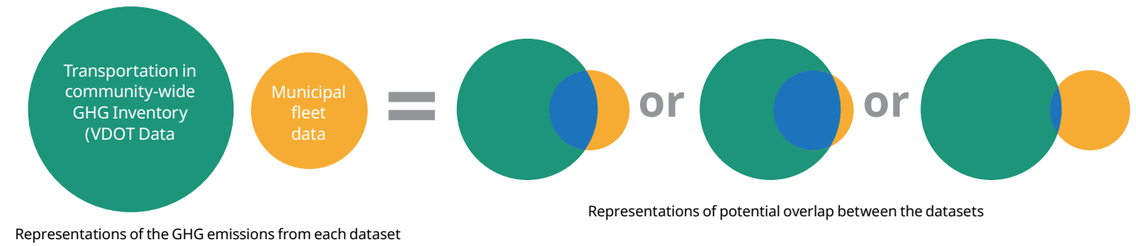


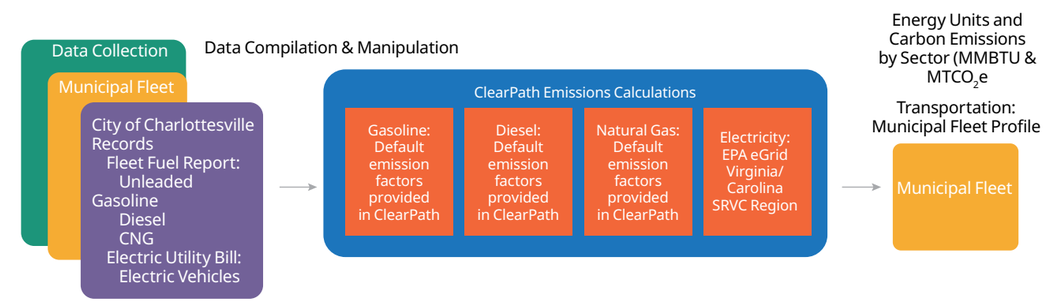
The Municipal GHG Emissions Inventory includes the following:

- Stationary Energy Use (Buildings)
  - Includes: municipal government (i.e. City of Charlottesville government buildings, facilities, and schools)
  - Is calculated from:
    - Electric and Natural Gas bills the City receives as a customer of the utility companies
  - Because the City is able to identify which of its electric bills are associated with charging electric vehicles, that energy use can be counted under the Fleet section
- Stationary Energy Use (Streetlights and Traffic Signals)
  - Sectors Included: all on-road transportation and passenger rail (Amtrak) within the city boundaries
  - Includes: streetlights and traffic signals on City roads and at municipal government and school locations
  - Is calculated from:
    - Electric bills the City receives as a customer of the electric utility
  - Note: Streetlights on private roads, parking lots, and other private facilities are not included here.
- Transportation & Mobile Sources (Municipal Fleet)
  - Includes: all City on-road vehicles and City equipment that uses fuel. Includes passenger vehicles, trucks, school and transit buses, fire trucks and apparatus, generators, and landscaping equipment
  - Is calculated from:
    - Volume of gasoline, diesel, and compressed natural gas (CNG) from the City's fueling station(s)
    - Electric bills the City receives as a customer of the electric utility

TRANSPORTATION DATA – WHY TWO PROFILES?

Fuel usage by the City's Fleet occurs both inside and outside of the City's borders. Data from the Virginia Department of Transportation (VDOT) is based on vehicle counts within the City of Charlottesville, which would include vehicles from the City's Fleet. Since we cannot determine how much of the City's fleet fuel usage occurs within the city, we cannot accurately subtract the City's fleet emissions from the Transportation emissions derived from the VDOT data. For example, if you imagine a Venn Diagram, we do not know how much overlap exists between the two datasets.

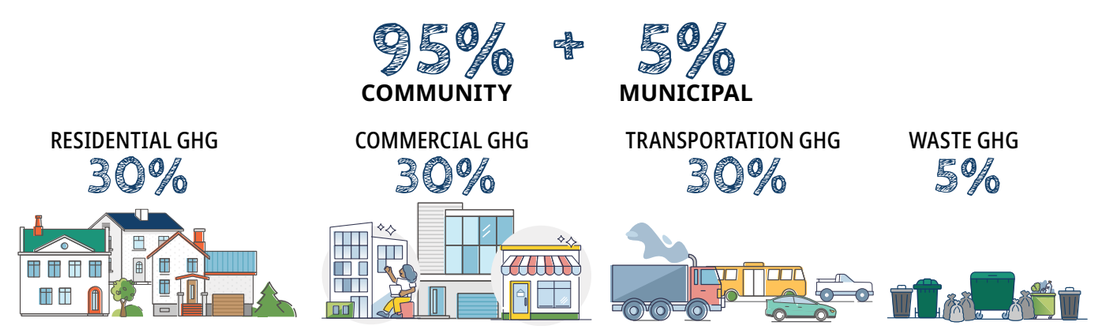




FOCUSING ACTION AND MEASURING REDUCTIONS

To achieve Charlottesville's adopted reduction goals, actions identified in this plan need to reduce emissions from the sectors and sources listed in the previous section. There are additional actions that can have meaningful impact on global greenhouse gas emissions – such as food/dietary choices and travel outside of the city boundaries – and actions that can impact emissions generated within Charlottesville that we are unable to calculate due to unavailable or incomplete data. GHG emissions from idling vehicles, commercial and industrial consumption of propane, and solid waste sent to the landfill that is not reported as part of the TJPDC's Solid Waste Report are examples of data limitations.

CHARLOTTESVILLE'S GREENHOUSE GAS EMISSIONS ARE APPROXIMATELY:



CONNECTING EMISSIONS DATA TO ACTIONS AND ACTORS

When seeking to reduce GHG emissions, there are generally three main ways to categorize types of actions:

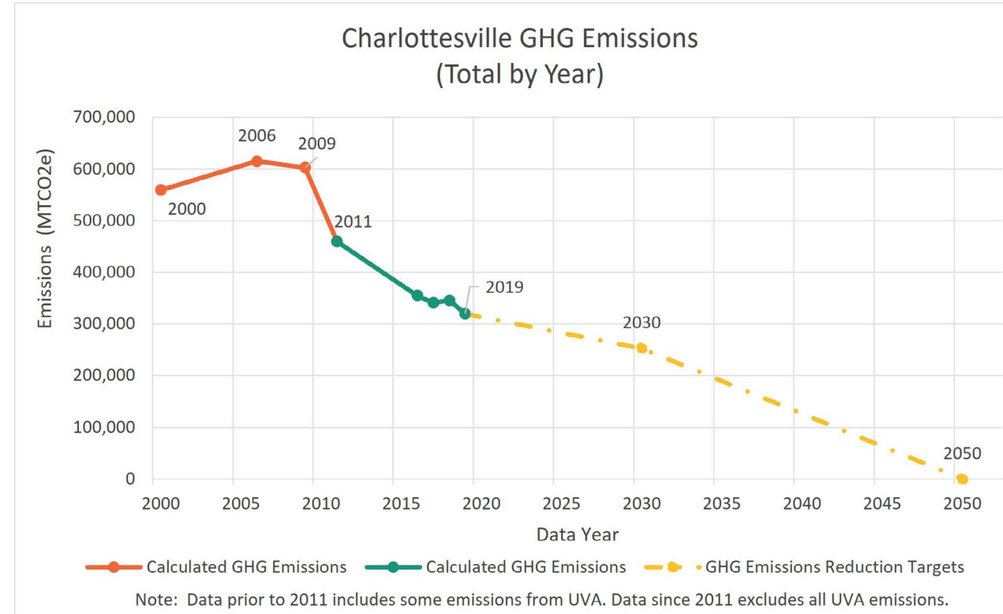
1. *Reduce the amount of energy or GHG emission-generating material*
   Action in this category can look like improving the energy efficiency of buildings and equipment or modifying habits and behaviors so that less energy is needed. These types of actions reduce the amount of GHG emissions going into the atmosphere.
2. *Switch to a lower or zero carbon fuel or processing method*
   Changing to renewable energy sources is one example. These types of actions reduce the amount of GHG emissions going into the atmosphere.
3. *Drawdown & Carbon Removal*
   Actions in this category aim to remove GHG emissions from the atmosphere. These can look like increasing healthy trees and other vegetation, or technologies such as carbon capture and storage. Many of the technologies in this category are parts of emerging industries, are costly, and are still being developed.

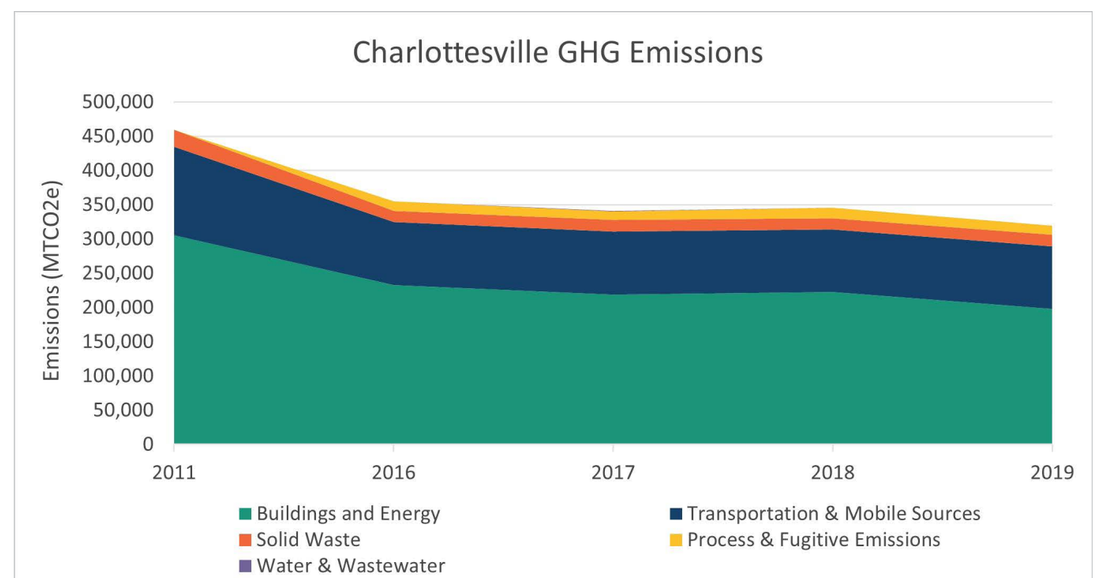
In addition to the types of actions that reduce greenhouse gas emissions, there is also a consideration of who within a community has the ability to take those actions. For example, Charlottesville has a ~60% rental vs. ~40% home ownership rate. Lack of control over the property and the buildings or apartment units that renters live in undermines their abilities to undertake actions such as improving the building insulation or installing a rooftop solar energy system that would significantly reduce their home's GHG emissions. Decisions on property improvements need to be made by the landlords and property managers who often are not paying the utility bills and would not see monthly cost savings that could repay the cost of the building improvements. This affect is referred to as a **split incentive**. Actions in this area would need to support and engage property owners and property managers and address the split incentive costs.

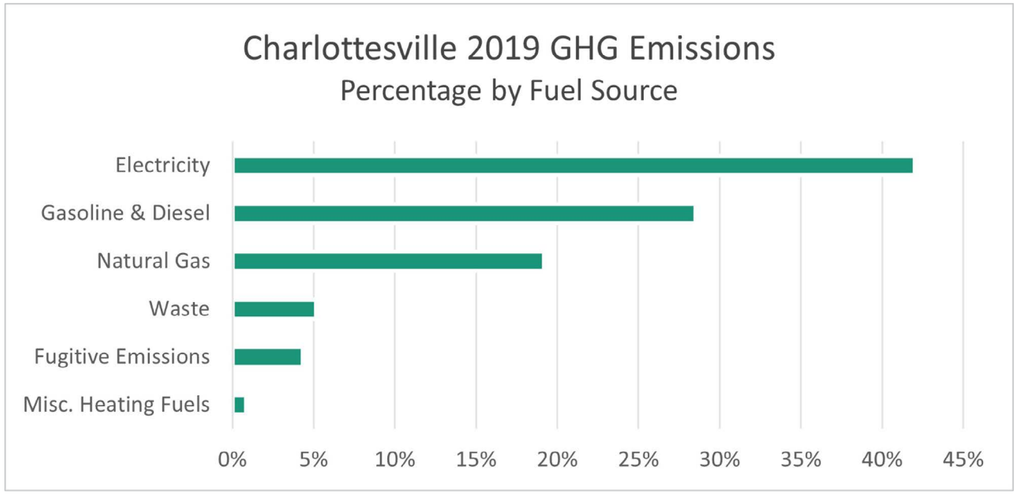
Check out the fact sheets in Chapter 4 of this document to learn more about specific emissions reducing actions!

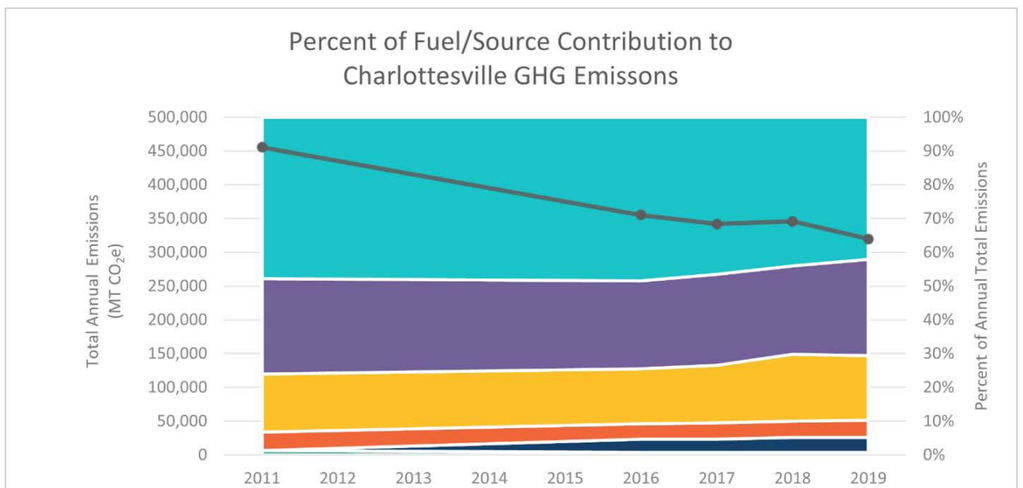
As another example, approximately 95% of Charlottesville's emissions come from activities within the community and outside of direct control of the local government. As such, actions to reduce Charlottesville's GHG emissions need to be compatible with our community's needs, values, and abilities. Decisions made by utilities, industry, service-provider companies, financial and funding organizations, and the state and federal government influence what options are available for our community. The local City government has decision-making control over its own GHG emissions and can support the community's choices through policy, process, projects, community services, incentives and funding, connecting our community with external resources, and education, outreach, and engagement.

PICTURING CHARLOTTESVILLE GHG EMISSIONS IN CHARTS AND GRAPHS









	2011	2016	2017	2018	2019
Electricity	48%	48%	47%	44%	42%
Gasoline & Diesel	28%	26%	27%	26%	29%
Natural Gas	17%	16%	17%	20%	19%
Waste	5%	5%	5%	5%	5%
Fugitive Emissions	0%	4%	4%	4%	4%
Misc. Heating Fuels	1%	1%	1%	1%	1%
TOTAL (MT CO2e)	455,681	355,206	342,021	345,965	319,737

EXAMPLE REDUCTION SCENARIOS

Our homes, businesses, and organizations account for approximately 60% of GHG emissions in Charlottesville and about 30% from transportation around town. Combined, these represent approximately 90% of all GHG emissions. To begin to project the scale of action that would be needed to achieve Charlottesville's 2030 reduction goal, the three scenarios shown in the chart below were developed using 2016-2018 data from Charlottesville.

In considering emissions reductions in our buildings, these scenarios considered improving the energy efficiency of existing buildings (with different levels of efficiency improvements), adding onsite rooftop solar energy systems, and the expected emissions reduction from electricity supplied by Dominion Power (Charlottesville's sole electric utility provider).

For transportation, these scenarios included a very moderate reduction in emissions as a reflection of the wide-range in public input as to how feasible changes of transportation behavior could be and a recognition that most of the identified barriers to change – infrastructure, technology development, market availability and price points – will take time to shift and, while they could be well underway by 2030, they may not be at a wide enough adoption scale to show significant emissions reductions by that year. Addressing these transportation barriers will be essential to achieving our 2050 goal and many of the initial supporting steps can and should be taken between now and 2030.

In combination, the three scenarios provide broad estimates of the total and annual number of buildings that would need energy efficiency (**EE**) projects completed, the total and annual number of renewable energy (**RE**) rooftop solar PV projects, and modeled annual costs in order for Charlottesville to achieve its 2030 reduction goals.

MODELED SCENARIOS USING ENERGY EFFICIENCY (EE) AND RENEWABLE ENERGY (RE) TO REACH 2030 GOALS

(BASED ON 2016 CHARLOTTESVILLE GHG EMISSIONS INVENTORY DATA)

	Scenario 1	Scenario 2	Scenario 3
Grid Reductions (Dominion by 2030)	30%	30%	30%
Energy Efficiency Retrofits (% of emissions reduction)	10%	20%	0%
Onsite Renewables (% of electricity emission reduction)	20%	15%	30%
Transport Emission Reductions	5%	5%	0%
Energy Efficiency Retrofits (# of all buildings)	1/5 of all buildings (~2,500)	1/4 of all buildings (~3,200)	0 buildings (0)
Renewables (# of buildings)	~1,200 rooftops (9%)	~450 rooftops (3%)	~4,700 rooftops (37%)
Yearly # of Projects (EE / RE)	300 / 150	400 / 56	0 / 592
Modeled Yearly Cost (EE / RE)	$1.3M / $22M	$3.2M / $17M	$0 / $34M

*Assumptions used in this high-level scenario model:

- Dominion Power meets their targeted level of renewable energy sourcing as consistent with the VCEA requirements (adopted in the Virginia General Assembly 2021 session)
- All buildings use the same amount of electricity and natural gas
- Energy efficiency retrofit costs are based on a small-to-medium house size
- Solar PV systems are installed in order from largest system to smallest
- Solar PV costs are the same as recent Solarize campaigns

CHAPTER 4 – GUIDES FOR ACTION

GUIDING PRINCIPLES

The following guiding principles reflect priorities of the community, were used to inform this plan, and should also be used to inform future implementation of climate action.

- Ensure that the transition to a low carbon future is effective, affordable, equitable and inclusive
- Prioritize actions that increase financial stability of Charlottesville households and businesses
- Prioritize actions that have **intersectional** benefits with other climate and City priorities, for example actions that reduce GHG emissions and increase climate resilience and adaptation, or actions that reduce GHG emissions, improve quality of life, and include economic gains, social benefits, and other environmental improvements.
- Develop pathways of meaningful (impactful & attainable) action in both owner-occupied properties and rental properties
- Prioritize financial incentives and assistance to support low-income and mid-income households
- Take actions that front-load reductions to accelerate reaching adopted climate goals
- Direct resources and programs to address racial and community inequities

ADDRESSING EQUITY

One central component of this plan is to address equity in the context of our climate action strategies and sub-goals. How programs and resources are designed and delivered can incidentally increase or decrease accessibility and exacerbate or alleviate existing burdens or barriers that may not be evenly distributed across our community. To that end, as we move into implementation of this plan, it is useful to acknowledge where equity issues are interrelated and consider how to integrate solutions with implementation.

This plan, and actions following from it, aims to engage and serve all residents, regardless of race, age, gender, income, sexual identity and expression, country of origin, neighborhood, religious affiliation, or other personal characteristics, including both rental and ownership opportunities.

What is social equity?

"The effort to provide different levels of support based on an individual's or group's needs in order to achieve fairness in outcomes. Working to achieve equity acknowledges unequal starting places and the need to correct the imbalance.

Social equity ensures zip-codes and dwelling type do not determine outcomes. All communities have access to, and can utilize, the resources, expertise, and systems of a jurisdiction a way that sees and acknowledges them. "

CSSP (2019). "Key Equity Terms and Concepts: A Glossary for Shared Understanding." Washington, DC: Center for the Study of Social Policy. Available at: https://cssp.org/resource/key-equity-terms-and-concepts-a-glossary-for-shared-understanding/

COMMUNITY CO-BENEFITS

Community **co-benefits** are beneficial outcomes from action that are not directly related to climate change mitigation. These win-win opportunities include cleaner air, green job creation, economic growth, health benefits from active travel, biodiversity improvement through expansion of green space, shifts to more sustainable behavior, resilience, and improved resource efficiency. The impact of climate actions themselves and their co-benefits can improve general quality of life. Co-benefits can enable Charlottesville to mobilize scarce resources across City departments as well as maximize opportunities to address multiple social, environmental, and economic challenges. For example, tree canopy cover can reduce building energy demand, improve air quality, shade bikeable, walkable, and transit-accessible routes, absorb stormwater, reduce erosion and flooding, and improve health.

More community co-benefits include:

- Disaster preparedness - increased preparedness of a city to respond to hazards
- Disaster risk reduction - reduced risk of hazards in a city
- Economic growth - increasing the value of goods and services produced in the city
- Ecosystem preservation and biodiversity improvement - for example, increased connectedness between green spaces
- Enhanced climate change adaptation - making the city more able to withstand changes in climate
- Enhanced resilience - making the city more able to quickly recover from shocks such as floods
- Environmental justice - achieving an equitable distribution of climate action benefits and addressing inequities in climate change burdens
- Greening the economy - making economic activity in the city more environmentally sustainable
- Improved access to and quality of mobility services and infrastructure - for example, improved access to public transport
- Improved access to data for informed decision-making – collection and sharing of data that supports city officials and wider stakeholders' decision-making
- Improved public health – for example, reduced chronic and acute respiratory diseases due to improved air quality
- Improved resource efficiency (e.g., food, water, energy) – meeting the needs of the city with a lower level of resource input
- Improved resource quality (e.g., air, water) – for example, improved air or water quality
- Improved resource security (e.g., food, water, energy) – for example, improved food, water or energy security
- Job creation – new jobs created
- Poverty reduction/eradication – for example, reduced fuel poverty
- Promote circular economy – for example, supporting greater reuse and recycling of resources
- Resource conservation (e.g., soil, water) – for example, soil or water conservation
- Security of tenure – for example, increased housing security for low-income urban residents
- Shift to more sustainable behaviors – supporting lifestyle change that not only reduces emissions but is also more sustainable in broader terms, for example, the health benefits of more active travel and changes in diet, reduced material consumption
- Social community and labor improvements – for example, a stronger sense of 'community' for citizens, and jobs with more security and benefits
- Social inclusion, social justice – engaging groups that are traditionally excluded and addressing inequalities

COMMUNITY ENGAGEMENT AND CAPACITY BUILDING

Throughout the Climate Action Plan development process, there were many calls for greater levels of community engagement. The need and desire for education, awareness, and involvement was heard from non-profit representatives, community advocates, and individuals both new to and already active in climate action discussions. The GHG emissions data reflects that success is reliant upon actionable pathways and choices made within the community. The 2021 Comprehensive Plan also speaks to the importance of this activity, providing the direction to include a "focus on equity and community and stakeholder involvement throughout the process".

It is our goal to empower our entire community to work together to slow the effects of climate change.

This area of action represents ample opportunities that could be taken up by the City government, local community groups, non-profits, businesses, individuals, and campaigns. The types of engagement identified include focuses on educational engagement, engagement that increases connections within the community and connections to nature, engagement around specific actions and resources, and engagement to inform the development of resources and programs.

Both general and targeted outreach efforts will be needed to ensure all members of our community are engaged with this Plan. The following groups were identified as having specific, unique roles when moving forward with implementing the Climate Action Plan:

- Communities of color
- Low-income households, including a specific line of outreach to public housing residents
- Recent immigrant communities and non-English speakers (Spanish-speaking youth in the schools was specifically noted)
- Youth
- Property managers and landlords, generally and those specifically related to low-income housing
- Local climate advocacy organizations
- Local business owners
- Faith communities
- Civic organizations

In addition to informing and educating, building the capacity to reach our emissions reduction goals will require bold action and creative leadership from both the City and community members. Implementation of the strategies and actions laid out in this Plan will require innovation, trust building, new partnerships, and a willingness to collaborate. One of the goals of this plan is to empower members of the community to take ownership of the Key Actions and think creatively about how to contribute to climate action. Continuing to reduce our emissions is a huge challenge, but it also presents our community with an opportunity – working together to implement this plan can ultimately make Charlottesville a safer, healthier, and more equitable place to live.

When moving into plan implementation, we need to be mindful of distinctions within groups of our community. For example, there is much interest in ensuring that Charlottesville's low- & middle-income community members can be part of our transition to carbon neutrality and experience the associated benefits of improved housing conditions and reduced energy bills. This grouping of residents includes differences that need to be considered during outreach and program design or resource matching:

- Low Income Residents and Households include:
  - Individuals, Couples, Families
  - Elderly, Youth, and all ages in between
  - Homeowners and Renters
  - Homes that are single family, duplexes, townhomes, apartments, and mobile homes
  - Immigrants from all over the world with whom language translation resources will be needed for inclusion

CLIMATE ACTION FACT SHEETS

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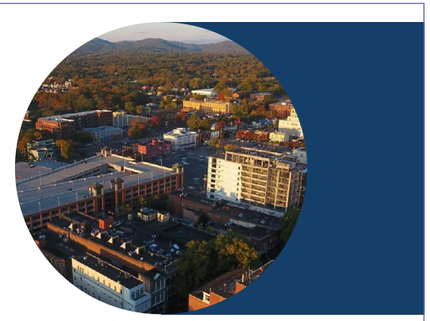

BUILD RIGHT, BUILD FOR THE FUTURE

What does it mean to Build Right and Build for the Future?

With 65% of greenhouse gas emissions coming from buildings, Charlottesville must take substantive action in this sector to meet its reduction goal of 45% by 2030. *Build Right, Build for the Future* focuses on designing and retrofitting our buildings to require less energy, be easily compatible with clean energy technologies, and be prepared for a changing climate. As we face the need to invest in new affordable housing, it is important to build for the future by ensuring that renewable energy, back-up energy storage, and electric vehicle charging infrastructure systems are able to be installed affordably and easily later. With this strategy, we increase the likelihood of future upgrades and set ourselves up for decreased energy costs. Building with an eye to a more sustainable future ensures that Charlottesville will thrive in the face of an evolving energy landscape and the challenges posed by increasing climate hazards.

SOLAR-READY BUILDINGS

Solar-ready buildings are designed and constructed in a way that facilitates and optimizes the installation of a rooftop solar photovoltaic (PV) system at some point after the building has been constructed. Solar-ready design and construction can take into consideration roof orientation, shade, and electric panel sizing, as well as wiring or pathways for wiring to be easily added later.

CONSIDERATIONS:

- Reduces the need for and cost of building modifications later
- Expedites solar installation
- Minimizes disruption to building occupants
- Makes it easier for building owners to see solar as a real possibility
- Reduces overall solar installation costs

Learn more about the Charlottesville Climate Action Plan and process at
charlottesville.gov/climateplan

ELECTRIC VEHICLE-READY

Electric vehicle (EV)-ready buildings meet EV infrastructure requirements, including electric capacity and pre-wiring, thereby reducing the costs of future EV charging installations.

CONSIDERATIONS:

- Removes the EV charging barrier for individuals to purchase electric vehicles
- Accommodates the growing number of electric vehicles in the market
- Supports the need to be adaptive to changing vehicle technology now driven by the market
- Requires training property developers and code compliance officers

ENERGY EFFICIENT & HIGH PERFORMANCE BUILDINGS

While switching to renewable energy ensures we are powering our buildings with clean energy sources, energy efficiency measures reduce the amount of energy we need in the first place. Improved energy efficiency can be achieved through better insulation of the entire building envelope, high-efficiency lighting, and upgrading to higher-efficiency heating and cooling systems, such as heat pumps or high-efficiency gas boilers.

CONSIDERATIONS:

- Reduces energy demand
- Reduces water usage
- Reduces heating and cooling costs
- Improves building air quality
- Improves building comfort
- Reduces ongoing operational costs
- Increases demand for skilled workforce

LEARN MORE

Solar Ready Buildings Planning Guide

EV Ready Buildings Planning Guide

ENERGY STORAGE

Times of high energy use rarely line up with times of high energy generation. Storing excess energy for later use, for example in batteries, allows us to increase use of onsite renewable energy and have backup power, if needed.

CONSIDERATIONS:

- Improves grid stability
- Curbs peak energy demand
- Enhances preparedness during power outages
- Requires a fair amount of space for installation

Learn more about the Charlottesville Climate Action Plan and process at
charlottesville.gov/climateplan

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HOW CAN WE FUND CLIMATE ACTION?

While many greenhouse gas reduction measures lead to annual savings, most funding and finance options require some upfront investments (both public and private). Below are a series of financing options for climate mitigation projects.

GRANTS & LOANS	BENEFITS	CHALLENGES
Grants Grants are non-repayable funds often disbursed by a government department, corporation, foundation, or trust to a local government, nonprofit, institution, business, or individual.	◊ Do not have to repay ◊ Often include access to other best practice or technical resources	◊ May be limited in availability ◊ Can be competitive, require a funding match, and time-intensive to receive and manage ◊ Typically come with eligibility and scope stipulations
Loans Loans provide individuals or organizations with funding for a specific project that must be repaid, typically with interest. There are many kinds of loans, all with different terms and conditions, benefits and challenges. Soft loans, for example, have comparatively lenient terms, such as below market interest rates, flexible repayment periods, or interest holidays. Other loan structures include green banks and energy efficient mortgages.	◊ Provide a path to receive money quickly ◊ Offer a wide variety of repayment options	◊ May require the support of an issuing government agency ◊ May be limited in availability depending on project type ◊ May be difficult to acquire and often have eligibility stipulations ◊ May require partnership with a financial institution
Revolving Loan Funds Most often used for energy efficiency and clean energy projects, revolving loan funds (RLFs) are pools of capital from which loans can be made for specific projects. Once the loan is repaid, the capital is reloaned for another project. For energy efficiency and clean energy projects, the energy savings are often used to repay the fund.	◊ Recycle capital over and over again ◊ Can capture savings from energy improvements to fund additional projects ◊ Often use lower interest rates and flexible terms ◊ Align cost savings over time with payment for the upgrade	◊ Can be compromised by loan defaults ◊ Requires generation of initial capital ◊ May "revolve" slowly depending on loan term length and administrative policies

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FINANCING AGREEMENTS	BENEFITS	CHALLENGES
Power Purchase Agreements (PPA) Typically used for solar financing, a power purchase agreement is a financial agreement in which a developer arranges for the design, financing, and installation of an energy system on a customer's property. The developer then sells the generated power to the host customer at a rate that is fixed for a certain period of time (i.e. 20 years) and is typically lower than the local utility's current rate.	◊ Reduce or eliminate upfront capital costs to customers ◊ Provide energy to customers at below-market rates ◊ Transfer risk of investment to developer ◊ Potentially increase property values for customers	◊ Typically last for a limited time frame (10-25 years) ◊ Require customer to provide maintenance support (e.g. rooftop repairs, tree trimming) ◊ Give tax credit access to the developer, not the consumer
Property Assessed Clean Energy (PACE) Financing PACE financing is a mechanism for financing energy efficiency, renewable energy improvements, and resilience projects on commercial properties. PACE financing is unique because the agreement is tied to the property itself, can transfer with property sales, and is repaid as part of the property tax bills.	◊ Limits upfront costs for property owner ◊ Makes energy projects cash flow positive ◊ Spreads repayment out over many years and possibly multiple owners ◊ Taps into sources of private capital ◊ Addresses split incentive between property owners and tenants	◊ Applies only to property owners of commercial properties ◊ May require high legal and administrative setup obligations to start a PACE program ◊ Requires investments above a certain threshold
On-Bill Financing & Repayment On-bill financing allows energy upgrades to be repaid through a monthly charge on customer utility bills. The upfront cost of the upgrade comes from the utility (typically electric utilities) or a third party.	◊ Centralizes savings and repayment on one bill ◊ Works well with a cooperative utility ◊ Aligns benefits and costs between owners and tenants ◊ Allows repayment term to extend over lifetime of improvements ◊ Ties repayment to the property, not individual utility customers	◊ Requires changing utility's billing system to allow for on-bill repayment ◊ May run into issues with repayment allocation if bills are not paid in full

OTHER FINANCING OPTIONS	BENEFITS	CHALLENGES
Government Tax Incentives and Rebates Tax incentives and rebates reduce what taxpayers owe to a government agency. They are granted by federal, state, or local governments to promote a specific behavior or kind of purchase.	◊ Encourage desired activities (e.g. buying electric cars or making energy efficiency upgrades) ◊ Offset some of the upfront costs	◊ Have high administrative costs ◊ Demand large government expenditures ◊ Produce benefits as part of tax returns, not at time of purchase
ESG (Environmental, Social, and Governance) Investing ESG investing is an umbrella term for investments that seek positive returns and long-term impact on society and the environment.	◊ Advances social and societal goals ◊ Rewards ethical behaviors ◊ Assigns value to low-carbon operations ◊ Provides access to non-government and non-financial institution capital sources	◊ Requires balancing ethics and rewards ◊ Limits investing pool due to fewer ESG investment options ◊ Requires a community program to transfer and repay funding from investors to local climate action projects

Learn more about the Charlottesville Climate Action Plan and process at
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THE FUEL SWITCHING LANDSCAPE

What is Fuel Switching?

Fuel switching involves transitioning from "carbon-intense" fuels (like gasoline or propane) to low- or zero-carbon alternatives (like renewable energy) in our homes and vehicles, and across our electricity grid. It can also mean electrifying—or switching from fuels to electricity. By switching away from fuels that produce more carbon dioxide and other greenhouse gases (GHGs), energy can be provided without contributing to the climate impacts associated with the burning of fossil fuels.

FUEL SWITCHING OPTIONS

ELECTRIFICATION OPTIONS

The Virginia Clean Economy Act puts the State's pledge to transition to 100% clean energy by 2050 into law, and Executive Order 43 commits to expanding access to clean energy. Switching from fossil fuel-powered appliances and vehicles to electricity-powered ones paves the way for large GHG reductions, as the electric grid increases use of renewable energy supply and becomes cleaner.

How will we get there?

Many systems in our homes, offices, and institutions are powered by propane and natural gas. See the table below for what it'll take to make the switch:

APPLIANCE/EQUIPMENT CONVERSION

For many of us, at least some of the equipment in our homes, like water heaters, boilers, stoves, and dryers, run on natural gas or propane rather than electricity. Switching to electric appliances can offer many benefits, including the potential to reduce GHG emissions.

CONSIDERATIONS:

- ◊ Increases efficiency, saving energy over time
- ◊ Reduces upfront cost for many new electric appliances
- ◊ Alleviates indoor air quality issues, particularly supporting individuals with respiratory issues
- ◊ May have higher operating costs depending on the price of electricity and natural gas
- ◊ May exacerbate the energy burden for renters and low-income populations through upfront and operating costs

Appliance	Type	Cost
Home heating system	Electric furnace	$1-$2.5K unit; $2K installation; $900 seasonal electricity cost
	Heat pump	$700-$2,800 unit; $5-$8K installation; $850 annual cost
	Gas furnace	$3-$4K unit, $1.5-$2K installation; $850 seasonal electricity cost
Water heater	Electric water heater	$300-$700 unit; $700-$1K installation
	Gas water heater	$400-800 unit; $1-$2K installation
Clothes dryer	Electric clothes dryer	$400-$600 unit; 15-25 cents per load
	Gas clothes dryer	$500-$750 unit; 30-40 cents per load
Stove	Electric cooktop	$400-$4K unit; $150 installation; $5.94/month
	Gas cooktop	$300-$4K unit; $150 installation; $2.34/month

Learn more about the Charlottesville Climate Action Plan and process at
charlottesville.gov/climateplan

An EV charging station in Charlottesville

HYBRID AND ELECTRIC VEHICLES

Most of us rely on gasoline-powered vehicles to get around. Switching from gas to hybrid or all-battery electric vehicles can help reduce GHG emissions associated with personal travel.

CONSIDERATIONS:

- ◊ Fuel-efficient and quieter
- ◊ No tailpipe GHG emissions or other air quality pollution
- ◊ Smoother EV driving experience/more immediate response
- ◊ More models and vehicle types are coming into the market
  - By 2022, over 500 models of EVs will be available globally
- ◊ New purchase price with tax incentives is on par with other cars
- ◊ Lower maintenance and fuel costs
- ◊ Need at home or public charging locations
- ◊ Distance limitations, which vary depending on make and model of car, not suited to all professions
- ◊ Used EV car market is currently very limited

How will we get there?

Most of our vehicles are powered exclusively by carbon-intensive fossil fuels like gasoline and diesel. Every major car manufacturer now has at least one electric vehicle model and there are only more to come. The prices have also come down as the supply has. Here's what it'll take to make the switch.

Vehicle Type	Starting Price of New Vehicle (Pre-Tax Incentives)
HYBRID	Toyota Prius: $25-29K
	Honda Civic Hybrid: $24K
	Ford Fusion Hybrid: $28K
PLUG-IN HYBRID	Toyota Prius Prime: $29K
	Kia Niro: $23K
	BMW 740e XDrive: $86K
BATTERY ELECTRIC	Nissan Leaf: $23K
	Chevrolet Bolt: $30K
	Tesla S: $67K; Tesla X: $79K

ALTERNATIVE FUEL OPTIONS

HYDROGEN

An emerging technology for conventional vehicle travel, hydrogen fuel cells leverage chemical energy to produce electricity. Despite minimal widespread distribution, hydrogen has been identified as a key strategy for VA's decarbonization because of its potential as low-carbon, alternative transportation fuel.

CONSIDERATIONS:

- ◊ Offers the potential of a lower-carbon fuel source with power potential similar to diesel
- ◊ Can be generated from excess renewable energy - although may not be - and stored for later use
- ◊ Has no onsite emissions or air quality particulate matter
- ◊ Has its primary market (currently) in California
- ◊ Relies on expensive raw materials and still-emerging technology
- ◊ Has limited infrastructure

RENEWABLE NATURAL GAS (RNG)

RNG is a form of biogas derived from the decomposition of organic material like food, yard, and animal waste, as well as other carbon-based material like carboard. It is largely made up of methane and is often captured at waste facilities like landfills or at farms.

CONSIDERATIONS:

- ◊ Is a lower-carbon alternative to fracked natural gas
- ◊ Repurposes biproducts of waste decomposition (methane) rather than emitting them to the atmosphere
- ◊ Could potentially utilize the vast natural gas infrastructure that is available in Virginia
- ◊ Relies on limited, and geographically-restricted, supply that may not meet the anticipated demand
- ◊ Is not universally considered a renewable or clean source of fuel (compared to energy sources like solar/wind)

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ONSITE RENEWABLES

What are Onsite Renewables?

Onsite renewable energy, sometimes called distributed renewable generation, refers to energy systems that are installed on the smae property as where the energy is used and is generated by renewable energy sources like solar, geothermal, and wind power.

ONSITE RENEWABLE ENERGY CONSIDERATIONS

On the whole, distributed renewable energy sources offer community benefits including carbon reduction, improved air quality, reduced reliance on the electricity grid, and lower utility bills. Compare the different renewable energy options below.

SOLAR

Solar panels, comprised of collections of photovoltaic (PV) cells, convert sunlight into electricity. Panels can be roof- or ground-mounted, offering options for residents in denser urban environments. Solar PV can also be combined with solar thermal collectors to heat water or air.

CONSIDERATIONS:

- Provides a reliable, predictable, proven source of power
- Is well-suited for Virginia
- Allows excess energy to be returned to the grid, reducing electricity demand
- Has a long lifespan (25+ year warranty)
- Is increasingly affordable
- Typically covers only partial electricity needs (due to property size limitations)
- May have high upfront costs
- Can require a significant amount of space

Why Not Just Wait on Dominion?

Currently, the electricity grid in Virginia relies heavily on non-renewable energy sources. Thanks to the 2020 VA Clean Economy Act, Virginia is on the path to 100% clean electricity by 2050. But that' s still 30 years away! We need immediate action to reduce GHGs. As utility companies transition, onsite renewables will be crucial to achieving our goals and offering protection from risk of rate increases.

Solar Capacity in Charlottesville

Charlottesville is well-suited for solar! Explore rooftop solar potential at charlottesville.gov/solar.

Learn more about the Charlottesville Climate Action Plan and process at
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GEOTHERMAL

Ground source heat pumps, or geothermal heat pumps, can be used in lieu of traditional home heating and cooling systems. Geothermal heat pumps harness the relatively stable ground temperatures (between 50-60°F) that begin several feet below the surface to heat water and cool or heat indoor air.

CONSIDERATIONS:

- Functions at all times of day
- Lasts approximately 20-30 years longer than a traditional HVAC system
- Can yield savings over time
- Requires less maintenance than boilers and furnaces
- Is not exposed to outdoor elements because of underground system components (less wear-and-tear than other forms of renewable energy)
- Requires upfront cost of installation
- May have limited contracting/installation options
- May have site-specific conditions that complicate installation (e.g. heat pump loops must be situated below ground)
- Requires that heat pumps be replaced every 20-25 years

WIND

Turbines produce electricity by harnessing the wind' s kinetic energy. Onsite, small-scale wind power is significantly less common. Instead, large-scale wind farms are more common.

CONSIDERATIONS:

- Can produce energy at any time of day when there is wind
- Is more efficient than solar, in terms of electricity produced and pollution generated over lifecycle
- Is one of the lowest-priced energy sources
- Is increasingly affordable
- Requires a battery to store the energy generated beyond the load it serves
- Depends on steady wind speeds
- Can require a large, open space for installation
- Large turbines/multiple turbines are required to generate significant amounts of energy

OFFSETS VS. RENEWABLE ENERGY CREDITS

Renewable energy infrastructure continues to become cheaper and more widespread, yet during this transition to a fully renewable grid, individuals and utilities will still rely partially on non-renewable resources to generate power. Two options exist to "balance" the GHG emissions associated with non-renewable energy: carbon offsets and renewable energy credits.

	Offsets	Renewable Energy Credit (REC)
DEFINITION	◊ Activities that reduce, remove, or store GHGs ◊ Entities can "balance out" GHG-emitting activities by purchasing offsets or engaging in offsetting activities	◊ A legal tool to balance GHGs associated with electricity production ◊ Allows an entity to claim the rights to the clean energy generated by a renewable energy source, often in a distant location
HOW IT' S MEASURED	◊ Metric tons of carbon dioxide equivalent (MTCO2e)	◊ Kilowatt-hours (kWh) or megawatt hours (MWh)
EXAMPLES	◊ Clean energy projects (e.g., wind, solar, hydropower, biomass, geothermal) ◊ Tree planting/sustainable forestry ◊ Seagrass meadow farming ◊ Energy efficiency improvements	◊ Clean energy projects: (e.g., wind, solar, hydropower, biomass, geothermal)
CONSIDERATIONS	◊ Not all offsets are created equal. Some reduce the need to generate energy from fossil fuels (wind farm), while others sequester/eliminate GHGs (seagrass).	◊ Only one entity may claim credit for a REC ◊ Enables pursuit of clean energy targets where local green energy sources cannot meet electricity demand

LOWERING GRID DEMAND / INCREASING GRID RELIABILITY

Electric utilities will face the challenge of meeting increasing energy demand, particularly as climate change leads to more extreme hot temperatures and longer heat waves. Onsite renewables can improve the reliability and stability of the grid by:

- Increasing the amount of potential off-grid energy generation, reducing the need for electricity from the grid at peak times
- Providing unused energy back to the grid to supplement an electric utility' s energy sources (known as net metering)

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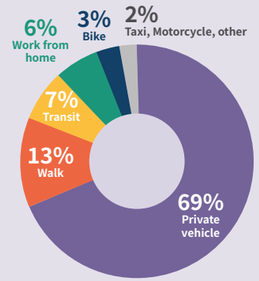
ADDRESSING GHG EMISSIONS FROM TRANSPORTATION

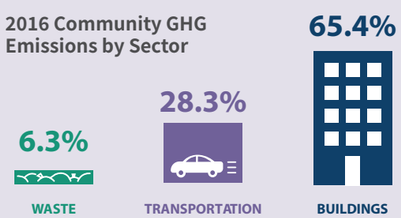
Why Focus on Transportation?

At approximately 30%, transportation is the third largest source of greenhouse gas (GHG) emissions in Charlottesville. Components of the transportation sector that produce GHGs include personal vehicles, municipal and business fleets, and the bus system. Looking at the different transportation options or "modes" we use to get around Charlottesville, nearly 70% of us commute to work alone and of that, the majority (60%) drive alone.[1] Based on these two facts, there is a lot of opportunity in Charlottesville to address emissions from transportation at both the individual level and at the community scale.

2008-2014 Commute Modes in Charlottesville (5-year average)



2016 Community GHG Emissions by Sector



COMMUNITY INVESTMENT + INDIVIDUAL CHOICES + MARKET TRENDS = CO LOWER EMISSIONS

The long-term sustainability of Charlottesville is dependent on a combination of community investment, individual choices and market trends. We all have to get around the city. Simple, sustainable choices—such as walking or biking to close destinations, using public transit, and making the next car purchase an electric vehicle (EV) or one with a high miles per gallon (MPG) rating—can really add up. Community investment is needed to support these individual choices. For example, people are more willing to walk or ride their bikes to work or to run errands if neighborhoods are designed with key necessities nearby, roads are designed for bicycle and pedestrian safety, and there are places to lock up their bikes once they arrive. Additionally, the market plays a role in our individual choices. By 2030, it is projected that nearly one-third of all new passenger-car and light-duty vehicle sales globally will be electric. It is expected that there will come a point where all new cars are electric.

As you can see, individual choice, community investment, and the market can effectively reduce GHG emissions and create a more sustainable future by coming together in the following two key ways:

1 Reducing the amount of fuel we use for travel with an efficient and interconnected transportation network, with fuel-efficient vehicles, and by supporting choices that reduce the need to drive a car

2 Switching to cleaner fuels and modes of travel

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TRAVEL EFFICIENTLY

We can intentionally redesign our street corridors and plan for community growth and new housing density to better support efficient travel. These community investments will help individuals eliminate unnecessary and inefficient trips while also making it easier and more pleasant to get around. Individual choices about whether a trip is needed and whether to select fuel-efficient vehicles—for personal use or for company fleets—can also reduce the amount of fuel we use for transportation.

Community Investment
- ◊ Provide better connections between locations to make trips more direct
- ◊ Connect bicycle and pedestrian infrastructure with transit and parking hubs
- ◊ Promote more mixed-use and transit-oriented developments that make it possible to get around without a personal vehicle

Individual Choices
- ◊ Reduce the need for a trip in the first place by meeting online or over the phone instead of in-person
- ◊ Opt to live in a mixed-use area
- ◊ Combine trips
- ◊ Purchase fuel efficient vehicles

Market Trends
- ◊ Accommodate renewed preference nationally among both younger and older generations to live and work in mixed-use areas that support walking and biking
- ◊ Anticipate more stringent MPG standards at the federal level

TRAVEL GREEN

While there are some trips we can avoid altogether, we all still need to get around. Transportation options such as public transit and carpooling reduce the energy required per person by serving many people with one trip. Others—walking, biking, and working from home—use no transportation fuels at all. Electrification of vehicles such as cars, buses, and bicycles represents a switch to a low-GHG fuel source, which becomes carbon-free when paired with renewable energy. Adding these travel alternatives to your routine even one day a week results in big changes to GHG emissions over time.

Community Investment
- ◊ Install safer pedestrian and bicycle infrastructure to reduce the need for private vehicle use
- ◊ Support the growing increase of personal and company fleet EVs with publicly accessible EV charging options
- ◊ Support integration of EV charging and EV-ready conditions in homes, businesses, and new developments

Individual Choices
- ◊ Choose to bike, walk, or use transit for at least some of your trips
- ◊ Consider alternative commuting options like public transit, carpooling, teleworking, biking, or walking
- ◊ Consider an EV for your next car purchase

Market Trends
- ◊ Moving toward an electric future: By 2022, over 500 models of EVs will be available globally. Many major car manufactures are making commitments to shift completely to EV production in the coming decades[2]
- ◊ The electrified options for fleet and heavy-duty vehicles are growing too; the market for electric buses, including school buses, is projected to grow 11% over the next five years[3]

[1] American Community Survey (ACS) 5-Year Estimates, 2014-2018
[2] BloombergNEF. Electric Vehicle Outlook 2020. Retrieved from https://about.bnef.com/electric-vehicle-outlook/.
[3] Global Market Insights. (2021, February). Electric Bus Market Size by Type. Retrieved from https://www.gminsights.com/industry-analysis/electric-bus-market.

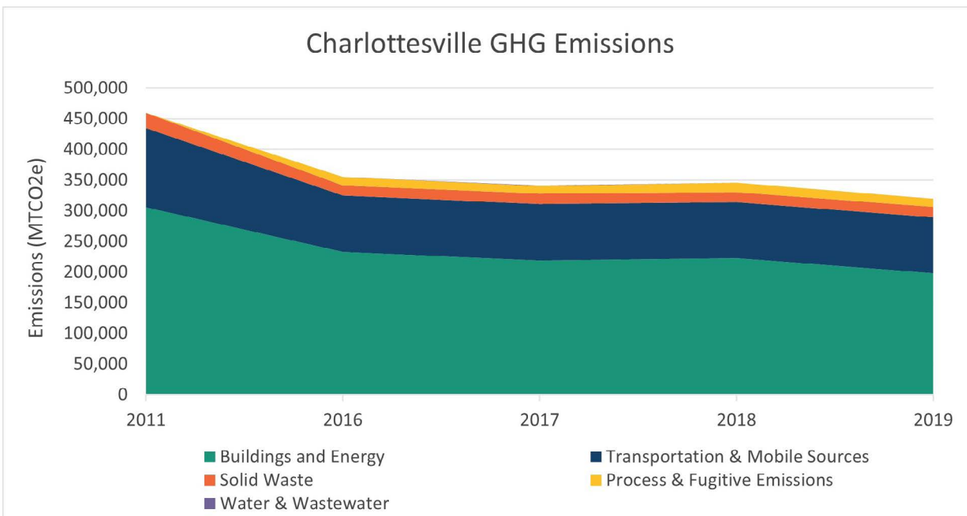
Learn more about the Charlottesville Climate Action Plan and process at
charlottesville.gov/climateplan

CHAPTER 5 – STRATEGIES AND ACTIONS: COMMUNITY

This chapter outlines the strategies and actions that can be undertaken as a community to reduce greenhouse gas emissions in Charlottesville. Some actions will be taken by the City Government, some by community members and organizations, and others present opportunities for partnership.

BUILDINGS AND ENERGY

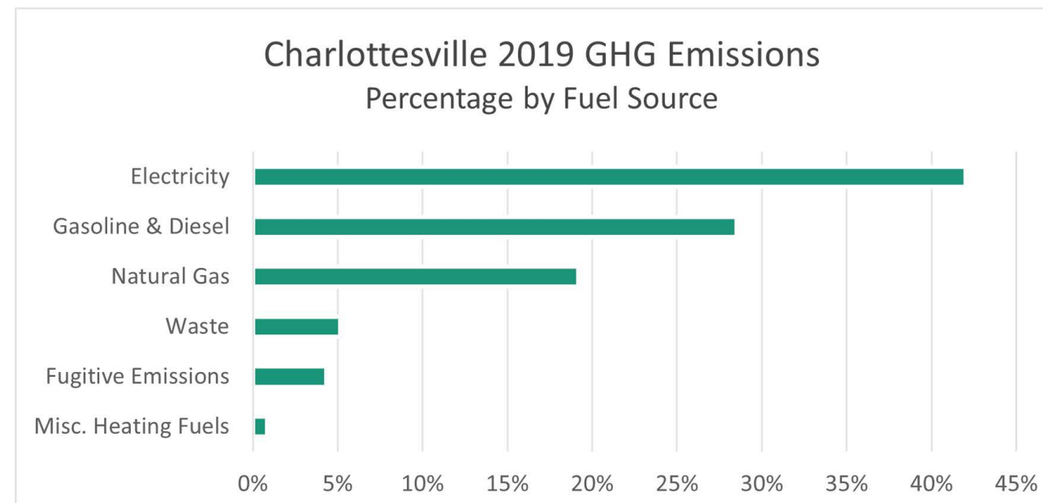
Buildings and the energy used to power, heat, and cool them make up approximately two-thirds of Charlottesville's GHG emissions, representing activities in the Residential, Commercial, Governmental (both municipal and non-municipal governments), and Industrial sectors. The Residential and Commercial sectors produce the majority of these emissions, representing nearly 30% each of Charlottesville's total emissions. Emissions from Buildings and Energy can be seen in the following chart, shown as the bottom layer in the chart in green:



Notes about Charlottesville's Buildings & Energy Emissions Data:

1. The University of Virginia is not included in Charlottesville's emissions data.
2. Due to data limitations, we are unable to determine how much electricity is used to charge electric vehicles. This amount is currently considered to be very small compared to the energy consumed by buildings.

The graph below shows the sources of all of Charlottesville emissions in 2019. Electricity, Natural Gas, and Miscellaneous Heating Fuels are attributed to the Buildings and Energy sectors, within which electricity accounts for a little more than two-thirds of the emissions and natural gas accounts for nearly one-third.



ELECTRICITY

With passage of the **Virginia Clean Economy Act of 2020**, Dominion Energy – Charlottesville's sole electricity provider – is required to transition its power sources and will be 100% renewable sources by 2045 and 40% renewable by 2030. As a result, Charlottesville's more than 40% of emissions from electricity will decline as Dominion Energy takes action, eventually becoming 0%.

Charlottesville can further its transition to carbon-free electricity and more greatly frontload its reductions by installing renewable energy systems onsite. Solar energy systems have been increasing in number through programs such as Solarize Charlottesville and with support by Charlottesville's Clean Energy Loan Fund for commercial and non-profit organizations. Federal tax incentives in the 2022 **Inflation Reduction Act** will continue to provide financial assistance as well. As of 2021, it is estimated that less than 3% of Charlottesville's rooftop solar capacity has been installed.

NATURAL GAS

Natural gas is known as a reliable and familiar fuel source for heating and cooking. Questions about transitioning natural gas to renewable sources are currently unable to be readily answered. [1,2,3,4,5] Renewable natural gas (**RNG**) and hydrogen are the main carbon-free sources being discussed at national and industry levels as potential options; both would require extensive buildouts and expansion within the U.S.[6,7] For hydrogen specifically, "blue" hydrogen – which uses natural gas to produce and has social and environmental justice challenges associated with it – should be avoided and only green hydrogen – which is produced from renewable energy sources – should be considered for Charlottesville's use.

As Charlottesville operates the local natural gas utility, Charlottesville Gas, it is in a unique position to evaluate and make decisions about decarbonization strategies. More about this topic and efforts that Charlottesville Gas is undertaking are in Chapter 7 of this plan.

As there is a clear pathway to zero carbon with electricity, there has been growing support over recent years for transitioning and incentivizing the transition of equipment and appliances to electricity, either proactively or at the time of replacement. Inexperience and uncertainty within the community with current technologies for all-electric appliances – such as induction stoves – is a reality that will require effort to address and overcome, as well as better understanding the affordability of quality all-electric appliances.

1 https://rmi.org/wp-content/uploads/2020/03/Methane-Insight-Brief.pdf
2 https://www.wri.org/research/renewable-natural-gas-climate-strategy-guidance-state-policymakers
3 https://www.nrdc.org/experts/merrian-borgeson/report-renewable-gas-pipe-dream-or-climate-solution
4 https://www.forbes.com/sites/energyinnovation/2022/03/29/gas-utility-hydrogen-proposals-ignore-a-superior-decarbonization-pathway-electrification/?sh=4500c7d476a1
5 https://www.reuters.com/article/sponsored/how-natural-gas-accelerates-the-path-to-hydrogen
6 Pacific Gas & Electric prepares to launch a demonstration facility to study the feasibility of blending hydrogen and natural gas in pipelines. (Green Car Congress)
7 https://www.greenbiz.com/article/7-things-know-about-renewable-natural-gas

EXISTING BUILDINGS, NEW DEVELOPMENTS, AND THE BUILDING CODE

The City of Charlottesville's land area is mostly already developed, meaning that increasing the energy efficiency of our buildings will require retrofit and rehabilitation, or redevelopment. At the same time, Charlottesville is both under pressure to increase affordable housing supply and is seeing population growth and demand for properties within the City. As the population continues to grow as a result of Charlottesville's attractiveness as a place to reside, and as anticipated inland migration begins as a result of increased coastal flooding (a projected result of climate change in Virginia)[1,2,3], these pressures will continue to increase.

1 https://statesatrisk.org/virginia/coastal-flooding
2 https://richmond.com/weather/virginias-critical-wetlands-are-marching-inland/article_f38585cb-0f97-5839-a4ee-9d4757f97f05.html
3 https://www.scientificamerican.com/article/virginia-islanders-could-be-u-s-first-climate-change-refugees/

Land Use and Urban Planning are important tools for reducing GHG emissions from the built environment. Density and mixed-use zoning promote walkability and expand both transportation and housing choice. Multi-family housing and mixed-use development are more energy efficient than single-family homes or stand-alone buildings due to shared surfaces insulating one another and reducing heating and cooling demand. Denser development has the additional co-benefits of reduced infrastructure costs, decreased transportation costs, increased access to services, and the potential for preservation of greenspaces from the smaller footprint of development. Additional density allowances within urban areas also helps to improve housing affordability and access, both of which are currently needed in Charlottesville. Intwined with denser land development is transportation planning and leveraging opportunities that greater transportation choice offers. Approaches such as **Transit-Oriented Development (TOD)** integrate transportation and land use planning.

On average, Americans' per-capita GHG emissions are double those of a person in Germany or Japan, largely due to our dependence on cars.

Our World in Data[1]

1 "CO_2 and Greenhouse Gas Emissions". Published online at OurWorldInData.org. Retrieved from: https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions

The recently adopted Future Land Use Map as part of the 2021 Comprehensive Plan update identifies areas for increased density, which will be accomplished both by adding additional units to existing sites and full redevelopment of other sites. Both approaches will result in an increase of new construction within Charlottesville. In Virginia, new buildings must be built to meet the standards of the state-adopted building code, which typically is an adoption of the international building code with amendments and alterations including those that lessen building energy efficiency. Localities are not permitted to require different buildings standards than the State's, although they are permitted to use incentives – including zoning incentives through discretionary processes – to encourage additional green building practices. Arlington County's Green Building Density Incentive Program is one example that has been successful within Virginia[4].

It is important to reiterate that new construction in the context of Charlottesville's densification is not expected to solely look like **greenfield development** or whole-cloth demolition and redevelopment of properties. There is a range of building types and approaches that can achieve increased density, improved walkability, and greater housing

4 Green Building Density Incentive Program – Official Website of Arlington County Virginia Government (arlingtonva.us) https://www.arlingtonva.us/Government/Programs/Sustainability-and-Environment/Energy/Green-Building/Green-Building-Density-Incentive-Program

Figure 3: Graphic from Missing Middle Housing website

availability, which concepts such as **Missing Middle Housing**[5] describe. Preservation and retrofits of existing buildings can be paired with densification through expansion of the existing structures through additions (building up and/or building out). Though beyond Charlottesville's GHG Inventory, it is important to consider the carbon embodied in the previously built environment. Rehabilitating or renovating existing buildings has the co-benefit of avoiding the GHG emissions and environmental impacts of new construction materials, which can account for the majority of emissions throughout the entire lifecycle of a building. In regard to reducing the greenhouse gas emissions related to powering our buildings, considerations and policies need to consider entirely new buildings, extensions and expansions within and attached to existing buildings, retrofits, rehabilitation, and weatherization of existing buildings.

The shift to decarbonize both new and existing buildings is a critical area of opportunity. This approach inherently consists of transition phases including grid decarbonization, improving energy efficiency, and use of or conversion to lower carbon and carbon-free energy sources. The recently passed **2022 Inflation Reduction Act (IRA)** includes rebates and tax credits for systems, appliances, and other qualified electrification projects that can support this transition[6]. The provisions target both retrofits and new buildings, provide funding to relieve energy burden of low- and moderate-income consumers, and support affordable housing, economic and workforce development, and energy-smart building codes.

5 https://missingmiddlehousing.com
6 https://energycentral.com/o/energy-innovation-policy-and-technology-llc/inflation-reduction-act-benefits-millions-efficient-electrified-buildings

EQUITY CONSIDERATIONS

As we look towards implementation, it is important to consider the upfront costs to retrofitting existing properties, funding sources and programs that could offset those initial costs, whether improvements could increase property assessments, thereby driving up annual taxes for low- and fixed-income residents. Additionally, it is common that lower- and fixed-income residents have a higher **energy burden** – a measure of the percentage of income that is spent on energy costs for the home. Older properties that have not been retrofitted or rehabbed likely have insufficient amounts of insulation, insulation that has degraded over time, or may not have insulation at all if built prior to 1970. Homes with delayed or limited investments – either due to household income constraints or due to lack of investment by property owners over the years – are more likely to have older and less efficient mechanical equipment as repairs to extend the equipment's lifetime are made in lieu of the costs for total replacement. With approximately 60% of Charlottesville's housing being rentals, situations exist where limited investment by landlords in energy improvements results in individuals and families having to manage higher energy bills with little ability to alter their situation. Enabling more energy efficient housing can have additional benefits of increased comfort, improved indoor air quality, and more available funds as a result of lower energy bills. When designing new construction for affordable and public housing, incorporating solar-ready and EV-ready aspects into the design at the beginning of the design process can avoid increased design and construction costs while reducing the barriers to adding these technologies in the future in manners that also minimize future disruptions for residents.

SUB-GOALS

- Equity: Increase participation of low-income households in funded energy efficiency and renewable energy programs.
  - Identify options for residents in single-family properties as well as in apartments and town-home style housing, and for both owner-occupied and rental units
- Equity: Develop pathways to ensure that all new City of Charlottesville supported affordable housing is built with energy standards that exceed requirements in the state code
- Energy Efficiency: 10% energy consumption reduction across all buildings by 2030
- Renewable Energy: Aim for 10% of Charlottesville's rooftop solar potential to be installed by 2030[1]

1 An estimated 2.5% of Charlottesville's rooftop potential was installed as of July 2021

STRATEGIES AND KEY ACTIONS

STRATEGY: Move New Construction closer to Net-Zero through increased levels of energy efficiency, incorporation of onsite renewable energy and solar-ready building standards

> Key Action: Education/Encouragement

> Key Action: Develop recommended lists of solar-ready, EV-ready, and energy design standards

> Key Action: Integrate recommended lists of climate-related design standards into the zoning code and zoning incentives as well as in the Standards and Design Manual

> Key Action: Connect energy standards with City-provided funding for buildings/construction

> Key Action: Advocate for higher energy efficiency standards in state's building code update

STRATEGY: Increase energy efficiency and onsite renewable energy use in existing buildings

> Key Action: Education/Encouragement

> Key Action: Increase participation by low-income households in fully funded programs for energy efficiency improvements and solar energy systems

> Key Action: Develop and identify funding assistance programs designed for mid-income households

> Key Action: Evaluate and increase resource support for commercial buildings

> Key Action: Develop and promote resource material specific to historic buildings

> Key Action: Review permitting processes, timelines, and fees for incentivizing and streamlining solar and EV permits, referencing targets from the SolSmart program.

> Key Action: Advocate for a commercial building energy benchmarking program

STRATEGY: Support transition to carbon-free sources and carbon-neutrality for building energy supply

> Key Action: Continued support of the Virginia Clean Economy Act, ensuring renewable sources for grid-supplied electricity in Charlottesville

> Key Action: Prioritize transition to electric for the Miscellaneous Heating Fuels that contribute to the Buildings and Energy sector emissions

> Key Action: Complete analysis of decarbonization options for Charlottesville Gas through the Decarbonization of Gas Utility Study

> Key Action: Ensure the zoning code is supportive of renewable energy systems

STRATEGY: Support increased energy efficiency and renewable energy through innovative financing mechanisms that enable and leverage private action and investment

See Funding and Financing chapter for Key Actions that support this strategy.

TRANSPORTATION

The transportation sector represents ~30% of Charlottesville's GHG Emissions Profile. Emissions come from the fuels used to power our automotive vehicles and are calculated based on annual vehicle count estimates conducted by the Virginia Department of Transportation and average fuel mileage by vehicle class type. The primary fuel sources for these emissions are gasoline and diesel.

When seeking to reduce GHG emissions within the transportation sector, approaches fall into three categories: shifting travel to alternative modes such as walking, biking, and transit; switching vehicles that use lower and no-fossil fuel sources; and adjusting behaviors to reduce the amount of travel needed.

Increasing travel modes of walking, biking, and transit requires networks and access routes that connect destinations in safe and reliable manners so that people can have confidence that they do not need a personal vehicle for every trip. Increasing safety for individuals using bicycle and pedestrian infrastructure is a key component, as well as making use of those routes comfortable and well-connected. For increasing transit ridership, closing gaps that challenge access to bus stops is important, as well as having a reliable bus schedule with frequent arrival times and direct or well-interconnected routes.

According to 2019 data from CleanTechnica, the five-year cost of ownership of a standard range Tesla Model 3 is over $5k less than a Toyota Camry SE.

Electric vehicles (EVs) are becoming more common, both as new and used vehicles. Multiple major manufacturers are rolling out new EV models each year, the purchase price for a new EV passenger vehicle is projected to be within about 3-5 years of a non-EV, and state-level vehicle emissions standards are shifting the vehicle market by requiring sales of zero emissions vehicles. EVs are able to be powered by 100% renewable energy, are better for air quality in urban environments due to the zero-tailpipe emissions, reduce road and traffic noise, handle well when driving, are less expensive to fuel than gasoline or diesel vehicles, and require less maintenance.

As more of these vehicles come onto the market for sale and for resale, customers will have to consider where they are able to charge the vehicles. For the ~60% of Charlottesville households that are renters and cannot make decisions about installing an at-home EV charger and may not have a dedicated parking space, the availability of a publicly accessible and affordable EV charging network will be key. Additionally, as new construction and redevelopment of housing moves forward, planning ahead for EV charging to be added by incorporating EV-ready building standards can reduce future barriers to adding EV chargers and minimize disruption to residents.

In 2021, the General Assembly passed, and the Governor signed, HB1965 – the Clean Car Standards Bill. This legislation will require approximately eight percent of model year 2025 vehicles sold in Virginia to be zero-emissions vehicles and adds Virginia to the list of states following California's vehicle emissions standards, which are stricter than the federal standards Virginia currently follows.

Federal incentives for new and used EVs and EV charging are part of recently passed legislation that Charlottesville could leverage, as well as state-level grants and partnerships

EQUITY CONSIDERATIONS

Equity considerations identified through this planning process focused on maintaining transit access for individuals who rely on public transit while increasing service and making other improvements to increase total transit ridership, and concerns that planning and investments to support the oncoming market growth of EVs will benefit only City residents who can afford to buy new vehicles. Balancing investments to provide for future opportunities while not underfunding current needs will be a core consideration for equitable roll out of EVs and EV charging, as well as tracking the Charlottesville market and ensuring that EV charging infrastructure is sufficiently installed and distributed to meet local demand.

Another equity consideration related to transportation that was identified during this planning process is access to food, specifically healthy and affordable food options as well as focusing on neighborhood areas that currently have limited or no available local options. Reducing the distance that residents need to travel to access food markets and garden areas could increase the possibility of utilizing non-motorized transportation modes. Similarly, increased alignment and collocation of transit locations and affordable food markets could also support residents' ability to utilize transit instead of personal vehicles for travel. When integrating transportation planning with land use planning and densification, access and connections to healthy food options is an important consideration.

SUB-GOALS

- Increase transit ridership
- Increase travel mode share for biking and walking
- Increase access to EV charging infrastructure for the ~60% of Charlottesville residents who are renters

STRATEGIES AND KEY ACTIONS

STRATEGY: Increase Travel by Walking, Biking, and Transit

> Key Action: Establish specific targets for increasing travel mode share of walking, biking, and transit ridership

> Key Action: Create walkable, bikeable, and transit-served neighborhoods

> Key Action: Include Transportation Demand Management Planning for sites in the zoning code

> Key Action: Develop a mobility plan approach that seeks to leverage and interconnect bicycle, pedestrian, and transit infrastructure networks along with parking and the Future Land Use Map density areas

> Key Action: Continue planning and investment in a well-connected network of trails, shared use paths, sidewalks, and bike lanes

> Key Action: When planning and funding transportation projects, prioritize filling in connectivity gaps with a focus on connecting bus stops to adjacent roadways, Safe Routes to School, food access pathways, and providing safe and smooth transitions where bicycle, sidewalk, and trail infrastructure stops

> Key Action: Include increasing transit ridership as a considered criteria for transportation investments

> Key Action: Work within Charlottesville's representation in the MPO/TJPDC to advocate for criteria that supports transit ridership

STRATEGY: Support Use of High-Efficiency Vehicles

> Key Action: Support increased adoption by Virginia and the Federal government of high fuel efficiency vehicle standards

> Key Action: Education/Engagement

> Key Action: Financial Incentives for purchase of electric or other alternatively fueled vehicles

STRATEGY: Develop a community electric vehicle charging network

> Key Action: Develop a network of publicly accessible EV charging stations to meet the needs of visitors, commuters, renters, and residents without onsite parking

> Key Action: Align EV charging planning with the TJPDC's EV Charging Station Study (2021)[1]

> Key Action: Increase EV Charging at workplace & commuter parking locations

> Key Action: Identify EV-ready code standards for integration with zoning and city-funding processes

> Key Action: Include EV-ready requirements for parking lot sizes that are over an established minimum size

> Key Action: Develop and include EV charging site standards and guidelines in the Standards and Design Manual to balance EV charging with public access, safety, and the different types of workplace and home parking locations available in Charlottesville

> Key Action: Ensure emergency response protocols and training for EV charging equipment are in place

> Key Action: Consider electric bicycles in overall charging station planning and implementation

STRATEGY: Encourage alternative travel behaviors

> Key Action: Expand availability and access to regional trails and shared use paths for recreation, commuting, and other daily travel activities

> Key Action: Encourage behaviors such as daisy-chaining trips, remote work, anti-idling, and a "5-minute walk" approach

> Key Action: Research and examine operations models and strategies to ensure access to bicycle and pedestrian routes and transit stops during and after inclement weather events

1 https://campo.tjpdc.org/news/ev-charging-station-study-2021

WASTE

Greenhouse gas emissions from landfills are a significant contributor to climate change. Landfills emit both carbon dioxide (CO2) and methane (CH4) when organic wastes such as food scraps, wood, and paper decompose under anaerobic conditions (without air) as in a landfill. Even with landfill gas capture mechanisms, because methane is such a powerful greenhouse gas, curbing methane emissions in the near-term is crucial to reduce the potential impacts of climate change. The highest levels of methane emissions occur in the early years of decomposition, with an overall average 12-year methane emission period. This means that diverting organic waste from landfills is consistent with climate goals and can be immediately impactful. Depending on the gas capture systems at a given landfill, some of these emissions may be kept out of the atmosphere. However, methane and other greenhouses gases enter the atmosphere even at landfills with gas capture systems in place. Therefore, food and organics diversion efforts are a critical lever in the efforts against climate change.

GHG emissions from solid waste sent to the landfill represent ~5% of Charlottesville's total GHG inventory. When looking to reduce the amount of organic matter sent to the landfill, there are three main methods that are integrated as parts of a Sustainable Materials Management approach: reduce the overall amount of material being wasted, divert unused materials to be used in another way (for example, donating edible but unused food – a practice also referred to as '**gleaning**'), and process the decomposition of the materials in another (lower or no-carbon) manner, such as composting.

Charlottesville's waste services are currently provided through a mixed-provider model, with the City of Charlottesville providing curbside collection of trash and recycling to a large portion of its residential neighborhoods and some commercial businesses and with private waste hauling companies also serving residential neighborhoods, housing developments and apartment/condominium complexes, as well as commercial businesses. Collection of organic materials is provided through free drop-off locations for household organics (such as kitchen scraps, paper towels, and tissues), through curbside leaf collection in the fall/winter season in residential neighborhoods, and by contracting with a private company for residential or commercial organics collection. There are a total of three household organics drop-off locations within the City: a 24/7 location near the Downtown Mall, at the City Market on Saturdays April through October, and at the McIntire Recycling Center managed by the Rivanna Solid Waste Authority.

Over a 20-year period, one ton of methane has a global warming potential that is 84 to 87 times greater than carbon dioxide.

Methane Matters, NASA EarthObservatory

Charlottesville's waste data is obtained from the Thomas Jefferson Planning District Commission's Solid Waste Management Plan. The Thomas Jefferson Solid Waste Planning Unit (TJSWPU) includes the Counties of Albemarle, Fluvanna, and Greene, the City of Charlottesville, and the Towns of Stanardsville and Scottsville. The Management Plan provides a breakdown of waste generated by type, as reported to the Virginia Department of Environmental Quality. The Solid Waste Management Plan provides combined data for Charlottesville and Albemarle and as a per capita number. To calculate Charlottesville's emissions, its population is multiplied by the waste per capita value in the Management Plan.

A landfill diversion study completed for the City of Charlottesville in 2022 approximated that ~30% of Charlottesville's total waste is from organics and compostable fibers. To address these emissions, the study recommended Charlottesville adopt an overall waste generation reduction goal and a complementary 50% organics diversion goal by 2030. Measuring and tracking these volumes is currently a challenge due to lack of data accessibility, however, "[a] true landfill diversion target for the City of Charlottesville does not refer solely to solid waste that the City currently manages, but rather encompasses all waste generated in the City."[1]

1 2022 Landfill Diversion Study Memo – provided to the City of Charlottesville, Department of Public Works by GBB

EQUITY CONSIDERATIONS

The current availability and affordability of waste services for organics largely benefits Charlottesville's single-family residential neighborhoods that have trees/fall leaves and residents who have convenient access to the McIntire Recycling Center or the Downtown Mall area. Residents who lack access to personal vehicles and do not live downtown have referenced challenges to using these services due to transportation options, the logistics of how to package and carry the compostable materials during travel, and matching travel times and schedule availability. The only remaining options for residents who are unable to access the free drop-off locations and for landscaping/yard waste beyond the City-provided leaf collection service is to contract at a monthly rate for private curbside compost collection.

Composting onsite can also be challenging as it is a new process for many residents, requires a balanced ratio of yard waste to food scraps to breakdown the materials properly, and can be restricted by landlords and lack of access to yard space. For commercial entities, including restaurants, the option for composting onsite is incompatible with their location and operations, and would be an additional contracted cost.

SUB-GOALS

- Reduce total waste generated volumes 20% by 2030 and 90% by 2050
- Divert 50% of Charlottesville's organic materials from the landfill by 2030
- Seek equitable distribution of costs, services, and generation of waste materials across community members

STRATEGIES AND KEY ACTIONS

STRATEGY: Apply a Sustainable Materials Management approach to Charlottesville's Waste System

> Key Action: Adopt a Sustainable Materials Management policy

> Key Action: Scope Charlottesville's full waste system, including key partners and actors

> Key Action: Adopt a waste generation reduction target and an organics diversion target

> Key Action: Education/Engagement (waste reduction, preferred materials, landfill alternatives)

> Key Action: For future zoning updates, consider how to support and provide space for the collection of multiple waste streams at businesses and residences

> Key Action: For future zoning updates, consider whether zoning changes are needed to support onsite composting

STRATEGY: Reduce Amount of Food and other Organics-based material waste

> Key Action: Working with community networks, identify meaningful ways to increase diversion of edible food to gleaning/donation programs

> Key Action: Increase education and engagement about food waste and waste reduction options

STRATEGY: Divert Organics from the Landfill

> Key Action: Add organics collection for yard waste and household compostables to the set of City-provided curbside waste services

> Key Action: Evaluate and propose options for expanding organics collection options for City non-curbside waste collection customers, including residential and commercial/organizational entities

> Key Action: Provide organics material collection for municipal government and school facilities and sites

> Key Action: Promote backyard composting strategies and resources, including an outreach focus to community, school, and urban agriculture gardens

> Key Action: Prioritize where possible consistency of signage, messaging, and waste stream separation across the Charlottesville-Albemarle-UVA region

NATURE BASED SOLUTIONS

Surrounding our buildings and transportation networks are natural and built landscapes. Areas with greenspaces (plants and vegetation) and shade – whether from constructed structures or natural elements like trees and tree canopy – are cooler and more habitable, making them more comfortable for people and less energy intensive. Tree canopy cover, for example, can reduce building energy needs, improve air quality, and shade bikeable, walkable, and transit access routes. Integrating these elements into our community's landscape helps to reduce GHG emissions, reduces the **urban heat island effect**, and better prepares Charlottesville for one of its top expected climate risks – extreme heat with higher temperatures over longer durations of time. Green space also has the co-benefits of providing habitat for wildlife and contributing to stormwater management.

EQUITY CONSIDERATIONS

Charlottesville's community strongly supports increased numbers of trees and maintaining and increasing the city's percentage of tree canopy cover. Currently, the tree canopy is not evenly distributed between neighborhoods, with Charlottesville's older and less wealthy neighborhoods having noticeably fewer trees and greenspaces. In these areas, property lot sizes tend to be smaller, and the roadways were built with little public investment in sidewalks and spaces for planting strips. Additionally, residents have raised concerns about trees being close to their homes and potential costs for maintenance, damage from downed limbs, and roots impacting utility lines. Given the health risks associated with extreme heat and the health benefits that greenspaces provide, it is worthwhile to consider how to reduce the amount of urban heat in these neighborhoods. Working with the community to understand their wants and identifying options that fit into this constrained urban landscape will be key to progress.

SUB-GOALS

- Identify and adopt a greenspace cover preservation goal, including tree canopy cover
- More equally distribute trees and greenspaces across the city, by identifying approaches to reducing urban heat that are appropriate for the built conditions of each neighborhood and reflect the interests of each neighborhood's community

CHARLOTTESVILLE HOT SPOTS

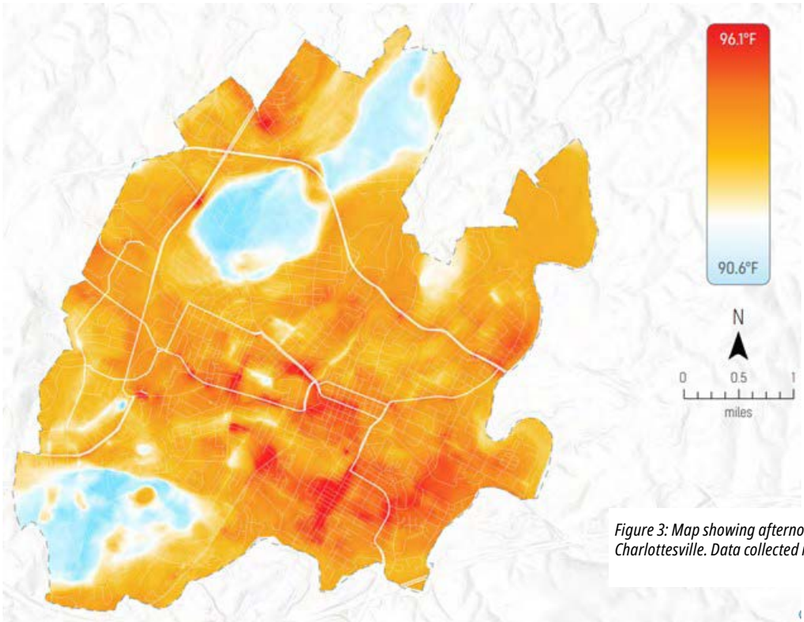


Figure 3: Map showing afternoon hot spots in Charlottesville. Data collected in the Summer of 2021.

STRATEGIES AND KEY ACTIONS

STRATEGY: Maintain a Robust Urban Forest on City-owned Lands

> Key Action: Update and implement a robust Urban Forest Management Plan, including tree preservation, planting, and maintenance; management; removal of invasive plant species; and a tree canopy cover goal

> Key Action: Integrate tree canopy shade with high-priority walkable, bikeable, and transit corridors to increase comfort and health-safety for users

STRATEGY: Encourage Healthy and Increased Tree Canopy on Privately Owned Properties

> Key Action: Education/Engagement on tree maintenance and care, selection, and placement ("the right tree in the right place") as well as invasive species management

> Key Action: Update code standards for trees

> Key Action: Review and pursue potential incentives and penalties for property owners to preserve, increase, and maintain tree canopy

STRATEGY: Integrate greenspaces and shade throughout our urban landscape to cool outdoor areas surrounding buildings, active transportation access routes, and recreational areas

> Key Action: Identify, integrate, and incentivize climate-focused nature based solutions in the zoning code and other guides as appropriate

> Key Action: Complete a planning concept evaluation for establishing a "emerald necklace/green bracelet" or connected network of parks and natural resources within Charlottesville to be integrated with bicycle & pedestrian network routes

> Key Action: Work to acquire lands to expand public parkland and green necklace/ bracelet and protect land-based carbon sinks

> Key Action: Identify and adopt practices to accommodate trees and greenspace along with density, utility lines, and fire/emergency response access in the City's zoning ordinance and incorporate any updates (if needed) in the Standards and Design Manual

> Key Action: Establish a minimum tree canopy or other shade cover minimum for new parking lots and incentives for shading or conversion of existing parking lots

> Key Action: Encourage trees for shading around buildings, with recommendations to preserve rooftop access for solar energy systems

> Key Action: Integrate climate-related design objectives, outcomes, and recommendations into the Small Area Plan development template

> Key Action: Increase education and outreach about greenspace options and benefits, including green roofs, urban gardens, small plot or balcony gardens, soil amendments such as biochar and compost, and transitioning lawns and hardscapes to native plants & drought-tolerant plants

> Key Action: Include urban food gardens in the zoning code as a listed allowable use for residential and commercial properties

> Key Action: Increase the number of community agriculture gardens through preservation of space, with a particular focus in areas identified as lacking access to healthy food and sites associated with or near to affordable housing developments

FINANCING AND FUNDING

When considering the scale and extent of action needed to achieve deep GHG emission reductions and carbon neutrality, it is clear significant levels of investment are needed – levels that exceed the funding capacity of what Charlottesville's local government can provide.

The types of funding needed are many. For example, for middle- and upper-income residents, the barrier to adopting energy efficiency improvements or renewable energy systems can be the initial upfront cost of the improvement, but if given the opportunity to repay the initial cost in installments (particularly if installments align with cost savings gained from the improvements), then taking action becomes possible. For lower-income residents, funding in the form of grants or repayment options guaranteed to be lower than the amount of cost savings may be the only way forward. Given Charlottesville's 60% rental rate, funding options that address the **split incentive** between owners and renters and offer pathways that work for both groups are necessary to pursue.

It is important to note that significant investment will be needed whether or not Charlottesville pursues climate action. The impacts and implications of climate change and climate-related events, including infrastructure damage, health impacts, and lost economic activity are increasingly frequent and extremely costly.

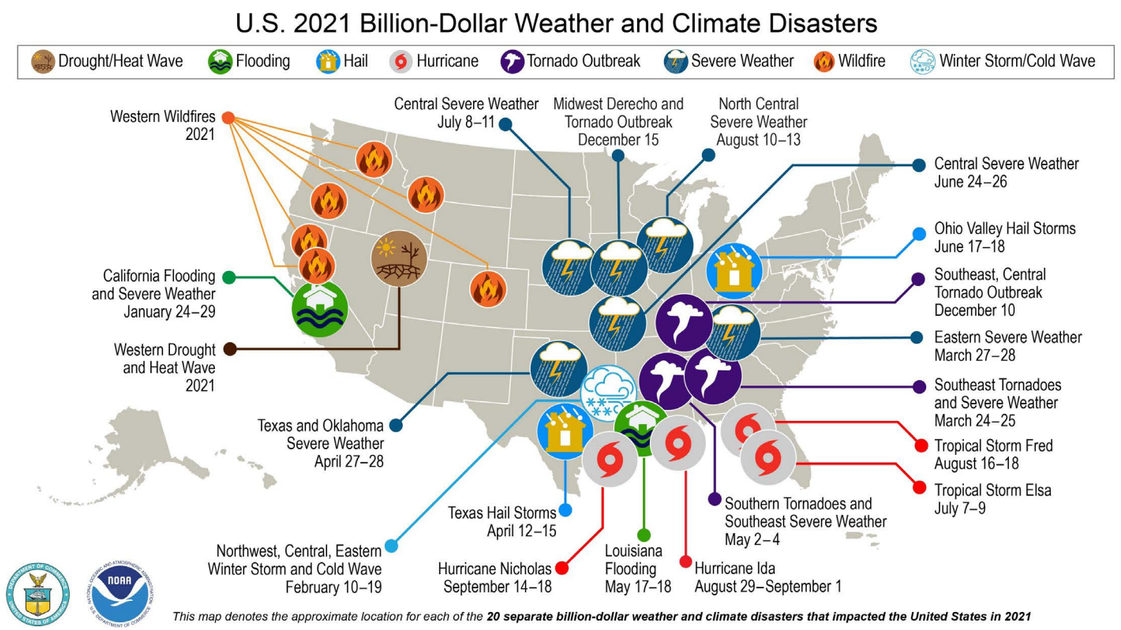


Figure 5: In 2021, the United States experienced record-smashing 20 weather or climate disasters that each resulted in at least $1 billion in damages. NOAA map by NCEI. Image credit and more details at climate.gov.

EQUITY CONSIDERATIONS

It is advantageous for Charlottesville to use as much outside funding as possible to support our local investments and further the scale of action we can achieve. Grant funding is limited, and often once spent, is gone. There is growing recognition globally that larger and ongoing sources of funding are needed to support climate action at the scale needed to meet global GHG emissions reduction goals. Financing programs – as an industry – have been successful in meeting initial funding needs and continuing to have funds available over time as a result of repayment requirements. It is these aspects that make green financing programs attractive as they can continue to support community climate investments in the future and many emission reducing actions also generate cost savings that could be used for financing repayment. With the financing industry's complicit role in the United States' history of redlining, and documented instances of discriminatory and/or predatory lending practices within the industry, we acknowledge that there is potential for harm as well as good within financing programs and that members of Charlottesville's community have suffered as part of these practices. As such, the offering of green financing programs within Charlottesville – particularly for programs aiming to serve communities of color, low- and lower-income households, and other vulnerable populations – should be considered thoroughly and designed for proper oversight and regulatory guardrails to protect community members. Additionally, community representatives should be engaged in the program design stages to identify fears, concerns, and appropriate solutions.

Another equity consideration is that Charlottesville has an approximately 60% rental rate, which limits the actions many of our residents can make due to their lack of control over their residences and parking locations. The involvement of property management companies and property owners is needed to make progress. When developing and assessing funding and financing programs, evaluate which programs are available for rental properties, commercial versus residential properties, supporting workplace and non-home EV charging access, increasing onsite renewable energy and battery backup storage, and new versus used efficient vehicles.

SUB-GOALS

- When establishing green funding/financing programs, design them to serve community members at all income levels with tiered levels of benefit based on income thresholds. Identify or establish complementary funding sources to support minimal or no financial investment from lower income level households.
- Ensure availability of funding/financing programs to support rental properties as well as owner-occupied properties in the commercial and residential sectors.

STRATEGIES AND KEY ACTIONS

STRATEGY: Leverage outside funding sources

> Key Action: Increase participation in funding programs available from the Federal and State governments as well as from utility companies.

> Key Action: Apply for funding through federal grant programs (such as the 2021 **IIJA**, and 2022 **IRA**) to support emission reduction actions in City government & school buildings as well as within the community. Funding uses should consider physical improvements – such as energy retrofits, EV charging installations, and renewable energy systems paired with battery storage – as well as for green financing programs and incentives.

> Key Action: Review the City's funding incentive programs and local authority with the aim of aligning with and increasing local leverage of financial incentives from the federal government, state government, and utilities. This should include, but may not be limited to, tax incentives, rebates, and service fees related to new onsite renewable energy systems, EV charging infrastructure, and purchase of new or used EVs.

> Key Action: Integrate climate criteria into local and regional infrastructure funding processes, including both planning and project development stages (e.g., MPO's Long Range Transportation Plan).

> Key Action: Explore establishing a Charlottesville Climate Action Fund, working in partnership with local community-based foundation(s) to enable leveraging public funds, private donations, and other grant and foundation funding sources to serve our community. Uses of the fund should consider leveraging other funding pathways – such as C-PACE for affordable housing developments and green financing programs for low- & middle-income residents – as well as supporting community-led climate projects and engaging the community through crowd sourced donations and direction of funding.

> Key Action: Develop 'shovel-ready' project concepts with that could be submitted as new grant programs and funding rounds come available. These could include projects that are City-led, Community-led, or City-Community partnership projects.

STRATEGIES AND KEY ACTIONS

STRATEGY: Evaluate the City's processes and cross-departmental program alignments to integrate intersectional goals and increase effective outreach to the community

> Key Action: For government- and utility-provided funded energy programs that have eligibility criteria, such as household income thresholds or resident's age, identify programs within the local government that have aligned eligibility criteria and work cross-departmentally to increase outreach to residents informing them of additional service programs they may be eligible for.

> Key Action: Review the City's funding programs for building and site improvements to identify and propose options for integrating low-carbon and no-carbon standards, as well as supporting future integration of GHG emission-reducing items. Example proposals could be to adopt energy efficient standards for insulation ratings or EV-ready and solar-ready building elements.

> Key Action: Review all City-provided rebates and incentives related to increasing energy efficiency and renewable energy use and co-locate links to them on the City website for easy reference

> Key Action: Examine and pursue use of the City's billing systems and authority to provide funding pathways that address the split incentive challenge and utilize non-local government funding sources, such Commercial PACE (**C-PACE**) and on-bill repayment programs.

STRATEGY: Support increased energy efficiency and renewable energy through innovative financing mechanisms that enable and leverage private action and investment

> Key Action: Pursue financing program models that can address rental property challenges

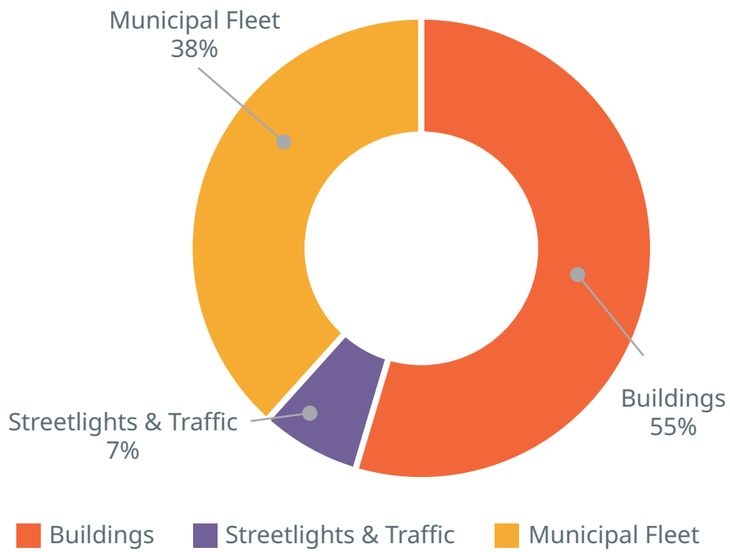
> Key Action: Establish or authorize a Commercial PACE program

> Key Action: Advocate for and support the state receiving funding to establish a state-level Green Bank

> Key Action: Support continuation of Virginia's participation in the Regional Greenhouse Gas Initiative (RGGI)

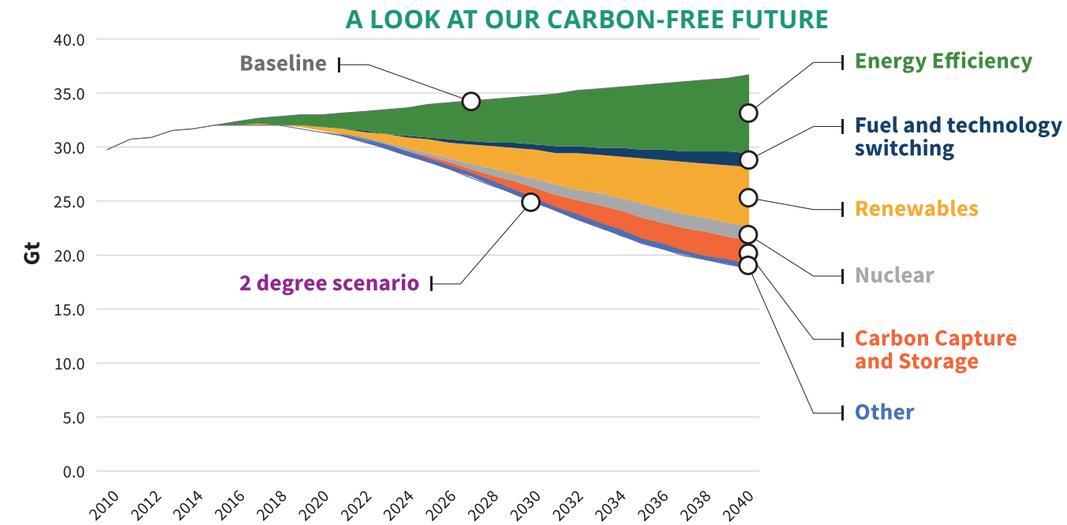
CHAPTER 6 – STRATEGIES AND ACTIONS: MUNICIPAL EMISSIONS

The Municipal Sector represents ~5% of Charlottesville's GHG Emissions Profile. GHG emissions come from energy used to power our City government and school facilities (referred to in this Chapter as 'the City'), our streetlights and traffic signals, and the fuels for City fleet, transit, school buses, and other mobile assets such as landscaping equipment and generators. The primary energy and fuel sources are electricity, natural gas, gasoline and diesel.



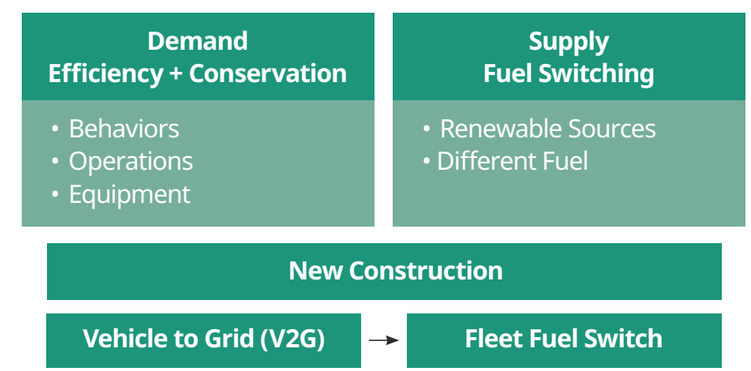
The chart above shows the proportion of emissions from each of these areas, with Buildings and Energy representing more than half of the municipal emissions, fuel uses representing about 40%, and the electricity to power our streetlights and traffic signals representing the rest. More information about how these emissions are represented in Charlottesville's community-wide emissions inventory is in Chapter 3 of this plan.

Different from the community-wide emissions chapter, as the owner and operators of most of its facilities, the City has direct control over its emissions and can undertake the actions needed to reduce them. Additionally, the City has some internal resources that can inform and support next steps, such as the Energy and Water Management Program and the managers for the various parts of the City's vehicles and mobile assets. As a result, some of the Key Actions and information in this chapter will be more detailed than what can be provided for addressing community-wide emissions reductions.



Source: https://www.aceee.org/sites/default/files/publications/researchreports/u1604.pdf

In looking to where emissions reductions are most possible, we see a similar order of potential as in the community profile: reducing demand followed by switching to lower and zero carbon fuels. The graph above, from a study done by the American Council for an Energy Efficient Economy, shows the areas with greatest potential to reduce GHG emissions. The green section corresponds to reducing Demand, and the blue and yellow sections to Fuel Switching. What these approaches look like in action can be seen in the chart below. Some actions, such as **New Construction** and **Vehicle-to-Grid (V2G)**, which is connected to Fleet fuel switching, can bridge across these two approaches.



MUNICIPAL BUILDINGS AND ENERGY

Charlottesville's Municipal Buildings and Energy section includes all City facilities and energy uses for which the City (schools and government) receives utility bills. The two power sources used are electricity and natural gas. Proposals for this section were developed with the City's Energy Management Program and build upon the work that program is pursuing to reduce energy demand within City facilities through equipment upgrades, improving operations, policies/process adoption for systematic change, and considerations of renewable energy and fuel switching options.

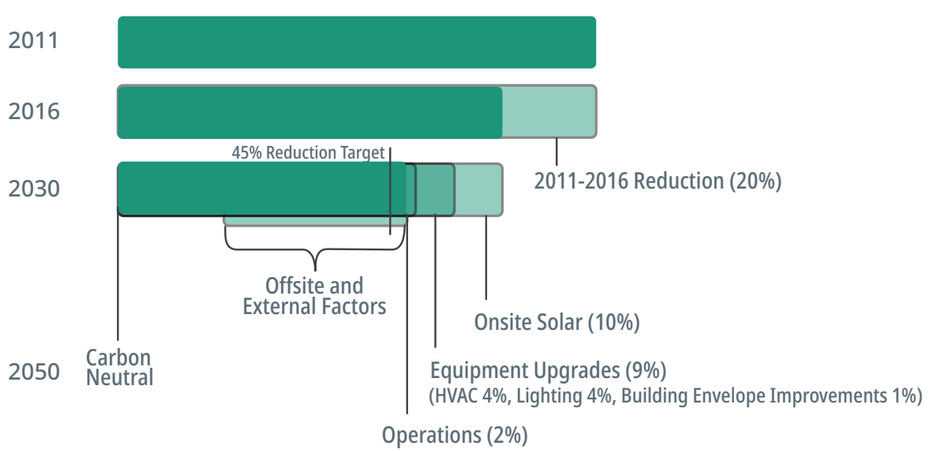
REACHING 2030

Working from the adopted goals of a 45% reduction by 2030 measured from 2011 and carbon neutrality by 2050, as well as City Council's resolution supporting front loaded reductions, the graph below (Municipal Building & Energy Use: GHG Reductions) shows the realized emissions reductions between 2011-2016 and the estimated potential of actions the City can perform onsite. With the combined reductions of 20% from 2011-2016, 10% from installing onsite solar, 9% from equipment upgrades (HVAC 4%, Lighting 4%, Building Envelope Improvements 1%), and 2% from operational adjustments, the City would only be able to achieve a 41% reduction and so must look to offsite and external factors to achieve its emissions reduction goals. Offsite and external factors include:

- Emissions reductions from grid-supplied electricity from Dominion Energy. Following the Virginia Clean Economy Act requirements, Charlottesville could expect that 40% of its electricity from Dominion will be carbon-free by 2030 and 100% carbon-free by 2045. These emissions reductions per kilowatt hour (kWh) will influence the Charlottesville's municipal emissions reductions.
- Transition of equipment to electric would significantly contribute to emissions reductions, and could provide an opportunity to front-load reductions. The City has not yet undertaken a study on electrifying city owned buildings, so emissions savings from this strategy are not reflected in the graph below.
- Increasing renewable electricity supply from offsite locations, including through **Virtual Power Purchase Agreements (VPPAs)**, also referred to as a "**contract for differences**"
- Purchasing of carbon offsets and participation in Dominion's Green Power Purchasing program (see Chapter 8 for more information on carbon offsets)
- Emerging Markets for renewable natural gas, hydrogen, and **carbon farming** will continue to evolve and may offer new options for Charlottesville to consider in future updates of this plan.

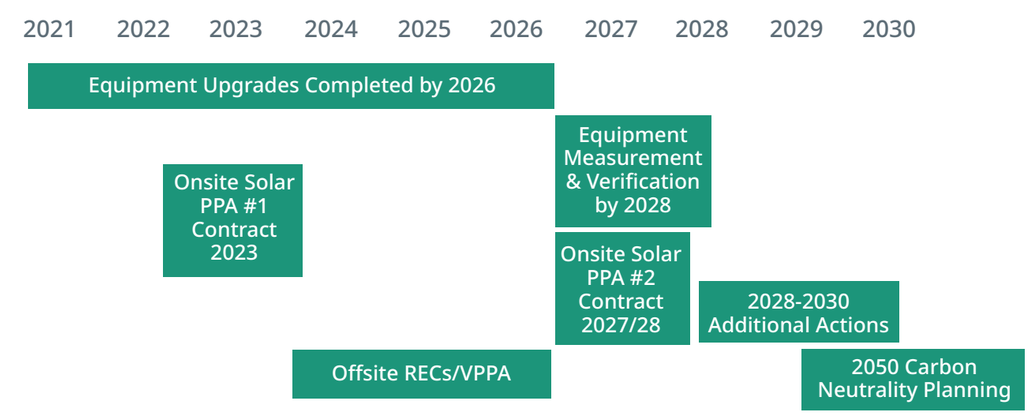
Municipal Building & Energy Use: GHG Reductions

Showing actual reductions from 2011-2016 and potential reductions available



The timeline below demonstrates how these could be ordered to target Charlottesville's 2030 goal. This timeline presents the pursuit of two onsite solar PPAs, completion of equipment upgrades along with initial measurement and verification of energy savings post-installation, execution of one offsite PPA, VPPA or other REC purchase, and consideration of remaining needs and options to be accomplished between 2028 and 2030 before transitioning to focus on achieving the 2050 carbon neutrality goal.

Potential Timeline – for 2030



ADDRESSING CHALLENGES

Accomplishing these actions will require both staff time and funding resources, both of which are currently constrained and limit opportunities for incorporating emissions reductions through new projects as well as during more routine activities such as equipment repairs and replacements. Specific points of challenge we heard are that:

- Staff is time constrained and is anticipated to continue to be so
- Local funding is constrained and is anticipated to continue to be so
- The combination of an aging building portfolio with little new construction or significant retrofit projects along with our constrained staff and funding resources has resulted in an environment where facility projects tend to be reactive – responding to specific issues that have arisen – and thus have the potential to be narrow in focus and for disparate but overlapping projects to occur within the same building
- There is limited awareness during project planning phases of energy performance of buildings across the City and Schools' portfolio
- There is a need for climate action projects to begin soon and at a larger scale than current coordination and project priority lists support
- Energy performance targets for existing and new facilities could be helpful
- The City utilizes a contractor network

to support its work, which may offer a potential avenue to additionally support GHG reductions through requirements in those contracts

Given these challenges, the following approaches are recommended for the City to pursue:

- Contracting structures that allow project funding through realized energy savings, avoided costs, and reduced operational costs are favored to maximize progress and reduce dependence on Capital Improvement Funds.
- Project delivery structures that allow for an extension of staff's resources through overseen contracted services – rather than relying solely on in-house staff support – are favored. Examples could be contracted construction management, turnkey construction, and contracting outside expertise for specific features. The costs of contracting this additional support would need to be included in the overall project budget, and involvement of Facilities Development and Facilities Maintenance to support and inform these contracts is essential.
- To support the integration of energy and climate action components in facility projects, internal coordination adjustments are needed, such as:
  - Increasing awareness of facility energy performance in project planning
  - Introducing opportunities for holistic consideration of facility improvements
  - Integrating climate and energy capital projects into the annual workplans for Facilities Development, Facilities Maintenance, and Environmental Sustainability

CONNECTING TO THE CAPITAL IMPROVEMENT PROGRAM (CIP) PROCESS

Every year, the City undergoes a process to adopt a budget for its Capital Improvement Program (CIP) Fund. The CIP provides funding for streets, public buildings, land, and other capital assets. Capital improvements include physical construction projects involving City properties, facilities, and infrastructure, such as new facilities, major renovations, roof replacements, sidewalk repairs, and tree plantings along streets and in parks. The CIP process looks at a 5-year funding projection. Each annual CIP funds only the upcoming year's projects.

The CIP process is designed to coordinate and align capital projects with Council's strategic priorities while balancing capital investments with available financial resources. It begins with budget funding requests from City departments for proposed capital improvement projects. Through reviews of available funding and project prioritization, a set of projects and their associated funding amounts are the subject of a series of Council work sessions and proposed for adoption by City Council as the City's annual CIP.

To date, climate-related capital projects have not solely been funded through City CIP. Grant funds, alternative financing structures that utilize energy costs savings, and other existing funding sources within the City continue to offer alternative means to fund emissions reducing projects within our local government assets. However, when a capital project is not part of the City CIP, it is then not incorporated into the annual project manager workplans which typically are developed to deliver the adopted CIP projects and fully fill existing project managers' workload capacity. This situation has resulted in conflicting priorities for staff and limited available project management resources to be dedicated to climate projects. With the oncoming federal grant funding through the 2021 IIJA and 2022 IRA, and other non-CIP contract structures for climate projects, it is anticipated that the City's capital climate projects will continue to face this CIP-project manager work plan challenge.

SUB-GOALS

Embedded in the 2030 timeline above and within the Strategies and Key Actions below are the following sub-goals:

- Complete an Energy Savings Performance Contract to accomplish equipment upgrades across the City's building and facilities portfolio and to supplement constrained staff time and local funding availability
- Complete onsite solar Power Purchase Agreement(s) PPAs to deploy renewable energy generation across the City's building and facilities portfolio in alignment with building roof replacement and to supplement constrained staff time and local funding availability
- Achieve 100% carbon-neutrality for all electricity used in City buildings and facilities by 2030
- Implement process improvements to resolve the challenge of accessing project management support for non-CIP funded climate projects
- Establish a process where cost savings from completed emissions-reducing projects are used to fund future projects

STRATEGIES AND KEY ACTIONS

STRATEGY: Reduce Energy Demand in Existing Buildings

> Key Action: Pursue energy retrofits holistically across the City's building portfolio:
  - Implement an Energy Savings Performance Contract to achieve scale and depth of energy improvements while leveraging City funds and reducing pressure on staff capacity
  - Integrate evaluation of energy demand needs when upgrading or replacing equipment, and opt for lower carbon energy sources when suitable equipment options are available
  - Adopt internal coordination and process adjustments to support ongoing holistic evaluation of energy needs within the City's buildings

> Key Action: Adopt operations procedures to maintain and increase efficient energy performance:
  - Establish a regular schedule for retro-commissioning, controls settings review, and performing preventative maintenance. Incorporate schedule into annual workplans and energy management reports
  - Identify and formalize opportunities to manage and reduce occupied building hours while maximizing use of facility space across the building portfolio. Consider schedule adjustments, remote work, and hour-shifted work schedules

> Key Action: Behaviors & Standards:
  - Engage, educate, and encourage building occupants on behavior practices that reduce emissions
  - Continue to operate in accordance with the 2019 Energy and Water Management Policy
  - Develop and adopt:
    - Comprehensive retrofit policy
    - Retro-commissioning policy
  - Publish building performance metrics

- Benchmarking disclosure for municipal buildings
- Utility dashboard
- ENERGY STAR score portfolio target
- Annual municipal Energy and Water Management Report

STRATEGY: Reduce Energy Demand for New Construction

> Key Action: Develop and adopt energy-based (EUI) design standards for new construction

> Key Action: Integrate new building standards into the City's Green Building Policy with consideration of integrated renewable energy systems, solar-ready, and EV-ready aspects

> Key Action: Develop a process to screen new construction projects for net zero potential

> Key Action: Evaluate by 2025 a cost, operations, and energy analysis comparison of adopted EUI standard vs. net zero construction for at least one project (current or past) to inform future project planning

STRATEGY: Achieve carbon neutrality for all electricity that is used by City facilities by 2030

> Key Action: Integrate renewable energy systems – or solar-ready standards – into all new construction projects. If solar-ready standards, ensure solar PV will be added within 2 years

> Key Action: Establish a coordinated schedule for roof replacement and installation of rooftop solar energy systems

> Key Action: Through energy efficiency improvements, building energy standards, and energy storage, maximize the percentage of total electricity use that is provided by onsite renewable energy

> Key Action: Implement Power Purchase Agreements (PPAs) to install solar energy systems at City facilities at scale and with reduced dependency on CIP funding

> Key Action: Assess and track offsite options for achieving carbon neutral electricity, such as RECs, carbon sequestration offsets, Dominion's Green Power Program

> Key Action: Assess and pursue Virtual Power Purchase Agreements (VPPAs) to secure carbon and renewable energy credit attributes

STRATEGY: Incorporate internal process adjustments to improve coordination effectiveness and collaboration on capital project and planning

> Key Action: Increase awareness of facility energy performance in project planning

> Key Action: Introduce opportunities for holistic consideration of facility improvements in CIP project planning

> Key Action: Integrate climate and energy capital projects along with CIP-funded projects into annual workplans

> Key Action: Involve Finance, Procurement, Risk, and Budget earlier than normal in capital improvement planning when pursuing energy procurement and energy service contracting structures

> Key Action: Establish a process by which cost savings from climate and energy improvement projects can be tracked and applied towards the next round of improvements

> Key Action: Provide training resources as needed and identified for project teams, first responders, and maintenance personnel

MUNICIPAL STREETLIGHTS AND TRAFFIC SIGNALS

Outdoor lighting along Charlottesville's streets, the Downtown Mall pedestrian mall, in its Parks, and at intersections is provided through a combination of streetlights that are owned and maintained by Dominion Energy and pedestrian and other outdoor lighting that is owned and maintained by the City of Charlottesville. Traffic signals are owned and maintained by the City of Charlottesville.

LED STREETLIGHTS

Light Emitting Diode (LED) lighting uses approximately 85%-90% less energy than traditional lighting, is available at different color temperatures (the color of the light), and can be designed to direct light in a fully downward and more linear manner which helps with reducing light pollution and focusing the light on particular areas such as sidewalks. LED outdoor lighting is generally considered to produce a better quality of light since it is able to more evenly distribute light and reduces hot spots that are brightly lit while areas between lights remain dark.

For many years, the utility rate structure with Dominion for streetlighting made LED lighting more expensive than the traditional High Intensity Discharge (HID) lighting that was already installed. This pricing structure was changed during the most recent contract update, and LEDs are now available to Charlottesville at a monthly cost less than their HID alternatives. Additionally, Dominion has adopted a policy of converting lighting fixtures that have failed to LED models. Charlottesville can request a proactive conversion of streetlights for a one-time fee. The estimated cost to proactively convert all Dominion-owned streetlights in Charlottesville would be recouped through cost savings within a 3-4 year period.

PEDESTRIAN LIGHTING

Along corridors such as West Main Street, paved pathways in some of the City's Parks, and the Downtown Pedestrian Mall have lighting that is referred to a 'pedestrian lighting'. These lights are intended to illuminate the sidewalk or non-motor vehicle travel way, are located closer to ground level than streetlights, and often have design features such as appearing similar to lantern lights. Lighting of this type is owned and maintained by the City of Charlottesville. A single full inventory of this lighting type and suitable LED alternatives has not yet been developed. This undertaking will require research into what LED models are available, associated costs, and approvals (depending on lighting location) by committees such as the Board of Architectural Review.

TRAFFIC SIGNALS

Approximately 90% of the City's traffic signals have already been converted to LEDs. Identifying the remaining fixtures and securing funding are the necessary next steps to completing this full conversion to LEDs.

SUB-GOALS

- Convert Dominion-owned streetlights to LEDs by 2030
- Convert City-owned exterior Lighting to LEDs by 2030
- Complete conversion of traffic signals to LEDs by 2030

STRATEGIES AND KEY ACTIONS

STRATEGY: Convert Streetlights & Traffic Signals to LEDs

> Key Action: Establish and fund a conversion plan for Dominion-owned lighting to LEDs

- Coordinate project timelines with City streetscape projects that would include lighting replacements, additions, or relocations

> Key Action: Develop conversion plan of suitable LED alternatives for City-owned lighting

- Compile comprehensive lighting inventory across departments for City-owned lighting
- Identify and secure approvals where necessary for suitable LED alternatives
- Include any identified LED model standards in the City's Standards and Design Manual

> Key Action: Develop a plan to complete conversion of remaining non-LED Traffic Signals to LEDs

> Key Action: Consider how energy cost savings from lighting conversion projects could be used to fund subsequent conversion rounds

MUNICIPAL TRANSPORTATION AND MOBILE ASSETS

GHG emissions in the municipal GHG inventory result from fuel use in City vehicles (referred to as the City Fleet, including passenger vehicles, light and heavy-duty trucks, fire apparatus, school buses, and transit buses) as well as the fuel used for other mobile assets such as landscaping equipment, mowers, and backup generators. Data is collected from the City-owned fueling stations that are reserved for City-vehicles only. Fuel sources are gasoline and diesel. Currently, data on fuel use for the 'other mobile assets' described above is intermixed with vehicle fuel data and cannot be separated.

See Chapter 3 of this plan for more information on how emissions from the City's fleet is included in the community-wide GHG inventory's Transportation data.

VEHICLES ACROSS THE CITY FLEET

The City fleet consists of different types of vehicles suited to each department's work needs. The City's Department of Public Works - Fleet Division works with City departments on vehicle selection and purchases (with the exception of transit buses) and provides maintenance for those fleet vehicles.

In looking towards reducing GHG emissions within the City fleet, strategies include transitioning to vehicles that use less fuel due to being more efficient with higher mile per gallon (MPG) ratings and vehicles that use lower and no-carbon fuels, as well as strategies that address driving behaviors, vehicle-sharing, and reducing the need to travel.

The largest fuel users within the fleet are police vehicles, school buses, and transit buses. It is estimated that 20%-30% of the fleet currently has comparable EV and hybrid models available. New models are coming available, and much research and development is happening in this market. For example, the Ford F-150 Lightning all-electric pick-up truck recently came onto the market with 7,700 pounds of towing capacity and an EPA-estimated travel range of 230 miles on a single full battery charge[1].

When it is time to purchase a new or replacement vehicle, the City's Fleet Division manager works with the City department to coordinate vehicle selection and purchase. The Fleet Division prioritizes EVs and then hybrid vehicles, when available. This prioritization is a practice within the department and is not currently institutionalized through an adopted policy or **Standard Operating Procedure (SOP)**. Similarly, while any increase in purchase price for these more fuel efficient and low/no carbon fuel vehicles is assessed to confirm that greater operational cost savings (lower fuel and maintenance costs) will be realized over the lifetime of the vehicles, funding constraints can limit purchases options. For example, the budget for vehicle purchases pre-COVID was $1.3 million; it has been reduced to $760,000 now.

1 https://www.ford.com/trucks/f150/f150-lightning-electric-truck

EMPLOYEE ENGAGEMENT AND TRAINING

Training and engagement of employees on driving behaviors can positively affect vehicle performance and levels of fuel consumption, particularly in urban environments like Charlottesville. For example, aggressive driving uses more fuel as the engine needs to work harder to provide power for quick acceleration that is then lost as drivers approach other vehicles and the next traffic signal and slow down before quickly accelerating again. Other potential components seen in other driving behavior trainings include in-person test drives, supplemental video materials, and training/engagement sessions where information like the City's anti-idling policy for City vehicles could be reviewed. There is also opportunity to encourage employees to consider carpooling to meetings and events, using public transit (formerly free to City employees with their ID badge and currently free to all riders) or biking, walking, and scooters, or utilizing remote video conferencing options such as Teams and Zoom platforms.

Training for employees on new vehicle technologies – such as EVs – is particularly important. Most EVs come equipped with special controls to increase driving efficiency, regenerative braking, single pedal driving, and dashboard indicators that are unique to EVs. In addition, although EV charging equipment is quite easy to use, as a new technology, it is unfamiliar to most people and an initial introduction is reassuring to familiarize drivers with what to do and how to assist in the management of charging. Many drivers new to EVs can also have questions about their basic use, how to monitor and understand the vehicle range potential, and hesitancy to rely on something unfamiliar for their work travel without the opportunity to practice with it outside of a pressured situation.

Training programs like these could be included as a responsibility of the Fleet Division but would require increased staff capacity.

TRANSIT

Charlottesville Area Transit (**CAT**) is a department within the City that provides service to Charlottesville and limited portions of Albemarle. Transit buses are purchased through a combination of local City funds and a sizable portion of funding from the Federal and State governments, which come with specific requirements that determine eligibility of vehicles for purchase, when replacement can occur, and how many vehicles a transit fleet can include.

The City transit fleet currently consists of both diesel and hybrid diesel buses. Due to costly maintenance issues in the hybrid buses that began to occur within the last two years and near the end of life of the buses, CAT has pivoted to buying only diesel buses at this time.

In looking ahead at vehicle purchase options and transit fleet expansion, the **Federal Transit Administration (FTA)** requires a fleet fuel transition study to be completed before it will provide funding for alternative low and no carbon fuels. The fuel transition study will consider existing technology capabilities for compressed natural gas (CNG) buses, battery-electric buses, and electric-hydrogen fuel cell buses, maintenance and operations, and the operational requirements tied to the substantial amount of vehicle purchase funding received from the state and federal governments. Similar to other segments of the vehicle market, much research and development is occurring in this space and the technology is evolving. CAT initiated this study in 2022, and its results are expected in 2023.

For transit to be an effective mode of transportation within the community, it must be reliable. This reliability includes ensuring that vehicles are capable of completing the route schedules assigned and being available consistently and frequently along routes so that members of the public have confidence in the bus system. CAT has determined that providing such reliability would require a minimum 30-minute headway model (15 minute is preferred), supported by 101 drivers and 55-60 vehicles, which is twice CAT's current capacity. Meeting these needs will require working within the Federal and State regulations and aligning levels of local funding match.

Access to transit bus stops is also an essential need and will require working with City zoning and transportation planning, construction, and maintenance. Current challenges include bus stops that are disconnected from the adjacent street corners and sidewalks, limited physical space within the public right-of-way or through easements on private property to locate a bus stop, storm event barriers (such as buildup of snow and ice during and after snow events).

OTHER MOBILE ASSETS (NON-MOTOR VEHICLES)

The City's other mobile assets are largely located within the Departments of Parks and Recreation, Public Works, and Utilities. Reducing fuel use within these assets can be accomplished through replacing them with more efficient equipment, switching to lower or no-carbon fuel equipment such as electric options, and through increased operation efficiency and reduction in the use of these assets.

There is opportunity for greater management and tracking of these assets, as well as evaluation of what lower-or no emissions options are available. A switch to electric landscaping equipment has occurred for some items within the Parks and Recreation department, but no City policy or SOP has been adopted nor has a comprehensive evaluation of equipment optimization been conducted. Lastly, as the transition to electric equipment continues, there is a need to coordinate with the City's Energy Management Program to coordinate charging times with City utility rate schedules and energy management practices.

STRATEGIES AND KEY ACTIONS

STRATEGY: Plan and Support Transition to Zero-Carbon and Carbon-Neutral Fuel Sources for the City's Mobile Assets

Fleet-wide Focus

> Key Action: Develop and implement a Green Fleet policy with commitments to:
- fuel efficiency
- transitioning to EVs when suitable vehicle models are available
- behavior and training components
- remote meeting and alternative travel mode options
- improve ability for data tracking of vehicle energy use throughout the Fleet

> Key Action: Develop site standards for EV charging installations to meet accessibility, safety, and energy management, and data tracking needs (Fleet, School Buses, & Transit)

Transit Focus

> Key Action: Complete the Transit Alternative Fuels Transition Study, including the Environmental/Health Addendum

> Key Action: Initiate a Transit Pathways to Carbon Neutrality by 2050 Assessment

> Key Action: Work with City zoning to investigate options to increase easement access for bus stops along new developments on transit corridors

> Key Action: Work with Public Works and other relevant departments to research and investigate models to improve bus stop access during and post-storm events

> Key Action: Work with other Virginia localities on Federal and State standards limits

School Bus Focus

> Key Action: Evaluate and begin integrating EV School Buses into the City's pupil transportation fleet

Non-Motor Vehicle Mobile Assets Focus

> Key Action: Determine a method for tracking the amount of fuel used for non-motor vehicle use (ex. landscaping equipment)

> Key Action: Develop a plan to convert City-owned gasoline and diesel-powered assets to electric
- Evaluate suitable electric alternatives and the potential for replacement prior to end of equipment life
- Coordinate with the Energy Management Program on charging practices and data tracking needs

> Key Action: Reduce mowing areas on City properties, including right-of-ways, by establishing natural habitats for pollinators with native and drought-tolerant plants.
- As part of planning for this effort, consult the community to identify and preserve informal access pathways.

CHAPTER 7 – CHARLOTTESVILLE LEADING BY EXAMPLE

This chapter details ways that Charlottesville has historically been committed to environmental stewardship and ways it is working to ensure a just and livable future for all its residents.

CHARLOTTESVILLE AS A LEADER

Charlottesville has a long history of environmental leadership and climate action. After adopting environmental sustainability accords in 1998, establishing a dedicated Environmental Office in 2002, and being one of the early Virginia municipalities to formally commit to Climate Program in 2006, it was the first locality in Virginia to adopt updated, IPCC-informed emission reduction goals of 45% by 2030 and carbon neutrality by 2050.

This posture is consistent with direction from leadership and expectations from the community. It is captured in the recent 2021 Comprehensive Plan in Chapter 7 (Environment, Climate, and Food Equity) as sub-strategy to Goal 1 (Climate Change Mitigation, Emissions, and Energy): "The City government should lead by example on implementing emissions reduction strategies." This underscores the need for this Charlottesville Climate Action Plan to have robust and impactful Strategies and Key Actions specific to municipal operations and services.

Leaderships is also demonstrated through involvement with peer networks and coalitions as well as through policy and regulatory engagement.

PEER NETWORKS

Charlottesville staff are members of and actively participate in several nested peer networks that provide access to and support on many sustainability topics, with a strong focus on climate and energy work. The Urban Sustainability Peer Network (USDN) brings local government sustainability practitioners together to learn, collaborate, and accelerate the work of local sustainability. By equipping them with the knowledge, resources, and partnerships, USDN helps advance change locally in member communities as well as across the field of practice. The Virginia Energy and Sustainability Peer Network (VESPN) is a regional network initiated in 2015 by several Virginia USDN members. This group's members include career sustainability staff representing cities, school districts, and counties from across Virginia who believe in the power of collective action advancing state energy solutions. This member-run group has held multiple peer learning exchanges and created working groups focused on key sustainability issues including renewable energy and transportation electrification. VESPN joined the Southeast Sustainability Director's Network (SSDN) in 2021 and members have access to even more resources and support. SSDN works to connect local government sustainability professionals throughout the region to accelerate, scale, and implement sustainable best practices so that communities are equipped to adapt to and mitigate climate change.

PJM CITIES AND COMMUNITIES COALITION (PJMCCC)

Charlottesville joined several other Virginia cities and counties in 2018 in becoming members of PJMCCC, the first formal coalition of local governments with ambitious clean energy goals organized to drive decarbonization at the wholesale electricity market level. These leading cities and communities are dedicated to pursuing solutions to climate change, reducing carbon emissions and removing barriers to decarbonization in their regional wholesale electricity market — **the PJM Interconnection**. Cities and communities are also well-positioned to incorporate important goals (such as equity goals) into clean energy solutions, advocate on behalf of the consumers in their territory and work holistically on concurrent decarbonization strategies, such as large-scale renewable energy procurement, electrification, and efficiency measures.

OTHER RELATED ORGANIZATIONAL PARTICIPATION

The City has been an active member of a number of organizations, many that are Virginia-focused, that work in the climate and energy space. These include ICLEI USA – Local Governments for Sustainability, the US Green Building Council, Virginia Clean Cities (clean transportation focused), Virginia Energy Efficiency Council, and Resilient Virginia. All these organizations have provided valuable information, tools, and resources that have been useful to the development and delivery of programs and services.

POLICY AND REGULATORY ACTIVITY

Annually, the City of Charlottesville develops a legislative packet that is supplemental to the one developed by the TJPDC for their member localities. Since 2009, there have been specific items included that related to clean energy, climate, and related sustainability topics. The City has also taken the opportunity to provide public comment or adopt a resolution on various legislative and regulatory items, including the Virginia Energy Plans, VA's participation in the Regional Greenhouse Gas Initiative, No/Low vehicles, Department of Housing and Urban Development's (DHCD) establishment of programs funded though RGGI participation, and updating of VA's Uniform Statewide Building Code. Increasingly, there is an effort to coordinate with peer Virginia communities on feedback and input as it has been pointed out that the voice of local governments, especially ones representing communities with formal climate, energy, and sustainability goals, is limited in the processes.

THE CITY AS A LANDLORD

The set of buildings and facilities that are used to calculate the Municipal GHG inventory are buildings and facilities that the City of Charlottesville owns, operates, and uses. In addition to these, there are other buildings and properties that the City owns and leases. These lease agreements vary, as do the type of buildings, and maintenance and onsite operations are sometimes assigned to the occupant as part of the lease agreement. This set of City-owned and leased properties have their GHG emissions represented in the Charlottesville community-wide GHG inventory.

As the effective landlord for these properties, the City has a unique opportunity to evaluate its lease agreements and the conditions of these properties for opportunities to reduce GHG emissions. Incorporating the practices and actions that we are encouraging private property owners to take is a form of leading by example and could help establish templates and precedents for the private property community in how to address issues like the split incentive between property owner and renter.

EQUITY CONSIDERATIONS

Related equity considerations need to be further investigated as more information about the City's currently leased properties and the lease agreements is understood. At the time of this writing, full information on these properties and the associated recommended climate-related actions for each is not determined. An equity component could be seen in the City being willing to take on the same role and actions as it is asking of the community.

SUB-GOALS

- Understand the City's owned & leased property portfolio and advance emissions-reducing actions for these properties

STRATEGIES AND KEY ACTIONS

STRATEGY: Incorporate energy efficiency and renewable energy improvements into City-owned and leased properties to reduce community GHG emissions and positively affect the utility bill costs and comfort of the property tenants

> Key Action: Complete compilation and review of a full listing of all City-owned and leased properties, identifying key aspects such as responsibility for maintenance, operations, and property upgrades as well as any operational minimum requirements and information on building age and past retrofits

> Key Action: Incorporate the expectation and support for tenants of City-owned and leased properties to be responsible for contributing to reducing community GHG emissions

> Key Action: Develop a plan to assess properties for current energy standard baselines and develop recommended energy efficiency and renewable energy upgrades, including consideration of supporting EV charging and energy storage backup systems

> Key Action: Evaluate complementary funding structures and sources to support completion of GHG emissions-reducing upgrades and to adequately address the split incentive of upgrade costs to the City versus financial benefit to the tenants

THE CITY AS A MUNICIPAL GAS UTILITY

Charlottesville Gas is a municipal natural gas utility owned by the City of Charlottesville. As such, there are unique considerations – and opportunities – in working towards the community goals of GHG emissions reductions and achieving carbon neutrality. In relation to GHG emissions reductions, one role of Charlottesville Gas is the supplier of natural gas (a fossil fuel) to customers within the City of Charlottesville and whose emissions are included within Charlottesville's GHG inventory and emissions reduction goals. An additional role in Charlottesville Gas' business model is its relationship with other localities and customers within the Charlottesville-Albemarle region.

The following overview of Charlottesville Gas is presented in the City of Charlottesville's 2023 Utility Rate Report:

> The City of Charlottesville's natural gas utility is one of three (3) municipally owned gas utilities in the Commonwealth of Virginia and has been providing service to the residents of Charlottesville and Albemarle County for over 150 years. The Charlottesville gas utility currently provides service to Charlottesville, and to various portions of Albemarle County. Within the City of Charlottesville, 87.5% of the utility customers are provided natural gas service. The system consists of approximately 342 miles of main and over 300 miles of service lines. The system currently serves 21,300 customers (12,243 of which are in the City and 9,057 in Albemarle County).

Similar to Charlottesville, Albemarle County has adopted goals for a 45% emissions reduction by 2030 (measured from 2008) and carbon neutrality by 2050. The University of Virginia – located within the Charlottesville-Albemarle area and one of Charlottesville Gas' largest natural gas customers – has adopted more aggressive goals of carbon neutrality by 2030 and fossil-fuel free by 2050. In combination, these commitments by Charlottesville, Albemarle, and the University of Virginia affect Charlottesville Gas' entire service territory.

Charlottesville Gas has taken steps in a multi-prong approach in support of emissions reductions to date. More information on these current activities is included below. When looking ahead at what remains to be accomplished and considering how Charlottesville and Charlottesville Gas can meet carbon neutrality and fossil-fuel commitments, there are multiple complex, entwined, and evolving topics with interlocked implications that extend beyond climate action goals.

INVESTMENT IN INFRASTRUCTURE AND STRANDED ASSETS

The most recent IPCC report, released in 2022, speaks to the physical and material infrastructure of fossil fuel industries:

> Even if carbon capture systems are widely deployed, staying within the Paris Agreement's limits "will strand fossil-related assets," likely to the tune of trillions of dollars, wrote the IPCC's scientists. That is especially true for coal, with oil and gas growing more vulnerable as 2050 approaches.[1]

Stranded assets in this context are defined as "fossil fuel resources that cannot be burned and fossil fuel infrastructure (e.g., pipelines, power plants) that is no longer used and may end up as a liability before the end of its anticipated economic lifetime"[2]. Such changes have the potential to impact the costs to customers and to the City of Charlottesville.

1 https://www.eenews.net/articles/ipcc-report-oil-renewables-and-stranded-assets

2 Defined by The London School of Economics and Political Science 's Grantham Research Institute on Climate Change and the Environment along with further information at https://www.lse.ac.uk/granthaminstitute/explainers/what-are-stranded-assets

ALTERNATIVE RENEWABLE FUEL OPTIONS

Advancement of alternative fuels to natural gas is ongoing, with industry and Federal government level considerations at play. Two alternative fuels discussed within this topic are Renewable Natural Gas (RNG) and hydrogen. These are evolving markets and technologies, and future availability and cost are some of the many unknowns at this time. Currently, both fuels are not readily available across the US, have limited supplies and distribution networks, and are expected to have high demand from industrial customers. For hydrogen, there is an additional consideration of what type of hydrogen is available. There are two ways by which it is generated – "blue" hydrogen, which uses fossil fuels, and "green" hydrogen that uses renewable energy; community input has expressed rejecting blue hydrogen as a fuel source.

LOCAL POLICY DRIVERS AND INTERESTS

Over the course of updating Charlottesville's emissions reduction goals in 2019, the development of the latest Comprehensive Plan, and the development of this plan, Charlottesville Gas' operations, role(s), and future have regularly been brought up. Strategies and actions that have been recommended and requested by community members and organizations over the past several years are discussed in this section and are reflected in the following strategies from Charlottesville's 2021 Comprehensive Plan:

- Chapter 7 (Environment, Climate and Food Equity), Goal 1 (Climate Change, Mitigation, Emissions, and Energy), Strategy 1.8 is to "Research and identify strategies for greenhouse gas emission reductions that are compatible with the City's adopted climate goals."
- Chapter 9 (Community Facilities and Services), Goal 11 (Gas Infrastructure), Strategy 11.2 is to "Promote energy efficiency programs and continue to explore avenues to reduce natural gas consumption, meet carbon neutrality goals, and mitigate climate change."

DECARBONIZATION OF GAS UTILITY STUDY

In July 2022, City of Charlottesville's Department of Utilities issued a Request for Proposal (RFP) for a Decarbonization of Gas Utility Study. This technical study seeks to determine how the gas utility can be a part of the solution in achieving the City Council and [Albemarle County] Board of Supervisor's adopted, community-wide greenhouse gas reduction goals and recognizes the University of Virginia's fossil fuel free goal. The study aims to explore the feasibility and effectiveness of policy-driven electrification and alternative routes to achieve net-zero emissions. The results will address possible energy sources, prospective emissions reductions, impacts on City financials, potential economic burden to customers, and the legal ability the City of Charlottesville has to adopt certain actions within the purview of federal, state, and local laws.

ENERGY EFFICIENCY

Charlottesville Gas offers energy efficiency rebates for natural gas customers for programmable thermostats, tankless hot water heaters, and attic insulation and the Charlottesville Gas Energy Efficiency Program (CGEEP) – a no-cost home weatherization and energy efficiency upgrade program for income-qualified households, which has demonstrated an average 20% reduction per household in gas consumption during the winter months. In 2022, Charlottesville Gas partnered with the Arbor Day Foundation to provide customers with a free tree. Depending on where the tree is planted, this could provide cooling to the home via shade in the summer months and, if maintained, would contribute to Charlottesville's overall tree canopy.

ELECTRIFICATION

Another approach related to reducing consumption of natural gas is transitioning equipment to non-natural gas fuel sources, in particular electrification that can be powered by renewable energy sources. In community input, this topic was often raised and is discussed in the Buildings & Energy chapter of this plan.

CUSTOMER BASE EXPANSION

Following the logic of reducing consumption of natural gas is the approach of not expanding the utility's service territory and limiting new customers. In 2018, Charlottesville Gas stopped all forms of paid and free advertising for new gas installation in homes and businesses and has seen a steady decline in demand for new gas services since then. With a scarcity of developable land in the City, the capacity to expand the gas system for new construction within City's limits is minimal. New construction continues to expand in Albemarle County's development areas.

Some community members also noted that Charlottesville Gas provides a discounted cost for new developments to include natural gas supply as part of their initial construction. Charlottesville Gas evaluates each proposed development as well as potential industrial/commercial customers based on the Gas Main Extension Policy, which is referenced in the City Code Section 31-30. Charlottesville Gas currently offers natural gas based on the proposed connected loads of the gas appliances and the prospective revenues that would be generated by natural gas sales in each development or industrial/commercial customers.

Some community input on this plan also advocated to restrict any new hookups within the gas system's existing territory. Charlottesville's legal authority to do this is unknown at this time and is included in the Decarbonization of Gas Utility Study. Such a decision could affect entities such as Charlottesville Area Transit that is currently undertaking a fuel transition study to look at alternatives to diesel for its buses. It is anticipated that the transit fuel transitions study will be completed in 2023 and will inform Charlottesville's potential to reduce GHG emissions within its Municipal Transportation inventory.

SYSTEM OPERATIONS AND LEAKS

Charlottesville Gas is a local utility that owns and operates the systems that deliver natural gas to homes and businesses. Charlottesville Gas purchases gas from British Petroleum and, as such they are not involved in several steps of the natural gas industry (extraction and transportation via pipelines) that is recognized to be a major contributor to GHG emissions though methane leaks. Community input included questions about leaks from the gas system and about reporting and monitoring procedures, referencing a 2021 report on an eight-year study of Boston's gas system[1]. Charlottesville Gas notes that how the gas system was constructed, and the continuous monitoring and maintenance of it, helps to prevent or reduce the release of greenhouse gas (GHG) emissions caused by leaks. Eighty-eight percent (88%) of the distribution system is constructed of high-density polyethylene (HDPE) pipe, a material resistant to corrosion and manufactured in lengths that minimize connection points.

Charlottesville Gas continuously monitors the entire gas system for leaks using a vehicle-mounted Optical Methane Detector, sensitive to 1 part per million (ppm) at 10,000 measurements per second, that is driven down the street over every gas line. Utility staff also utilize handheld detectors to check lines that run from the street to homes and businesses. A leak that poses a threat to life, property or the environment is immediately repaired. Charlottesville Gas has seen year after year decreases in system leaks. In 2021, Charlottesville Gas reported 56 system wide leaks (not including 3rd party excavation damages). Charlottesville Gas' leaks per mile rate is 0.095, which is well below the national average of 0.282.

1 "Efforts to repair natural gas leaks aren't reducing methane emissions in Boston area, study finds". October 25, 2021. https://www.wbur.org/news/2021/10/25/methane-emissions-natural-gas-leaks-boston-study

CARBON OFFSETS

Carbon offsets are discussed further in the Carbon Offsets section of the Strategies and Actions: Drawdown chapter of this plan. Charlottesville Gas is in a multi-year agreement for a carbon offset program managed by its natural gas supplier, British Petroleum (BP), at a level equivalent to 25% of Charlottesville Gas' emissions. The program includes various carbon sequestration projects around the world, and includes afforestation activities, agricultural methane capture projects, and the construction of biogas installations. The offsets are subject to an issuance and verification process that aims to ensure the emissions reductions are real, additional, verifiable, and permanent. Community members who are familiar with offset programs and their complexities have expressed concern about the reliability and quality of these offsets.

EQUITY CONSIDERATIONS

Two primary equity focuses arose in conversations about transitioning to carbon neutrality and GHG emissions reductions in relation to natural gas:

1) As larger and more customers reduce their consumption of natural gas and/or transition away to become fully electric, the costs to meet operational and regulatory requirements will be placed on the utility's remaining and smaller customer, equating to a higher cost per customer. As discussed in the Buildings and Energy chapter, lower income households and rental households have less ability to transition their homes to alternative fuels and may be caught carrying this concentrated cost burden.
2) Specifically regarding transitioning away from natural gas to electric appliances and equipment, there are concerns about grid reliability and backup generators or battery storage. It was shared during some public housing redevelopment discussions that residents wanted to retain gas powered stoves and ovens because during electric outages, residents relied on those for cooking food and, on some occasions, for adding some heat to their units. Battery backups are currently higher cost items, and some properties may opt for a generator with a fuel tank. For larger users and essential resources, such as hospitals and emergency shelters, consideration of reliable backup power sources will be essential.

The Decarbonization of the Gas Utility Study is anticipated to consider equity and energy burden impacts within its scope of work.

STRATEGIES AND KEY ACTIONS

STRATEGY: Promote energy efficiency programs and continue to explore avenues to reduce natural gas consumption, meet carbon neutrality goals, and mitigate climate change

> Key Action: Complete the Decarbonization of Gas Utility Study and share results of the study with City Council

> Key Action: Work with BP to better understand its carbon offset program, evaluate its reliability, and be able to compare its benefits to other emissions reductions actions

> Key Action: Consider a commitment to make Charlottesville Gas fully carbon neutral – throughout its service territory – by 2050

> Key Action: Review the Gas Main Extension Policy for opportunities to align with climate action commitments

> Key Action: Evaluate additional funding and enhancements for energy efficiency property upgrade rebates and the CGEEP

> Key Action: Evaluation of a carbon fee for gas customers

REGIONAL AND STATE COORDINATION

While there is much need and opportunity for climate action within Charlottesville's city limits, there is an understanding that conditions external to Charlottesville can limit or enhance the actions that Charlottesville can take. Examples include state-level decisions affecting what local authority Charlottesville has to offer tax incentives, what the required building code standards are, and whether there is funding available from programs such as the Regional Greenhouse Gas Initiative (RGGI). Recognizing these outside influences, important efforts at various scales and coordination and collaboration with different stakeholders, peers, and partners are ongoing. Charlottesville has been engaged in a range of such efforts and will continue to identify and pursue opportunities.

During the development of this plan, the following topics were identified as focused opportunities for the City to support:

- Funding/Financing programs and sources – such as supporting the continuation of RGGI and initial funding of a state-level green bank
- Increasing energy efficiency standards in the building code
- Establishing a commercial building energy benchmarking program
- Actions to support and further anti-idling of privately owned automotive vehicles

CLIMATE ACTION TOGETHER

Launched in 2019, the City of Charlottesville, Albemarle County, and the University of Virginia recognized that they would each be making new commitments for climate action and undertaking new initiatives. In response to requests from the community to coordinate and limit duplication of efforts, sustainability staff from each organization established Climate Action Together – a joint effort to intentionally coordinate on community engagement and share resources to collaboratively support each other's climate action planning efforts. Each organization is working in parallel on specific goals and collaboratively building upon each other's work.

Together, through having each adopted new climate goals and developing climate action plans, we are building upon our region's history of commitments to sustainability and climate action and are collaborating on community outreach and some specific projects, such as the intersection of equity and climate action.

Community engagement and public input are an important part of the collaborative process, and Climate Action Together aims to engage our community to help advance climate action in our region.

During this planning process, the following topics were identified as opportunities for future collaboration:

- GHG Emissions Data
- Carbon Offsets
- Climate Resilience/Adaptation (and points where it connects to GHG emissions reductions)

CLIMATE LIAISON COMMITTEE

Convened in 2021 and meeting regularly, this committee is comprised of executives and program leads from the City and its regional planning partners including: Albemarle County, University of Virginia, Thomas Jefferson Planning District Commission/ Metropolitan Planning Organization (TJPDC/ MPO), Rivanna Authorities, City Council, City Management, City Public Works Department, and City Environmental Sustainability Division. The intended purpose for this committee is to find areas of alignment through the following:

- Develop and maintain awareness of City climate action discussions
- Function as a conduit to and from other regional coordination efforts
- Provide guidance on long-term approaches to "big horizon" topics

Through this committee, the following areas of alignment for possible future coordination were identified:

- Co-Create a 'picture' of regional planning timelines & grant opportunities
- Regional Hazard Mitigation Planning Opportunities:
  - TJPDC-led Regional Hazard Mitigation Plan Development – provide recommendations for next update's methodology, and opportunity to incorporate locality-specific data and climate risk vulnerability assessment results
  - Specific topics for coordination: Water Supply Plan; Flood Risks; Urban Heat Reduction
- TJPDC/MPO Long Range Transportation Plan and Smart Scale Projects – opportunity to make recommendations on climate criteria for project prioritization
- Transportation – managing the inflow and transition of commuters to and around the urban area
- Solid Waste – improved handling of organics and glass

LOCAL PARTNERSHIPS WITH NONPROFITS

Charlottesville is fortunate to have a number of non-profits whose mission and work is directly related to and supportive of climate action. Over the years, the City has had the opportunity to partner with these groups in various ways that focus on education and outreach, facilitation of action implementation, and investment in local assets that serve our community. The following are a few examples of local nonprofits with whom the City has worked for many years:

- The City works closely with the Local Energy Alliance Program (LEAP) to promote energy efficiency and renewable energy in the community through a suite of direct services that have included home energy audits and checkups, income qualifying weatherization, rebate programs, retrofit programs, solar programs, fuel-switching projects, and education and outreach. The City was one of a strong set of partners who collaborated on a successful grant application that established LEAP in 2009 and has continued to find ways to partner with them to pursue energy efficiency improvements and renewable energy upgrades.
- The City has worked with the Community Climate Collaborative (C3) on several initiatives in the last several years, including sponsoring (and participating in) the Better Business Challenge, a community-wide initiative that helps organizations save energy and innovate around sustainability, supporting the residential-focused Home Energy Challenge, and sponsoring the distribution of Climate Activity Kits created by C3 and the Virginia Discovery Museum. C3 has conducted work on a number of other climate-related topics (e.g., transportation, zoning, energy burden, climate policy) and has shared outcomes of that work with the community and with the City.

As the Climate Action Plan has many components that are well (or better) delivered by local nonprofits, ongoing and new opportunities will present themselves.

ADDITIONAL POTENTIAL LEADERSHIP OPPORTUNITIES

The City holds representative seats on many regional area boards and commissions. In addition, the City has staffed programs and expertise in the climate and energy space that other regional government agencies and authorities may not. Two potential opportunities for Charlottesville to lead regionally on climate are:

- Work with regional agency boards where the City sits as on the governing board or as a member of an advisory committee to assess energy efficiency, renewable energy, community solar, transportation, and land use planning opportunities
- Pursue opportunities for the City to utilize procurement processes to support and further energy efficiency and renewable energy projects and goals, such as solar PPAs, with other local government agency entities (e.g., Charlottesville City Schools, the Charlottesville Albemarle Airport Authority, the Albemarle-Charlottesville Regional Jail Authority, etc.)

CHAPTER 8 – STRATEGIES AND ACTIONS: DRAWDOWN

CARBON SEQUESTRATION

NATURE BASED SEQUESTRATION

On a global scale, about a third of annual GHG emissions related to human activity are re-absorbed into the land and oceans, while the remaining emissions remain in the atmosphere. Carbon absorbed into these natural "sinks" is sequestered - or stored - through natural processes. The most well-known and efficient process for sequestering carbon is photosynthesis, where trees and other plants absorb CO2 from the atmosphere and hold the carbon in their leaves, stems, roots, and trunks. Supporting land-based carbon sinks through protecting and restoring ecosystems and using already degraded land for development, as opposed to denuding wild lands, are critical strategies for drawing carbon out of the atmosphere, also known as **drawdown.**

Drawdown: the future point in time when levels of greenhouse gas concentrations in the atmosphere stop climbing and start to steadily decline

Soil is another important land-based carbon sink. Approximately a third of global GHG emissions come from the agricultural sector. Shifting from conventional to regenerative agricultural practices has the potential to sequester vast amounts of carbon through **carbon farming** and other innovations.

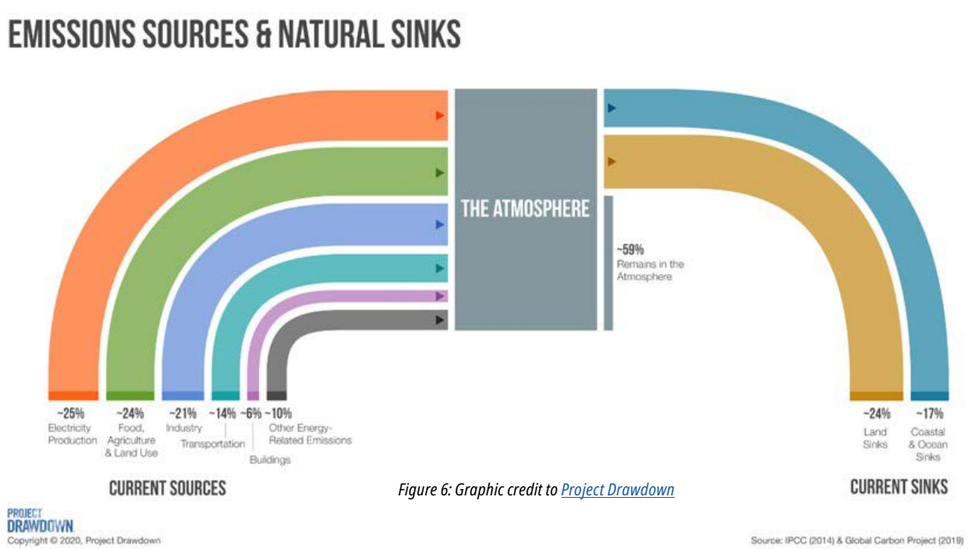


Figure 6: Graphic credit to Project Drawdown

TECHNOLOGICAL SEQUESTRATION

According to the Intergovernmental Panel on Climate Change's 2019 Working Group 1 Special Report, there are no open pathways to limiting global warming to 1.5°C without drawing greenhouse gases out of the atmosphere. The technological way to sequester GHGs is known as Carbon Capture, Utilization, and Storage (CCUS). This catch-all term refers to a wide variety of technologies that capture emissions at their source for either long term storage or industrial use, most often in a place where there is a point-source of pollution like a power plant or industrial facility. There are potential geologic storage sites for recovered GHG emissions all over the world, though transportation to those sites is currently a formidable barrier to storage scalability. As technology advances, there is a growing market for captured carbon as it can be used in the beverage industry, for enhanced oil recovery, and to make synthetic fuels, construction materials, biochar, and plastics.

CCUS is still an emerging technology, and a tiny fraction of emissions today are captured. Even further from large scale deployment than point-source capture is direct air capture (DAC), where carbon is recovered from ambient air. However, much advancement and investment has been made in CCUS in recent years and the industry is picking up momentum. In order to meet global net-zero targets by 2050, hard-to-abate emissions sources will require CCUS technology in one form or another.

It is important to acknowledge that investments and advancements in CCUS do not diminish the need to reduce greenhouse gas emissions in other ways.

STRATEGIES AND KEY ACTIONS

For strategies and actions related to nature-based sequestration, see the Nature Based Solutions section in Chapter 5.

STRATEGY: Continue to track the evolution of carbon sequestration technologies and incorporate as appropriate into future Climate Action Plan updates.

CARBON OFFSETS

Carbon offsets are a transactional item whereby individuals or organizations can purchase the environmental carbon benefits of an action that is taken elsewhere and count those towards a reduction of its own GHG emissions.

There is a wide variety of programs, types of activities, and price points for which carbon credits are offered. Industry experts have expressed concern surrounding the reliability, durability, additionality, and tracking/reporting accuracy of carbon offsets. Unlike increasing building insulation, installing more efficient HVAC equipment, electric vehicles, or new renewable energy systems where investments are made once within the community and the emissions reductions remain year-after-year, carbon credits need to be purchased and do not provide additional benefits within the community.

There is currently not a reliable way for Charlottesville to track and measure carbon offsets purchased by the community as a strategy to achieve GHG emissions reductions.

The carbon credit market and measurement and verification industry are evolving and offer the potential to fund meaningful projects such as reforestation in the Amazon or restoration of sea marshes and wetlands that can offer significant climate and climate protection benefits over the long term.

EQUITY CONSIDERATIONS

Carbon offsets may appear particularly attractive in situations where an individual or organization does not have choice over the equipment or fuel sources they use, where they do not have physical space to install on-site power generation, or where they cannot afford the upfront costs to do so and yet want to reduce their GHG emissions at least in part. Airline travel is one example where individuals and organizations seek to reduce their global GHG emissions impact even as they have no direct influence over the fuel efficiency of the plane, how the plane is operated and tuned, nor what type of fuel source the plane uses (jet fuel, as commercially viable electric plane travel is still an emerging technology).

For communities seeking to reduce the emissions of their regular day-to-day activities, purchasing carbon offsets implies a commitment to ongoing regular funding expenditures. If those same funds were directed towards activities that reduced the community's emissions in a reliable and ongoing manner (for example, with energy efficiency improvements to equipment and buildings or with onsite renewable energy systems), the benefits produced would continue to be realized annually without additional investment being necessary. As such, where there is a choice between investing in offsets elsewhere or investing in tangible actions and installations locally to reduce GHG emissions, particularly if those actions have intersectional benefits and can lessen unequally distributed burdens within the community, the choice of directing funds towards local tangible investments better aligns with equity goals.

SUB-GOALS

- Prioritize financial investments in local energy efficiency and renewable energy installations before pursuing carbon offsets and credits from outside of the community
- Support community decision-making around carbon offsets by beginning to establish recommended standards and assessment criteria

STRATEGIES AND KEY ACTIONS

STRATEGY: Continue to track the evolution of the carbon offset market while prioritizing local, verifiable, and measurable carbon reductions.

> Key Action: Adopt a commitment to high-quality standards for carbon credit purchases, using the Oxford Principles for Net Zero Aligned Carbon Offsetting and Second Nature Carbon Markets & Offsets Guidance, and work with regional partners and stakeholders to develop a process to guide and evaluate potential future purchases of offsets by the City, including a method of comparison of investments in offsets to investments in local emission-reduction projects.

> Key Action: Work regionally with partners to develop educational materials that can help community members and organizations understand carbon offsets and the associated considerations.

> Key Action: Consider establishing an advisory group for evaluating and recommending future purchases by the City to offset operations and service activities.

CHAPTER 9 – BEYOND THE GHG INVENTORY

During the development of this Plan, we heard from many members of the community about which areas of action they would like to see included. Those who participated in the listening sessions, workshops, and other input-gathering forums will recognize many of those ideas throughout the earlier chapters of this document. As discussed in Chapter 3, the directive for this document specifically focuses on pathways to achieve Charlottesville's adopted GHG reduction goal and the emissions that are accounted for in Charlottesville's GHG Inventory. There are items, however, that are important to consider beyond the GHG inventory.

Below is a list of topics we heard multiple times from the community as important areas of interest and additional solutions to the challenge of climate change. While these topics reach beyond Charlottesville's GHG inventory and this plan's focus, they are important to note as areas for parallel efforts and potential future community action:

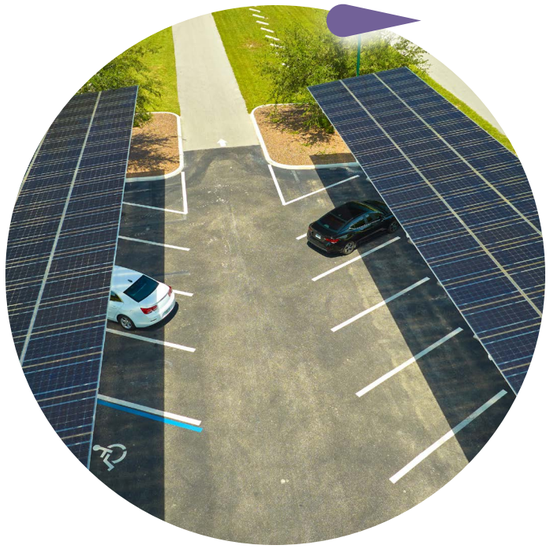
- Reducing idling within the community
- Addressing upstream emissions (specifically supply chain and food sourcing)
- Participating in or helping to develop the Circular Economy
- Addressing gas-powered lawncare equipment within the community
- Food choices and plant-based diets
- Reducing the embodied carbon in building materials, including concrete
- Retain the embodied carbon of existing buildings and structures by preserving and rehabilitating them on site

An example is the recent action the US Congress took on refrigerant management. An often overlooked but very potent source of greenhouse gases are the refrigerators and air conditioners found in our homes, vehicles, and businesses. Chemical refrigerants, a family of chemicals also known as Hydrofluorocarbons (HFCs) have up to 9,000 times more atmospheric warming capacity than carbon dioxide. 90% of the emissions from HFCs occur at our appliances' end-of-life, so proper handling and disposal is critical to preventing these chemicals from being released into the atmosphere[1]. Management can be difficult because refrigerant use is dispersed and widespread. Nearly everyone in the United States has a refrigerator and approximately 85% of Americans have some type of air conditioning in their home. Globally, as the world warms, access to cooling is expanding and is increasingly seen as a human rights issue. Fortunately, there are alternatives to chemical refrigerants such as propane and ammonia that are already available. Additionally, the HVAC (Heating, Ventilation, and Air Conditioning) industry is a rapidly evolving field that has been working to both reduce emissions and increase energy efficiency.

1 Refrigerant Management | Project Drawdown

In 2016, world leaders gathered in Kigali, Rwanda and made an agreement to phase out the use of HFCs over the next several decades. Building on the Montreal Protocol that phased out the manufacture and use of ozone-depleting chemicals (CFCs & HCFCs) in the 1980s, this agreement is known as the "Kigali Amendment". It requires countries who join the agreement to step down production and use of HFCs by 80% over 30 years. The United States did not ratify the Kigali Amendment until September 2022, during the development of this plan[2]. The adoption of the Kigali Amendment in the U.S. will change the availability of refrigerants over time and will lead to the development and adoption of new cooling technologies. There could also be increased regulation around the use and disposal of chemical refrigerants. This is a topic that Charlottesville will need to track and incorporate in the future as appropriate.

2 US Senate ratifies Kigali Amendment - Cooling Post



CHAPTER 10 – IMPLEMENTATION & NEXT STEPS

COMMUNITY INVOLVEMENT & AN "ALL HANDS WELCOME" APPROACH

Success in accomplishing the objectives of this plan and reducing Charlottesville's GHG emissions is reliant upon actions both within the community and within the local government. To that end, important next steps include engagement with the community, City departments, City regional partners, and City boards and commissions to facilitate ownership of and involvement in emissions reducing actions. As we move forward, integration of these partners in both actions and the annual update process referenced in Chapter 2 will be critical. The cross-community nature of climate action in Charlottesville can provide ground for new collaborations, partnerships, and leadership opportunities.

FURTHERING INDICATORS AND METRICS

One task for the first year of this plan is to further define and research meaningful (and available) **outcome indicators** and metrics for monitoring progress. These success measures will be sought for sub-goals, strategies, and key actions and, where applicable, will be specific, measurable, and time-bound. When working at a community-wide scale, there are barriers that limit our ability to access data at levels that can be connected to specific strategies in this plan. For example, improvements to the energy efficiency of existing buildings and the addition of onsite solar generation will appear the same in the energy use data that is available to us from the utilities – thus, in order to attribute decreases to one strategy over another, additional data is needed. Currently, through data collected by the Department of Neighborhood Services and the electrical permitting process, we are able to calculate an estimate of new onsite renewable energy produced. The ability to measure this, however, is dependent upon maintaining collection of this data as the City's permitting system continues to undergo its transition to a new permitting platform. Additionally, reduction gains through energy efficiency and onsite renewable energy generation will be offset and visibly 'erased' from the total energy use data by other actions that increase energy use – such as using more electronic devices at home and work and increases in the number of households and buildings within Charlottesville. Thus, identifying meaningful metrics and outcome indicators is an important task that needs to be thoroughly considered across many data sets – some of which may be available to the local government and some of which may be available through community and organizational partnerships.

As a starting point, we have compiled the activity data used to calculate Charlottesville's GHG inventory as well as a listing of what peer communities from across the state and country have included in their climate action plans for measuring and assessing outcomes.

IDENTIFIED PROJECTS AND NEEDED RESOURCES

Throughout this document are strategies and actions that speak to needed projects, processes, programs, and policies that require support in the form of funding and time (e.g. work capacity). Below is an initial summarization of key areas where further resources from the City are needed before actions can progress. It is anticipated that further refinement of needs and identification of needed resources will be identified as implementation of this plan is pursued.

The recently passed IRA and IIJA present opportunities to secure federal funding to invest in infrastructure and to mitigate the impacts of climate change. Furthermore, as this is a community-wide CAP with Strategies and Key Actions that are applicable to multiple community sectors, there are also private sector funding and financing opportunities.

CITY CAPITAL IMPROVEMENT PROGRAM PROJECTS

Project	Funding Need	Climate Sector
Energy Savings Performance Contract	$20M over 5 years	Municipal Buildings & Energy
LED Streetlight Conversion	$600,000 over 3 years	Municipal Streetlights & Traffic Signals
Onsite Solar PV Energy Systems (CHS is priority location)	Depends on funding/ financing method	Municipal Buildings & Energy
Increased pedestrian and bicycle infrastructure (including paved trails, sidewalks, and on-street facilities)	TBD	Transportation
Municipal Fleet EV Charging Installations	TBD	Municipal Transportation

PERSONNEL CAPACITY

- Project Management (Climate sector: Municipal Buildings & Energy)
- City Fleet Management (Climate sector: Municipal Transportation & Mobile Assets)
- Sustainable Materials Management & Organics Collection (Climate sector: Waste)
  - Public-facing services & Internal/ Custodial Services
- Translation support – both for proactive outreach and for community response

VEHICLES & EQUIPMENT

- Fuel-efficient and electric vehicle purchase funding for City vehicles – supporting transitions across the fleet include school buses and transit buses (Climate sector: Municipal Transportation & Mobile Assets)
- EV charging equipment to support City vehicles and a publicly accessible charging network (Climate sector: Municipal Transportation & Mobile Assets, and Community Transportation)
- Landscaping equipment replacements to electric-powered models (Climate sector: Municipal Transportation & Mobile Assets)

PROGRAMS/SERVICES

- Organics collection as a separate waste stream for City-provided community waste services
- Waste diversion and reduction within municipal facilities

FUNDING PROGRAMS

- Charlottesville Climate Action Fund, to leverage other funding pathways and support community-led climate projects (Climate sector: Community Buildings & Energy)
- City's Commercial Clean Energy Loan Fund, supporting energy efficiency and renewable energy projects in commercial properties (Climate sector: Community Buildings & Energy)

ALIGNMENT WITH THE CITY'S ZONING CODE UPDATE

The following is a list of items identified within this plan that relate to the City's Zoning Code Update that is currently in process.

	Buildings & Site Development	Transportation	Parking Lots	Tree Canopy	Greenspace (w/ urban agriculture)	Waste / Composting	Land Use & Small Area Planning
Identify, integrate, and incentivize climate-focused nature based solutions in the zoning code and other guides as appropriate				X	X		X
Establish a minimum tree canopy or other shade cover minimum for new parking lots and incentives for shading or conversion of existing parking lots			X	X			
Review and update code standards for trees within new developments	X			X			
Identify and adopt practices to accommodate trees and greenspace along with density, utility lines, and fire/emergency response access in the City's zoning ordinance and incorporate any updates (if needed) in the Standards and Design Manual	X	X		X			X
Include urban food gardens in the zoning code as a listed allowable use for residential and commercial properties	X				X		
Increase the number of community agriculture gardens through preservation of space, with a particular focus in areas identified as lacking access to healthy food and sites associated with or near to affordable housing developments					X		X
Integrate recommended lists of climate-related design standards into the zoning code and zoning incentives as well as in the Standards and Design Manual							X
Integrate climate-related design objectives, outcomes, and recommendations into the Small Area Plan development template							X
Complete a planning concept evaluation for establishing a "emerald necklace/green bracelet" or connected network of parks and natural resources within Charlottesville to be integrated with bicycle & pedestrian network routes		X			X		

	Buildings & Site Development	Transportation	Parking Lots	Tree Canopy	Greenspace (w/ urban agriculture)	Waste / Composting	Land Use & Small Area Planning
Create walkable, bikeable, and transit-served neighborhoods		X					
Include Transportation Demand Management Planning for sites in the zoning code		X					
Develop a mobility plan approach that seeks to leverage and interconnect bicycle, pedestrian, and transit infrastructure networks along with parking and the Future Land Use Map density areas		X					X
Continue planning and investment in a well-connected network of trails, shared use paths, sidewalks, and bike lanes		X					X
When planning and funding transportation projects, prioritize filling in connectivity gaps with a focus on connecting bus stops to adjacent roadways, Safe Routes to School, food access pathways, and providing safe and smooth transitions where bicycle, sidewalk, and trail infrastructure stops		X					
Work with City zoning to investigate options to increase easement access for bus stops along new developments on transit corridors		X					
Ensure the zoning code is supportive of renewable energy systems	X						
Identify EV-ready code standards for integration with zoning and city-funding processes		X	X				
Include EV-ready requirements for parking lot sizes that are over an established minimum size		X	X				
For future zoning updates, consider how to support and provide space for the collection of multiple waste streams at businesses and residences						X	
For future zoning updates, consider whether zoning changes are needed to support urban agriculture gardens and onsite composting					X	X	

APPENDIX 1 – DEFINITIONS & ABBREVIATIONS

DEFINITIONS

Adaptation Changing human systems and behaviors to better withstand the effects of the changing climate, for example increasing greenspace to better absorb increased rainfall.

Base Year Reference year used to measure from

Carbon Offsets A reduction or removal of emissions of carbon dioxide or other greenhouse gases made in order to compensate for emissions made elsewhere.

Carbon Farming Term for a variety of agricultural methods aimed at sequestering atmospheric carbon into the soil and in crop roots, wood and leaves.

CDP An international non-profit organization that helps companies and cities disclose their environmental impact. Formally the Carbon Disclosure Project. The CDP reporting platform is used by the Global Covenant of Mayors for communities like Charlottesville to share annual updates on their commitment progress and GHG emissions inventories.

Climate Change The long-term shift in global or regional climate patterns. In this plan, climate change refers specifically to the rise in global temperatures from the mid-20th century to the present.

Climate Justice A concept that addresses the just division, fair sharing, and equitable distribution of the benefits and burdens of climate change and responsibilities to deal with climate change.

Co-Benefits Benefits that result or are expected to result from a project or program other than a net reduction in greenhouse gas emissions, net reduction in energy use, or net sequestration of carbon.

Commercial Property Assessed Clean Energy (C-PACE) A policy-enabled financing mechanism that facilitates the financing of energy efficiency, renewable energy, and resiliency projects on both new and existing buildings.

Contract for Differences See definition for Virtual Power Purchase Agreement (VPPA)

Dillon Rule A legal principle that local governments have limited authority. Virginia is a Dillon Rule state.

Drawdown The future point in time when levels of greenhouse gas concentrations in the atmosphere stop climbing and start to steadily decline. Also, the act of removing CO2 or other GHGs from the atmosphere.

Energy Burden The percentage of household income that goes toward energy costs (electricity, home heating, and transportation). It stands to reason that the less money you make, the greater your energy burden will be.

Federal Transit Administration The agency within the United States Department of Transportation that provides financial and technical assistance to local public transportation systems.

Gleaning Donating edible but unused food, or harvesting extra crops from farms and gardens, to give to our neighbors facing hunger.

Global Covenant of Mayors A global coalition of city leaders addressing climate change by pledging to cut greenhouse gas emissions and prepare for the future impacts of climate change.

Greenfield Development Construction that takes place on previously undeveloped land.

Greenhouse Gases Heat trapping gases in the Earth's atmosphere that contribute to the greenhouse effect. Carbon dioxide, methane, and water vapor are the most commonly referenced greenhouse gases.

Inflation Reduction Act The IRA is a piece of federal legislation that was passed by the 117th US Congress and signed into law by the President in the Summer of 2022. It specifically allocates $369 billion to energy and climate change spending.

Infrastructure Investment and Jobs Act Also known as the Bipartisan Infrastructure Bill, IIJA is a piece of federal legislation passed by the 117th United States Congress and signed into law by the President in Fall 2021.

Intersectional/ Intersectionality A qualitative analytic framework that identifies how interlocking systems of power affect those who are most marginalized in society and takes these relationships into account when working to promote social and political equity.

Missing Middle Housing A range of house-scale buildings with multiple units—compatible in scale and form with detached single-family homes—located in a walkable neighborhood

Mitigation Reduction or elimination of actions and behaviors that contribute to climate change, for example reducing GHG emissions.

New Construction A piece of real estate that has a completely new improvement on the property.

Outcome Indicator The representation of a combined result of different initiatives, circumstances, and actions in areas where data limitations prevent the ability to connect specific actions or initiatives with discreet amounts of GHG emissions reductions.

DEFINITIONS CONTINUED

PJM Interconnection	A regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia. An RTO does not own power lines or generation equipment, but is a neutral, regulated organization that directs the operation of power lines and generators for many different owners.
Process and Fugitive Emissions	Leaks or other irregular releases of gases or vapors from appliances, storage tanks, pipelines, wells, or other infrastructure. Common sources include natural gas and refrigerants. In addition to the economic cost of lost commodities, fugitive emissions contribute to local air pollution and environmental harm.
Resilience	The capacity of a system (can be social, economic, or natural) to cope with a hazardous event, trend or disturbance, in this case those caused by climate change.
Split Incentive	The lack of appropriate incentives for landlords to implement energy efficiency measures in tenant-occupied properties.
Transit-Oriented Development (TOD)	A mix of commercial, residential, office and entertainment centered around or located near a transit station. Dense, walkable, mixed-use development near transit attracts people and adds to vibrant, connected communities. Successful TOD depends on access and density around the transit station. Convenient access to transit fosters development, while density encourages people to use the transit system.
Urban Heat-Island Effect	A phenomenon whereby cities experience higher air temperatures than the surrounding countryside. Temperatures can be especially high in urban areas with no or little tree cover or vegetation. See the City's Urban Heat Island webpage for more information.
Vehicle-to-Grid	Technology that enables energy to be pushed back to the power grid or to buildings from the battery of an electric vehicle.
Virginia Clean Economy Act of 2020	A piece of state-level clean energy legislation signed into law in the Spring of 2020 designed to spur clean energy job creation and reduce Virginia's carbon emissions primarily through the expansion of wind and solar power.
Virtual Power Purchase Agreement (a.k.a. Contract for Differences)	An agreement to pay a fixed price for a unit of power produced at a wind or solar facility, but there is no physical exchange of energy.
Vulnerability	The exposure and difficulty of a system in coping with shocks, risk, and other contingencies associated with climate change. Lack of adaptive capacity.

ABBREVIATIONS

BAU	**Business as usual**
BTU	**British Thermal Units**
CAP	**Climate Action Plan**
CAT	**Charlottesville Area Transit**
CIP	**Capital Improvement Program**
CO2	**Carbon Dioxide**
CO2e	**Carbon Dioxide equivalents based on global warming potential**
C-PACE	**Commercial Property Assessed Clean Energy (financing)**
EE	**Energy Efficiency**
EV	**Electric Vehicle**
FTA	**Federal Transit Administration**
FY	**Fiscal Year**
GHG	**Greenhouse Gas**
GPC	**Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories**
GWP	**Global Warming Potential**
ICLEI	**International Council on Local Environmental Initiatives (now known as Local Governments for Sustainability)**
IIJA	**Infrastructure Investment and Jobs Act of 2021**
IPCC	**Intergovernmental Panel on Climate Change**
IRA	**Inflation Reduction Act of 2022**
kWh	**Kilowatt hours**
LED	**Light Emitting Diode, a type of high-efficiency light bulb**
LEED	**Leadership in Energy and Environmental Design**
MWh	**Megawatt hours**
MT	**Metric Tons**
PACE	**Property Assessed Clean Energy (financing).**
PPB	**Parts per billion**
PPM	**Parts per million**
RE	**Renewable Energy**
RNG	**Renewable Natural Gas**

ABBREVIATIONS (CONTINUED)

RPS	**Renewable Portfolio Standard**
SOP	**Standard Operating Procedure**
TJPDC	**Thomas Jefferson Planning District Commission**
TOD	**Transit-Oriented Development**
USDN	**Urban Sustainability Peer Network**
VESPN	**Virginia Energy and Sustainability Peer Network**
VMT	**Vehicle Miles Traveled**
V2G	**Vehicle-to-Grid**