Fairfax County Community-wide

Energy and Climate Action Plan

A Fairfax County, Va., publication

Fairfax County Board of Supervisors

Jeffrey C. McKay, Chairman, At-Large
Penelope A. Gross, Vice Chairman, Mason District
James R. Walkinshaw, Braddock District
John W. Foust, Dranesville District
Walter L. Alcorn, Hunter Mill District
Rodney L. Lusk, Lee District
Daniel G. Storck, Mount Vernon District
Dalia A. Palchik, Providence District
Pat Herrity, Springfield District
Kathy L. Smith, Sully District

Bryan J. Hill, County Executive
Christopher Leonard, Deputy County Executive
Rachel O'Dwyer Flynn, Deputy County Executive
David M. Rohrer, Deputy County Executive
Joseph Mondoro, Chief Financial Officer

Acknowledgments

The Community-wide Energy and Climate Action Plan (CECAP) was coordinated by the Fairfax County Office of Environmental and Energy Coordination (OEEC). The Project Team consists of the following community members, Fairfax County staff, and consultants.

Working Group Members, participation from January 2020 to June 2021

Bradford Britain

Alexander Rough, Hunter Mill Focus Group, Sierra Club Great Falls, 350 Fairfax

Alexis Sloan Johnston, Dranesville Focus Group

Ann Bennett, Mason Focus Group

Anne Regan, Dranesville Focus Group

Bill Hafker, Sully Focus Group

Bob Kitchen, Springfield Focus Group, Virginia Clinicians for Climate Action, Citizens Climate Lobby

Brian T Castelli, Dranesville Focus Group, Sierra Club representative for the Virginia Chapter of Sierra Club

Caroline Gergel, Springfield Focus Group

Catherine C. Ledec, Audubon Society of Northern Virginia

Chip Goyette, Inova Health System

Cindy Speas, Providence Focus Group, Faith Alliance for Climate Solutions

Don Cammarata, Mount Vernon Focus Group, Covanta

Douglas L. Britt, Hunter Mill Focus Group

Dr. Ana I. Prados

Dr. David R. Kepley, Braddock Focus Group, Faith Alliance for Climate Solutions

Edward W. Monroe, Jr., Dranesville Focus Group, Fairfax County Environmental Quality Advisory Council (EQAC)

Elizabeth Ende, Dranesville Focus Group

Elizabeth Spike, Mason Focus Group, Great Falls Group of the Sierra Club

Eric Goplerud, Faith Alliance for Climate Solutions

Erin Trager, Hunter Mill Focus Group

George Lamb, Northern Virginia Soil and Water Conservation District

George Kralovec, Braddock Focus Group, Citizens Climate Lobby, Friends of Accotink Creek, Friends of Long Branch Stream Valley Park, American Association for the Advancement of Science STEM volunteer

Glenda C. Booth, Audubon Society of No. Va.

John Gustavo Blair, Fairfax County Economic Development Authority (FCEDA)

John T. Friedman, WGL Holdings, Inc.

Johna Gagnon, Lee Focus Group, Fairfax County Environmental Quality Advisory Council (EQAC)

Julie Kimmel, 350 Fairfax, Mothers Out Front

Karen Keegan, Dranesville Focus Group

Kathryn Ayan Alsegaf

Ken Quincy, Providence Focus Group, Dunn Loring Woods Civic Assn.

Kevin Holland, Mason Focus Group

Mike Zatz, Fairfax County Environmental Quality Advisory Council (EQAC)

Nancy Egan Sharma, Sully Focus Group

Paul Duncan, Braddock Focus Group, Faith Alliance for Climate Solutions

Paul W Gross, Braddock Focus Group, Friends of Royal Lake

Renee Grebe, Lee Focus Group, Audubon Naturalist Society

Richard Aiken, Mount Vernon Focus Group

Richard Weisman, Sully Focus Group, Environmental Quality Advisory Council

Rick Healy, Mason Focus Group, Fairfax County Environmental Quality Advisory Council (EQAC)

Robert D Brown Jr, Dranesville Focus Group

Sara A. Holtz, Providence Focus Group

Sarah Karush, Providence Focus Group

Scott Peterson, Faith Alliance for Climate Solutions

Shyamali Roy Hauth, Hunter Mill Focus Group, Faith Alliance for Climate Solutions

Sonya Breehey, Coalition for Smarter Growth

Thomas Calhoun, Braddock Focus Group

Tiffany Pryce Russom, Fairfax County NAACP

Wes Speer, Mount Vernon Focus Group, South County Federation

Whitney Redding, Mason Focus Group, Friends of Holmes Run and Raymondale Civic Association

Task Force Members, participation from January 2020 to October 2020

Laura Sebastianelli, Mount Vernon Focus Group

Rebecca Mordini, Mount Vernon Focus Group, Mt. Vernon Unitarian Church Climate Action Team

Samuel Raasch, Providence Focus Group, Inova Health System

Shawn O'Neill

Focus Group Members, participation from January 2020 to October 2020

Anila Angjeli, Mount Vernon Focus Group

Jim Kirkpatrick, Springfield Focus Group

Jim Zook, Springfield Focus Group

Judy Dority, Mount Vernon Focus Group

Matt Bell, Lee Focus Group; Former Commissioner of Fairfax County Redevelopment & Housing Authority

Michael S. Lawrence, Springfield Focus Group

Rev. Dr. Jean Wright, Providence Focus Group, Faith Alliance for Climate Solutions

Richard Bliss, Dranesville Focus Group

Fairfax County Staff

Aline Althen, OEEC
Kambiz Agazi, OEEC
Matthew Meyers, OEEC
Maya Dhavale, OEEC
Susan Hafeli, OEEC

ICF Incorporated, LLC

Adam Agalloco
Anna Wolenski
Candace Blair Cronin, Ph.D.
Cara Blumenthal
Carolyn Pugh
Deborah Harris
Eliza Puritz
Emily Golla
Erin Asher
Joanne Potter
John Jameson
John Venezia
Logan Pfeiffer
Michelle Paul Heelan, Ph.D.
Paola Massoli
Tyler Brewer
William Prindle
Zeyu Hu

The Metropolitan Washington Council of Governments

Jeffrey King
Maia Davis
Timothy Masters

CECAP
Community-wide Energy and Climate Action Plan

Office of Environmental and Energy Coordination

ICF

Metropolitan Washington Council of Governments

Table of Contents

LETTER FROM THE CHAIRMAN v

EXECUTIVE SUMMARY ES-1

INTRODUCTION 1

Climate Change Impacts in Fairfax County 2
Reducing Emissions 4
Why Develop a CECAP? 4

CECAP PROCESS AND METHODOLOGY 8

Key Contributors and Roles 8
Timeline 10

GREENHOUSE GAS EMISSIONS 13

Overview: 2005–2018 13
Community Inventory Methodology: 2005–2018 14
Drivers of GHG Change: 2005–2018 15
Components of the Emissions Inventory: Specific Inventory Sectors 16
County Operations Emissions Inventory 18
Modeled Scenarios for Consideration in Goal Setting 19

GREENHOUSE GAS REDUCTION GOALS 25

Goal-Setting Approach 25
Selected Goals 26

EMISSIONS REDUCTION STRATEGIES AND ACTIONS 32

CECAP Framework 32
Impact Categories 33
Implementation Categories 37
Greenhouse Gas Emissions Reduction Modeling 38
Impact Category Summary Matrix 39
Summary of Working Group Priorities 42
How to Read the Strategy and Action Sections 43

Buildings and Energy Efficiency 45

Strategy 1: Increase Energy Efficiency and Conservation in Existing Buildings 45
Action 1a: Increase Energy Efficiency in Residential Buildings 46
Action 1b: Increase Energy Efficiency in Commercial Buildings 48
Action 1c: Increase Energy Efficiency in Local Government Buildings and Streetlights 49
Action 1d: Develop and Expand District Energy and Combined Heat and Power Systems 50
Action 1e: Expand Gas and Electricity Demand Flexibility 52
Working Group-Recommended Activities for Implementation for Strategy 1 54

Strategy 2: Electrify Existing Buildings 58
Action 2a: Electrify Existing Residential Buildings 59
Action 2b: Electrify Existing Commercial Buildings 61
Action 2c: Reduce the Use of High Global Warming Potential Refrigerants 63
Working Group-Recommended Activities for Implementation for Strategy 2 65

Strategy 3: Implement Green Building Standards for New Buildings 68
Action 3a: Increase Building Code Stringency for Residential and Commercial Buildings 69
Action 3b: Support All-Electric Residential and Commercial Construction 70
Action 3c: Support Green Building Principles and Practices 72
Action 3d: Support Reuse of Existing Buildings 73
Working Group-Recommended Activities for Implementation for Strategy 3 75

Energy Supply 78

Strategy 4: Increase the Amount of Renewable Energy in the Electric Grid 78
Action 4a: Develop Large Offsite Grid Renewable Energy 79
Action 4b: Develop Grid Storage 80
Action 4c: Maintain Nuclear Generation at Current Levels 82
Working Group-Recommended Activities for Implementation for Strategy 4 84

Strategy 5: Increase Production of Onsite Renewable Energy 86
Action 5a: Expand Solar Photovoltaics on Existing Buildings 87
Action 5b: Support Solar Photovoltaics in All New Construction 89
Action 5c: Support Community Solar 90
Action 5d: Develop Battery Storage Projects 92
Working Group-Recommended Activities for Implementation for Strategy 5 94

Strategy 6: Increase Energy Supply from Resource-Recovered Gas, Hydrogen, and Power-to-Gas 97
Action 6a: Expand the Supply and Use of Resource-Recovered Gas, Hydrogen, and Power-to-Gas 99
Working Group-Recommended Activities for Implementation for Strategy 6 101

Transportation 103

Strategy 7: Increase Electric Vehicle (EV) Adoption 103
Action 7a: Leverage County Assets to Expand EV Use Across On-Road Vehicles and Off-Road Equipment 104
Action 7b: Increase EV Adoption by Residents, Businesses, and Private Fleets 106
Action 7c: Install EV Chargers in New Buildings 107
Working Group-Recommended Activities for Implementation for Strategy 7 109

Strategy 8: Support Sustainable Land Use, Active Transportation, Public Transportation, and Transportation Demand Management (TDM) to Reduce Vehicle-Miles Traveled 112
Action 8a: Support the Use and Improvement of Bicycle and Pedestrian Infrastructure 113
Action 8b: Support the Use and Improvement of Public Transportation and Commuter Services 114
Action 8c: Support Smart-Growth and Transportation Demand Management (TDM) Strategies 116
Working Group-Recommended Activities for Implementation for Strategy 8 118

Strategy 9: Increase Fuel Economy and Use of Low-Carbon Fuels for Transportation 121
Action 9a: Support Low-Carbon Fuels for Transportation 122
Action 9b: Support Improvements to Fuel Efficiency 124
Action 9c: Support Low-Carbon Fuels for Aviation 125
Working Group-Recommended Activities for Implementation for Strategy 9 127

Waste 129

Strategy 10: Reduce the Amount of Waste Generated and Divert Waste from Waste-to-Energy Facilities and Landfills 129
Action 10a: Reduce Overall Waste Generation 130
Action 10b: Increase Waste Diversion from Landfills and Waste-to-Energy Facilities Through Recycling and Composting 131
Working Group-Recommended Activities for Implementation for Strategy 10 134

Strategy 11: Responsibly Manage Waste Generated 137
Action 11a: Capture and Use Energy Generated at Waste-to-Energy Facilities and Landfills 138
Action 11b: Explore Alternative Options for Long-Term Waste Management 140
Action 11c: Capture and Use Energy Generated by Wastewater Treatment Processes 141
Working Group-Recommended Activities for Implementation for Strategy 11 143

Natural Resources 145

Strategy 12: Support Preservation, Restoration, and Expansion of Natural Systems, Green Spaces, and Soil Quality 145
Action 12a: Conserve Existing Tree Canopy, Green Spaces, and Soil Quality 146
Action 12b: Expand Tree Canopy and Green Spaces, and Improve Soil Management 148
Action 12c: Cross-Disciplinary County Staff Team to Evaluate Climate Change and Natural Resources Policies and Programs 150
Working Group-Recommended Activities for Implementation for Strategy 12 152

Emerging Technologies 155

COMMUNITY ENGAGEMENT 160

CURRENT POLICIES AND PROGRAMS/ IMPLEMENTATION 164

Strategies Related to Building Energy Use 165
Energy Supply 167
Transportation 169
Waste 171
Natural Resources 172
Next Steps 174

APPENDICES 175

Appendix A: Acronyms 175
Appendix B: Glossary 177
Appendix C: Full GHG Inventory Report, Business-As-Usual Projections, and Emissions Reduction Scenarios 178
Appendix D: GHG Modeling Methodology 179
Appendix E: Working Group Brainstorming Matrix 185
Appendix F: Results of the Working Group Prioritization Exercise 186
Appendix G: Summary of Public Feedback 188

Letter from the Chairman

Climate change is one of the biggest challenges facing Fairfax County today. As our region experiences more frequent and severe storm and precipitation events, flooding, high wind, and extreme heat, we are already grappling with the social, economic and environmental effects of a changing climate. As the largest county in Virginia, Fairfax County must lead in making significant, community-wide reductions to its greenhouse gas emissions that drive climate change.

Many Fairfax County businesses, organizations, and residents have already made notable progress toward reducing their greenhouse gas emissions. However, it will take collective action across the entire community to ensure we prevent or limit some of the worst effects of climate change. The Community-wide Energy and Climate Action Plan, or CECAP, lays out multi-sector greenhouse gas reduction strategies and identifies roles and responsibilities for federal, state and local stakeholders. As many of these strategies are ultimately voluntary, the CECAP is intended to educate and motivate community members on steps they can take to mitigate their carbon footprints.

When the Board of Supervisors voted to support the development of CECAP in 2019, we knew we needed a community-driven plan. Over the past 18 months, a Working Group including representative from local businesses, utilities, environmental groups, religious organizations, and social justice institutions, met to define the goals of CECAP, including the overarching goal to be carbon neutral by 2050. Relying on public input through surveys, meetings, and feedback sessions, the Working Group met routinely with county staff and consultants to evaluate and prioritize strategies and actions that community members can take to reduce their greenhouse gas emissions.

The Working Group was charged with a difficult task – to develop climate mitigation goals, strategies, and actions that reflect the needs of the Fairfax County community. As an added challenge, the CECAP planning process coincided with the onset of the COVID-19 pandemic and the need to transition to a virtual meeting environment. Community engagement processes subsequently had to be adapted. I would like to commend all involved in the planning process for their flexibility and patience throughout this time. Despite these difficulties, the Working Group, with input from the greater Fairfax County community, has developed an ambitious yet achievable plan that addresses the unique issues and opportunities the County faces.

Although the planning process for CECAP has come to an end, our work is far from over. The Board of Supervisors is committed to the long-term success of the plan by ensuring adequate and dedicated resources are in place to support implementation. However, meeting these aggressive climate mitigation goals will require all of us together to act to fight climate change.

This will be challenging. “Stopping” climate change often feels abstract, distance, and too difficult to resolve. That is why we developed CECAP to give our community the recommendations, tools, and steps to help us. This is crucial if we want Fairfax County to continue to be a safe and healthy place to live and work. As we move into the implementation phase of CECAP, I encourage each of you to work with us to ensure an equitable, sustainable future for generations to come.

Jeffrey C. McKay
Chairman, Fairfax County Board of Supervisors

EXECUTIVE SUMMARY

Climate Change Impacts in Fairfax County

Key Points

- Climate change is a human-caused crisis affecting human health, livelihoods, and the environment.
- Climate change effects are already impacting the lives of Fairfax County residents.
- Fairfax County worked with local stakeholders to create a Community-wide Energy and Climate Action Plan (CECAP).
- CECAP sets several greenhouse gas reduction goals to combat climate change.
- CECAP provides many strategies and actions everyone can do to reduce their emissions.
- CECAP gives guidance on elective actions for community members to take to assist in reaching CECAP goals, as well as actions for county, state, and federal governments.

Climate change is an existential crisis that is affecting human health, the environment, infrastructure, and the lives of people around the world and in Fairfax County. Global temperatures have already increased 1.8 degrees Fahrenheit (°F) since the end of the 19th century and will continue to rise for the foreseeable future. This global warming has led to climate change, which includes various effects such as altered precipitation patterns, more frequent and intense storms, longer and harsher droughts, and much more.

In Fairfax County, the amount of snowfall has been decreasing for decades, the number of extremely hot days (95°F+) has increased seven days from 1970–2018, and the incidences of tick- and mosquito-borne diseases has been increasing in recent years due to longer warm seasons. Current climate models project that Fairfax County and the surrounding region will experience substantial increases in temperatures by 2100 (up to 7°F), increased levels of precipitation, and more droughts in summer. Other key potential impacts of climate change include:

- Increased flood risk due to sea level rise and tidal surges.
- Expansion of flood-prone areas and an increase in flood frequency due to changes in precipitation patterns.
- Increased failure of septic systems, contaminating groundwater.
- Increased health impacts due to excessive heat, and vector-borne and communicable diseases.
- Economic impacts due to extreme weather events.
- Potential reduction in the reliability of electrical systems and the grid due to heating and cooling needs.[1]

[1] Reston Association. 2020. Reston Annual State of the Environment Report (RASER). Available at https://www.reston.org/nature-environmental-overview.

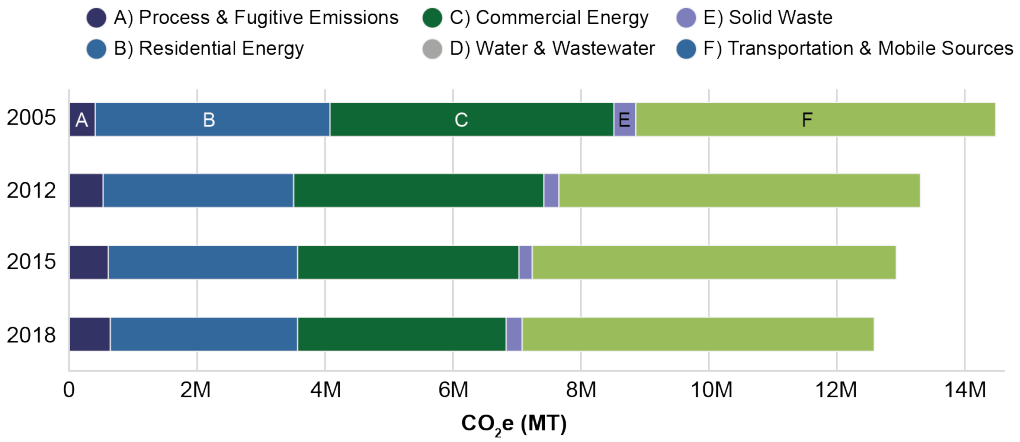
The scientific evidence demonstrating global climate change is clear and growing; human activities—such as burning fossil fuels, clearing undeveloped land, and managing waste poorly—are overwhelmingly responsible for causing climate change. These activities emit greenhouse gases (GHGs), such as carbon dioxide (CO_2), that enter the atmosphere and trap heat. Over time, the trapped heat slowly increases global temperatures, causing cascading climate effects that have significant effects on our lives and the environment. Global GHG emissions have been increasing since the 1800s, and unless we reverse this trend, the effects of climate change and the impacts on people and the environment will continue to increase as well.

How Does Fairfax County Contribute to Climate Change?

Community-wide GHG emissions have been tracked in Fairfax County since 2005 by creating an inventory of all GHGs emitted by various sources over one year. Different GHGs have different global warming potentials, so scientists created a measurement unit that converts the different potential to the equivalent amount of CO_2—this unit is called CO_2 equivalency, or CO_2e.

In 2018, Fairfax County emitted 12.6 million metric tons of CO_2e[2] (MMT CO_2e), which is equivalent to the emissions from the energy use of 1.5 million homes.[3] More than 90% of GHG emissions were the result of residential and commercial building energy consumption and transportation (see Figure ES-1). The other emissions are from other sources, including solid waste, wastewater treatment, and process and fugitive emissions (fugitive emissions are leaks and irregular releases). The main drivers of increased emissions in the county are primarily growth in population, increased commercial development, and use of synthetic refrigerants called hydrofluorocarbons. The main drivers of decreased emissions are improved energy efficiency, an increasingly less carbon-intensive electricity grid, and more fuel-efficient vehicles.

Figure ES-1: Fairfax County GHG Emissions by Activity Over Time



[2] CO_2 equivalent (CO_2e) is the basic unit of measure used to sum different GHGs by comparing their respective relative global warming effect to an index unit, namely the global warming effect of carbon dioxide.
[3] 2018 is the most recent year for available data for a GHG inventory for Fairfax County.

Between 2005 and 2018, the county population grew 15% to nearly 1.2 million people. Despite this growth, total GHG emissions decreased 13% from 14.52 MMT CO_2e in 2005 to 12.56 MMT CO_2e in 2018. Per capita emissions decreased 24% from 14.5 metric tons of CO2e (MT CO_2e) per capita in 2005 to 11.0 MT CO_2e per capita in 2018. These results show that we can reduce GHG emissions even as our community and economy grow. However, they also show that Fairfax County still emits a significant amount of GHGs and can reduce emissions further.

What Is CECAP?

In 2018, the Board of Supervisors Environmental Quality Advisory Council recommended that Fairfax County create CECAP to reduce GHG emissions. The Office of Environmental and Energy Coordination (OEEC) coordinated development of CECAP to:

- **Develop a roadmap** for Fairfax County to reduce GHG emissions and provide a way to engage the community in GHG emissions reduction efforts.
- **Provide citizens and local stakeholders a voice** in the climate planning process to ensure that the plan addresses local priorities and needs.

The plan gives a path for a **multi-level approach** to tackling climate change, which involves:

- **Community, individuals, and organizations**, which are specifically added to the climate change solution effort through CECAP.
- **Fairfax County government**, which can build on existing policies, programs, and planning processes to address climate change, as well as advocate for legislative change at the state level.
- **State and federal governments**, which both community members and the Fairfax County government can influence through collective advocacy.

CECAP is the first effort to involve the community in GHG emissions reduction efforts, and the first opportunity to add individual efforts to existing county, state, and federal emissions reduction efforts. CECAP is a community-driven plan that seeks the involvement of everyone across the county to take action to reduce GHG emissions.

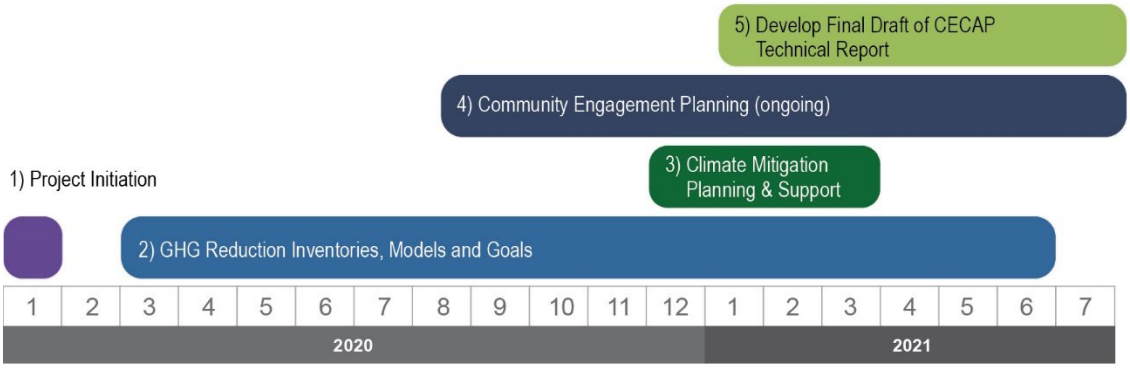
How Was CECAP Developed?

There were five main steps in the CECAP development process (see Figure ES-2), each of which had a distinct purpose and included several supporting actions. The key contributors included the following:

- **The Office of Environmental and Energy Coordination (OEEC)** led the process, coordinated among all the various contributors, and provided content for the final CECAP report.

- **ICF** supported climate action planning, technical analyses, facilitation of meetings with the community, and the development of the final CECAP report.
- **The Metropolitan Washington Council of Governments (COG)** developed the GHG inventory, business-as-usual emission projections, and emissions reduction scenarios.
- **The CECAP Working Group** served as the community decision-making body.
- **The Board of Supervisors** provided key input on the process.

Figure ES-2: The CECAP Process



1. **Project initiation**—Community members were selected by the Board of Supervisors to serve on nine Focus Groups, a Task Force (subsequently called the Working Group after October 2020) was created, and the project began in January 2020.
2. **GHG reduction inventories, models, and goals**—COG developed the 2018 GHG inventory for Fairfax County, COG created emissions reduction scenarios at the direction of Fairfax County to estimate future emissions, and members of the Working Group provided input on CECAP goals.
3. **Emissions reduction planning and support**—ICF developed the initial list of emissions reduction strategies and actions, which was revised and edited by the Working Group. ICF then developed the accompanying analyses, and the Working Group evaluated the options and selected the final set of actions.
4. **Community engagement planning**—The county developed outreach and communications materials and hosted public meetings to collect and assess public opinions of CECAP.
5. **Develop final CECAP technical report**—The CECAP technical report is a product of the Working Group discussions and perspectives, with technical materials produced by ICF and COG, with input from the public. The report reflects the majority opinion. Occasionally, in matters of significant difference, minority perspectives are represented.

Ultimately, the iterative process between community groups, local organizations, and other stakeholders resulted in a roadmap for the community to achieve its GHG emissions reduction goals.

What Is in the Plan?

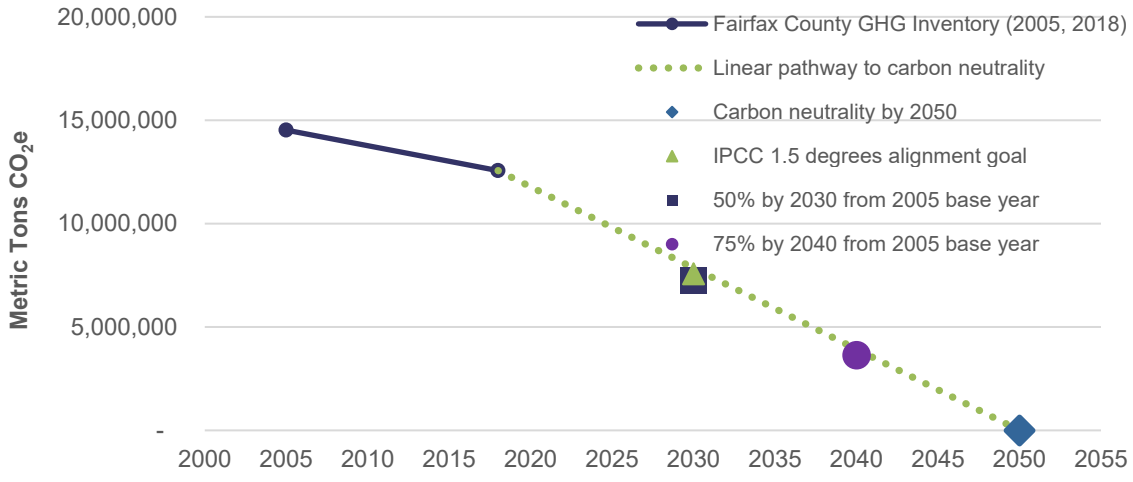
There is no comprehensive or immediate solution to reduce GHG emissions. Instead, we must implement multiple strategies, and all groups across society must commit to helping. CECAP sets forth GHG reduction goals, strategies, and their accompanying actions; the impacts of those actions; and activities for implementation for individuals and organizations, as well as county, state, and federal governments.

Greenhouse Gas Reduction Goals

CECAP is guided by a long-term emissions reduction goal, interim goals, and sector-specific goals. Fairfax County's long-term goal is to achieve carbon neutrality by 2050 from a 2005 base year, with at least 87% coming from GHG emissions reduction. The scenario modeling conducted by COG determined that a least an 87% reduction in GHG emissions was technically feasible given today's technologies and the additional opportunities future technologies may provide. It is for this reason that the community's long-term goal specifies at least an 87% reduction in actual emissions. Interim goals for 2030 and 2040 were established to help chart Fairfax County's path to carbon neutrality, as shown in Figure ES-3. The Working Group also established sector-specific goals for the Buildings and Energy Efficiency, Transportation, Waste, and Natural Resources sectors. See the Greenhouse Gas Reduction Goals section for more information on the goals of CECAP.

Fairfax County's long-term goal is to achieve carbon neutrality by 2050 from a 2005 base year, with at least 87% coming from GHG emissions reduction.

Figure ES-3: Fairfax County GHG Emissions Reduction Goals



CECAP Goals

- **Long-term target goal:** Fairfax County will aim to achieve carbon neutrality by 2050 from a 2005 base year, with at least 87% coming from GHG emissions reduction.
- **Interim year goal 2030:** Fairfax County will reduce GHG emissions by 50% by 2030, from a 2005 base year.
- **Interim year goal 2040:** Fairfax County will reduce GHG emissions by 75% by 2040, from a 2005 base year.
- **Sector-specific goals:** The sector-specific goals include two goals specific to the Building and Energy Efficiency sector, two goals specific to the Transportation sector, one goal specific to the Natural Resources sector, and one goal specific to the Waste sector.
  - All new, eligible buildings will have a commitment to **green building**.
  - Retrofit at least 100,000 housing units with **energy efficiency** measures by 2030.
  - Increase **transit and non-motorized commuting** to 30% (including teleworking) by 2030.
  - Increase plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs) to at least 15% of all light-duty vehicle registrations by 2030.
  - Expand the **tree canopy** to 60% with a minimum of 40% tree canopy coverage in every census block by 2030 and a minimum of 50% tree canopy coverage in every census block by 2050, prioritizing areas of highest socioeconomic need first.
  - Achieve **zero waste** by 2040, defined as at least 90% waste diverted from landfill/ incineration, in alignment with the definition by the Zero Waste International Alliance.

Emissions Reduction Strategies and Actions

In order to achieve those goals, CECAP encompasses strategies and actions needed to reduce GHG emissions in Fairfax County. Because more than 95% of all GHG emissions in the county come from sources other than government and school operations, CECAP describes what residents, businesses, and nonprofit organizations can do to be part of the solution. CECAP also describes what government at the county, state, and federal levels can do to reduce GHG emissions in the county. CECAP includes 12 strategies and 37 actions, presented in Figure ES-4. In the figure, each strategy is indicated with an "S" followed by the strategy number and each of the five sectors is identified by a different color.

Due to the ambitious nature of the GHG goals, **all strategies and actions must be part of the solution.**

Each strategy and its associated actions have different expected impacts, as well different activities for implementation recommended by the Working Group, all of which are described in detail in CECAP. Some actions are less expensive, easier, and faster to deploy than others. Some actions will have additional benefits, such as improved health outcomes

or increased equity. Some actions will reduce emissions a great deal, while others may reduce emissions to a lesser degree.

All of the actions described in CECAP will need to be undertaken in order to achieve emissions reduction goals. Still, Fairfax County residents, businesses, county government, and other stakeholders (e.g., organizations, commuters, state and federal governments) have diverse priorities and values that may lead to the selection of one action over another. To help community members and decision makers inside and outside of Fairfax County prioritize which actions to take, each action section describes the action's potential impacts in various categories.

The impact categories assessed include the following and are described further in the Impact Categories section:

- Greenhouse Gas (GHG)
- Public Health
- Environmental Resources
- Economic Opportunity
- Equity (i.e., One Fairfax)
- Payback
- Cost to Community Members
- Timeframe
- Other Considerations (e.g., climate adaptation, synergies with other strategies)

The expected GHG emissions reduction for each strategy are presented in Figure ES-5. Even with all strategies implemented by 2050, members of the Fairfax County community will need to rely on a portion of either emerging technologies or carbon offsets to meet the goal of carbon neutrality.

Together, the actions in CECAP can reduce emissions, slow climate change, and create a healthier and more just community.

Read the How to Use This Report and use the links to each strategy and action section in Figure ES-4 below.

Figure ES-4: Links to Strategies and Actions

S1: Increase energy efficiency and conservation in existing buildings

- 1a: Increase energy efficiency in residential buildings
- 1b: Increase energy efficiency in commercial buildings
- 1c: Increase energy efficiency in local government existing buildings and streetlights
- 1d: Develop and expand district energy and CHP systems
- 1e: Expand gas and electricity demand programs

S2: Electrify existing buildings

- 2a: Electrify existing residential buildings
- 2b: Electrify existing commercial buildings
- 2c: Reduce the use of high-GWP refrigerants

S3: Implement green building standards for new buildings

- 3a: Increase building code stringency for residential and commercial buildings
- 3b: Support all-electric new residential and commercial construction
- 3c: Support green building principles and practices
- 3d: Support the reuse of existing buildings

S4: Increase the amount of renewable energy in the electric grid

- 4a: Develop large offsite grid renewable energy
- 4b: Develop grid storage
- 4c: Maintain nuclear generation at the current levels

S5: Increase production of onsite renewable energy

- 5a: Expand solar PV on existing buildings
- 5b: Support solar PV in all new construction
- 5c: Support Community Solar
- 5d: Develop battery storage projects

S6: Increase energy supply from resource-recovered gas, hydrogen, and power-to-gas

- 6a: Expand the supply and use of resource-recovered gas, hydrogen, and power-to-gas

S7: Increase electric vehicle (EV) adoption

- 7a: Leverage county assets to expand EV use across on-road vehicles and off-road equipment
- 7b: Increase EV adoption by residents, businesses, and private fleets
- 7c: Install EV chargers in new buildings

S8: Support sustainable land use, active transportation, public transportation, and transportation demand management (TDM) to reduce vehicle-miles traveled

- 8a: Support the use and improvement of bicycle and pedestrian infrastructure
- 8b: Support the use and improvement of public transportation and commuter services
- 8c: Support smart-growth and transportation demand management (TDM) strategies

S9: Increase fuel economy and use of low-carbon fuels for transportation

- 9a: Support low-carbon fuels for transportation
- 9b: Support improvements to fuel efficiency
- 9c: Support low-carbon fuels for aviation

S10: Reduce the amount of waste generated and divert waste from landfills and waste-to-energy facilities

- 10a: Reduce overall waste generation
- 10b: Increase waste diversion from landfills and waste-to-energy facilities through recycling and composting

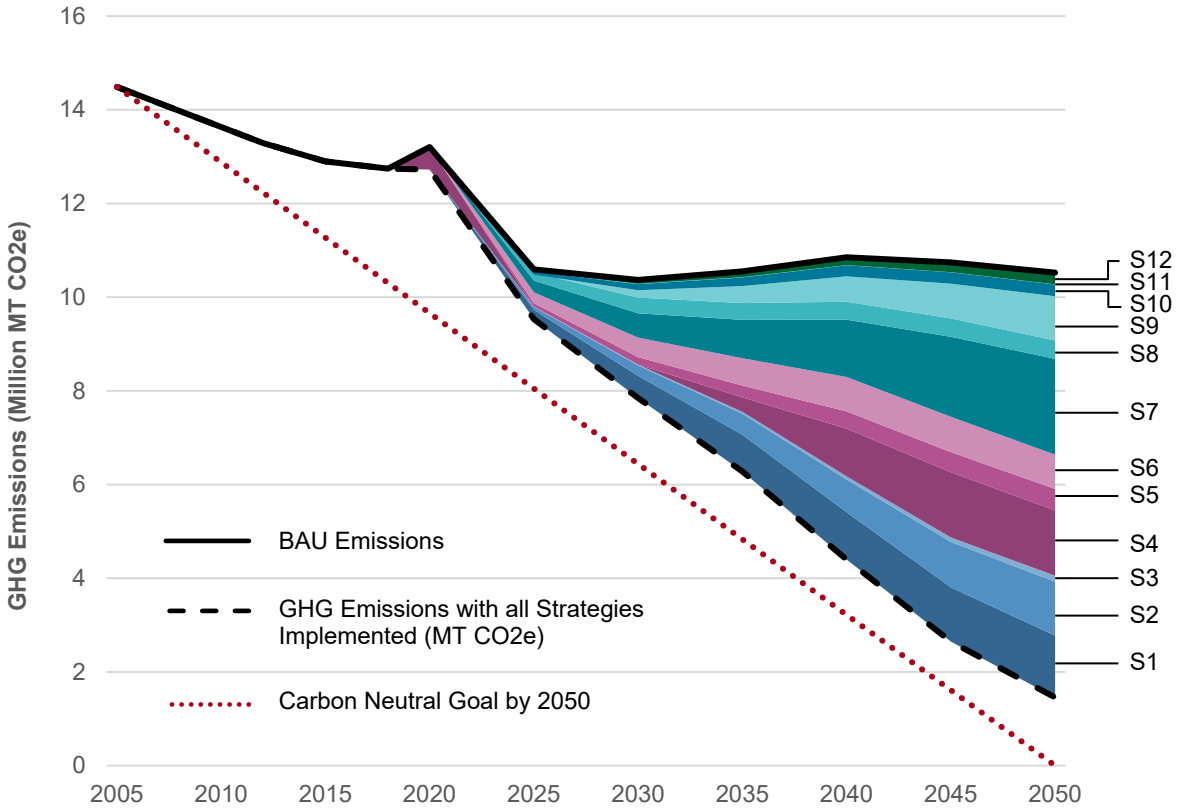
S11: Responsibly manage all waste generated, including collected residential and commercial waste, wastewater, and other items

- 11a: Capture and use energy generated at waste-to-energy facilities and landfills
- 11b: Explore alternative options for long-term waste management (landfill, waste to energy, and other options)
- 11c: Capture and use energy generated by wastewater treatment processes

S12: Support preservation, restoration, and expansion of natural systems, green spaces, and soil quality

- 12a: Conserve existing tree canopy, green spaces, and soil quality
- 12b: Expand tree canopy and green spaces, and improve soil management
- 12c: Create a cross-disciplinary county staff team to strengthen climate change and natural resources policies and programs

Figure ES-5: Modeled GHG Emissions Reduction by Strategy



S1: Increase energy efficiency and conservation in existing buildings
S2: Electrify existing buildings
S3: Implement green building standards for new buildings
S4: Increase the amount of renewable energy in the electric grid
S5: Increase production of onsite renewable energy
S6: Increase energy supply from resource-recovered gas, hydrogen, and power-to-gas
S7: Increase electric vehicle (EV) adoption
S8: Support sustainable land use, active transportation, public transportation, and transportation demand management (TDM) to reduce vehicle-miles traveled
S9: Increase fuel economy and use of low-carbon fuels for transportation
S10: Reduce the amount of waste generated and divert waste from landfills and waste-to-energy facilities
S11: Responsibly manage all waste generated, including collected residential and commercial waste, wastewater, and other items
S12: Support preservation, restoration, and expansion of natural systems, green spaces, and soil quality

Note that there are technical differences between the business-as-usual (BAU) scenario used by COG in the GHG inventory and the BAU used for the GHG emissions reduction modeling shown here. See Appendix D: GHG Modeling Methodology for details.

Working Group-Recommended Activities for Implementation

Recommended activities for implementation were developed by the Working Group in consultation with county staff and ICF. Each recommended activity for implementation is grouped into one of five categories, which indicate where the ability to impact change might exist.

These implementation categories were developed because Virginia is a Dillon Rule state. The Dillon Rule declares that state law is pre-emptive of local law unless the state confers the power to local government. The Dillon Rule is strictly interpreted so that if there is reasonable doubt about whether a power has been conferred to a local government, then it has not been.

Working Group-recommended activities for implementation may fall into one or more the following categories.

Recommended Activities for Implementation for All Actors: Actions that are applicable to all actors, including individuals and organizations, the county, state government, and federal government.

Recommended Activities for Implementation for Individuals and Organizations: Actions that individuals, businesses, and organizations can take now.

Recommended Activities for Implementation for the County: County measures and programs that the Fairfax County government can do right now. The recommended measures and programs in this category were specifically noted by the Working Group for action by the Fairfax County Board of Supervisors.

Recommended Activities for Implementation for the County Requiring State-Enabled Legislation: County programs and policies that the county might someday be able to do with state enabling legislation. The county and its stakeholders can advocate for items in this section at the state level.

Recommended Activities for Implementation for State and Federal Governments: State and federal measures and programs that the county will likely not have the authority to do on its own. The county and its stakeholders can advocate for these items at the state, regional, or federal level.

Working Group-Recommended Activities for the Board of Supervisors

This section summarizes the list of Working Group-recommended activities that the county government can begin to implement for each of the 12 strategies in CECAP. The Working Group wished to emphasize these specific recommendations for immediate consideration by the Fairfax County Board of Supervisors, as the Board can take immediate action without state-enabling legislation. Click on the links in the table below to go directly to these recommendations within each strategy section.

Strategy	Working Group-Recommended Activities for Implementation for the Board of Supervisors
Strategy 1: Increase Energy Efficiency and Conservation in Existing Buildings	Establish new energy efficiency and conservation incentive programs; Require energy code compliance requirements; Develop a county code enforcement officer training program; Create an energy audit program; Support businesses that support energy efficiency; Establish energy efficiency job training programs; Establish a local green bank, financing program, or Property Assessed Clean Energy (PACE) programs; Implement technology pilots in government buildings
Strategy 2: Electrify Existing Buildings	Establish incentive programs through grants, rebates, and tax credits; Expand existing financing programs to support electrification measures; Continue to support the Commercial PACE program; Support businesses providing electrification services; Support and educate installation contractors; Establish job training programs; Partner with building owners to conduct an analysis and work to reduce refrigerant emissions
Strategy 3: Implement Green Building Standards for New Buildings	Push for more stringent green building policies; Incorporate the county's own policies in planning and zoning guidelines; Develop a county code enforcement officer training program; Create an energy audit program within Fairfax Land Development Services; Encourage building commissioning; Establish new green building incentive programs; Expand incentives for homebuilders to build green and reuse existing buildings
Strategy 4: Increase Renewable Energy in Electric Grid	Support renewable energy projects and products (e.g., power purchase agreements, community solar); Enhance opportunities for renewable energy via zoning changes and partnerships in land use and transportation planning; Educate the community on efforts to make the regional grid more sustainable and how they can help; Develop county-wide renewable energy projects and/or programs, such as a green bank
Strategy 5: Increase Production of Onsite Renewable Energy	Implement programs that lower soft costs of solar PV; Support community solar projects; Amend local building codes to accommodate battery storage; Implement programs that connect with residents and private businesses to determine the best way to improve battery adoption; Build solar canopies at county owned sites; Provide financial incentives such as tax incentives or grants
Strategy 6: Increase Energy Supply from Resource-Recovered Gas, Hydrogen & Power-to-Gas	Subsidize the upfront costs of equipment for resource-recovered gas feedstock operators to provide an opportunity to encourage increased levels of adoption
Strategy 7: Increase EV Adoption	Electrify county and school fleet; Install EV charging at county facilities; Enact local policies to streamline EV charging permitting and inspection processes; Incentivize EV-ready charging infrastructure; Work with key industry and policy partners to integrate EV technologies in autonomous vehicles; Take advantage of federal grant and incentive programs for alternative fuel vehicles; Create equitable opportunities for EV adoption through low interest EV loans and rebates; Incentivize integrating EVs across carsharing programs, ride hailing services

Strategy	Working Group-Recommended Activities for Implementation for the Board of Supervisors
Strategy 8: Support Sustainable Land Use, Active Transportation, Public Transportation, and TDM to Reduce Vehicle-Miles Traveled	Expand and improve maintenance/safety of paths and bike lane networks; Install bike racks; Expand public transit routes; Conserve and plant trees along trails and sidewalks; Use zoning and land use codes to create dense, mixed-use development; Explore higher pricing schemes for parking at county-owned facilities; Modify parking minimums; Create local congestion fees, zero/low emission delivery zones, and pedestrian-only zones in densely populated areas; Allow telework options for county employees; Upgrade broadband infrastructure; Work with private companies to promote rental bikes and other micro mobility solutions; Support carpooling and vanpooling
Strategy 9: Increase Fuel Economy and Use of Low-Carbon Fuels for Transportation	Encourage the use of low-carbon fuels or the conversion to hybrid-electric retrofits of county-owned diesel powered medium and heavy-duty vehicles; Create financing programs for low/no carbon fuel technologies; Enact property tax credits for consumers purchasing higher fuel economy vehicles
Strategy 10: Reduce the Amount of Waste Generated and Divert Waste from Landfills and Waste-to-Energy Facilities	Expand education and outreach on source reduction, recycling and composting; Improve accessibility through education materials in alternate languages; Expand of composting operations (e.g., drop-off sites, curbside pick-up); Expand the glass recycling program; Provide for stricter enforcement of recycling; Implement a pay-as-you-throw program; Incentivize building deconstruction, rather than demolition, to salvage and reuse building material.
Strategy 11: Responsibly Manage Waste Generated	Ensure waste contracts align with best practices and best available technology for reducing emissions; Understand and clearly disclose impacts of existing waste-to-energy facilities; Reclaim treated wastewater and sewage sludge; Optimize trash pickup frequency; Develop plans to reduce litter and illegal dumping; Promote solar PV projects on closed landfills
Strategy 12: Support Preservation, Restoration, and Expansion of Natural Systems, Green Spaces, and Soil Quality	Strengthen county programs that conserve and expand green spaces and trees; Pursue the expansion of financial tools to include tree planting in private spaces; Use research and inventory data to conduct land use reviews and status checks; Require a higher density tree canopy replacement in development projects; Partner with homeowner's associations to promote additional trees and native vegetation; Incentivize more infill development; Reevaluate the existing Infill Development Review Process to incorporate best practices for preserving mature tree canopy; Incentivize or require conservation of tree canopies or green spaces in development projects and reduction of soil disturbance

In addition, Fairfax County government will continue to build on existing policies, programs, and planning processes to address climate change, as well as to advocate for legislative change at the state level. As described in the section above, recommended activities for implementation are also provided for individuals and organizations, and for state and federal governments.

Working Group Priorities

Of the six strategies in the Buildings & Energy Efficiency and Energy Supply sectors, the Working Group prioritized Strategy 1 and Strategy 4. Of the six strategies in the Transportation, Waste, and Natural Resources sectors, the Working Group prioritized Strategy 7, Strategy 8, Strategy 9, and Strategy 12. Working Group members noted that there are both synergies and tradeoffs between strategies, and that actions taken during implementation should seek to balance the strategies' varied tradeoffs and maximize synergies. See the Working Group Priorities textboxes throughout the report for more information and Appendix F: Results of the Working Group Prioritization Exercise.

Cost and Benefits Considerations

Throughout the development of CECAP, Working Group members emphasized the importance of analyzing the costs and benefits of the strategies and actions in CECAP. When a Working Group member raised a concern about the high costs or the need to conduct a detailed quantification of costs, another Working Group member countered with the need to also quantify the benefits of the climate actions and the cost of not taking action. The CECAP planning process and report were not intended to provide a quantitative cost-benefit impact assessment, but a key output of the CECAP process was the desire of the Working Group for a detailed quantification of costs and benefits from the strategies and actions, as part of CECAP implementation. See Costs and Benefits Considerations for more discussion on how costs were considered in this report and recommendations for future cost assessments.

Emerging Technologies

As the GHG modeling shows, emerging technologies will be needed to reach the goals set forth in CECAP. Through research and development efforts and innovative business practices, technologies continue to improve over time, and novel technologies emerge that can reduce GHG emissions further. Emerging technologies can help shift the current emissions-intensive energy paradigm to a green growth paradigm and can help "future-proof" long-term plans by overcoming existing economic and technological barriers and minimizing future systemic shocks or stresses. Some emerging technologies include advanced fuel cells and refrigerants, next generation heat pumps, microgrids, and electric cars, among others, and they will become more widespread and effective over time. See the Emerging Technologies section for more information.

Community Engagement

Since CECAP development began in earnest in 2019, the public has been engaged in the process in two distinct ways. First, the members of the CECAP Working Group are, essentially, public representatives. Several members represent their magisterial districts as individuals. All of them serve voluntarily on this public body to advise the Board of Supervisors. They represent the first tier of public engagement in CECAP, and their very invested and high level of engagement has made the creation of this report and all the substantive recommendations it contains possible.

Second, throughout the CECAP development process, county staff created opportunities for widespread public outreach, education, and engagement. Occurring in three phases over the course of 10 months, these engagement periods were designed to provide timely and relevant information to county residents and stakeholders about CECAP, and to invite their input on the goals, strategies, and actions likely to appear in this final plan. This portion of the report summarizes the public engagement tactics used to gather feedback and to raise county residents' awareness of the climate planning effort. See the Community Engagement section for more information.

Current Policies and Programs/Implementation

The county has existing policies, programs, and tools to help residents and businesses enact GHG reduction measures. Together with federal, state, and other local programs, existing initiatives provide a starting point for the strategies included CECAP. The Fairfax County community, including government, residents, businesses, and organizations, can continue to support additional programs and policies at the local level, while advocating for state and federal assistance to help make the goals of CECAP a reality. This section identifies the existing programs, policies, and tools that can help community members begin to adopt the CECAP strategies. Remaining challenges and implementation methods are summarized for future consideration. See the Current Policies and Programs/Implementation section for more information.

How to Use This Report

As CECAP is a community-driven plan, written by community members of Fairfax County, this is the first opportunity for community members, individuals, and organizations to get involved in addition to the existing efforts at the county, state and federal level. CECAP describes 12 strategies and 37 actions. Detailed descriptions of strategies and actions are provided in the Emissions Reduction Strategies and Actions section. **Use Figure ES-6: Strategy and Action Roadmap below to navigate the Strategy and Action sections of the report.**

A **strategy** is a broader set of actions or set of subsector work that can be modeled to understand emissions reduction. Each **strategy section** includes the following:

- A description of the strategy, including a list of actions included in the strategy.
- The GHG emissions reduction potential for each strategy by the year 2050. The percentage provided demonstrates the reductions needed from the 2050 business-as-usual projection to reach the county's carbon neutrality goal.
- Cost considerations for the strategy, such as whether the strategy is currently cost-effective or challenged by cost barriers.
- Working Group Priorities textbox, that summarizes the opinions and priorities of the Working Group to focus efforts during implementation of CECAP.

An **action** is a project or specific technology that impacts GHG emissions within a strategy. Each **action section** includes the following:

- A description of the action
- A rating for each impact category and a discussion of the rating

Finally, **Working Group-Recommended Activities for Implementation** are provided for each strategy for five categories: all actors, individuals/organizations, county government, county government with state-enabling legislation, and state and federal governments.

To be successful, CECAP needs the support of your fellow community members and you! To learn more about how to get involved, visit Fairfax County's CECAP Web page.

Figure ES-6: Strategy and Action Roadmap

A) Review Strategy Description and Associated Actions

BUILDINGS AND ENERGY EFFICIENCY

Strategy 1: Increase Energy Efficiency and Existing Buildings

Energy efficiency and energy conservation are cost effective and proven strategies that produce significant co-benefits while also improving the effectiveness of future strategies. Energy efficiency encompasses technology enhancements that improve building energy performance (that is, delivering the same services with fewer Btus). Energy conservation includes behavioral enhancements that improve building energy performance (that is, services are adjusted to reduce Btus). This strategy includes the following actions:

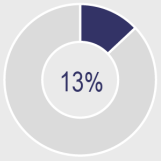
- Action 1a: Increase energy efficiency in residential buildings,
- Action 1b: Increase energy efficiency in commercial buildings,
- Action 1c: Increase energy efficiency in local government buildings and streetlights,
- Action 1d: Develop and expand district energy and combined heat and power (CHP) systems, and
- Action 1e: Develop and expand gas and electricity demand programs.

B) Review Emissions Reductions Associated with the Strategy

GHG Emissions Reduced by 2050

1,324,000 MT CO_2e

Emission Reduction Contribution Needed in 2050



C) Review each Action Description

Action 1a: Increase Energy Efficiency in Residential Buildings

This action supports energy efficiency and energy conservation in existing single-family and multifamily residential buildings.

Timeframe: Immediate. The technology is currently available and is being commercially deployed at significant scale.

Technology considerations: Building energy efficiency can employ many technologies and target various end uses depending on scope and budget. Efficiency measures can be sensitive to occupant behavior. In residential buildings, occupant comfort and preferences are very important to consider. Renters have less ability to make meaningful upgrades, while long-time homeowners can face significant energy cost burdens.

D) Review Impact Category Results

Public Health	+
Environmental Resource	+
Economic Opportunity	++
One Fairfax	=
Payback	3-7 years
Cost to Community Member	$$$
Timeframe	Immediate

E) Review Working Group-Recommended Activities for Implementation

Working Group-Recommended Activities for Implementation for Strategy 1

Implementation for this strategy may include a combination of incentive programs, financing tools, education and outreach, support for business growth, pilot programs, and regulations and other mandates. Recommended activities for implementation for this strategy were developed by the Working Group and include:

Recommended Activities for Implementation for All Actors

Education

Energy efficiency and, in particular, energy conservation will affect residents' interactions with the buildings they live in, work in, and visit. Individuals will need to learn how to use and maintain different building systems. Many of these interactions will be seamless, however educational programs can help earn broad understanding of the changes and why they are happening and may help to realize higher adoption rates. Education programs should leverage existing tools such as EPA's ENERGY STAR which including appliance labeling, and building and home performance tools. Additional educational programs include:

INTRODUCTION

Climate change is an existential crisis that is affecting human populations, natural systems, infrastructure, and economies across the globe, and is already causing impacts in Fairfax County. As of 2021, 2019 was the second warmest year on record, at the end of the warmest decade ever. Global temperatures have already increased 1.8 degrees Fahrenheit (°F) since the end of the 19th century and will continue to rise for the foreseeable future (UN, 2021). This global warming has led to climate change, creating various effects such as altered precipitation patterns, more frequent and intense storms, longer and harsher droughts, larger wildfires, and much more. To reduce the impacts of climate change and to contribute to the solution, the Community-Wide Energy and Climate Action Plan, or CECAP, is Fairfax County's first-ever GHG emissions reduction plan for the community.

CECAP is the first effort to involve the community in GHG emissions reduction efforts, and the first opportunity to add individual efforts to existing efforts by the county and to highlight opportunities for county, state, and federal action. The plan includes goals to help chart a path forward for Fairfax County residents, businesses, organizations, and other stakeholders to reduce our collective GHG emissions. The plan also includes strategies and actions that individuals and organizations can take to help achieve the goals. This is not a top-down plan full of programs and policies being implemented or to be developed by the government—it is truly a community-driven plan that seeks the involvement of people across the county.

The plan gives a path for a multi-level approach to tackling climate change, which involves the following:

- Community, individuals, and organizations, which are specifically added to the climate change solution effort through CECAP
- Fairfax County government, which can build on existing policies, programs, and planning processes to address climate change, as well as advocate for legislative change at the state level

- State and federal governments, which both community members and the Fairfax County government can influence through collective advocacy

Through a separate process, Fairfax County is looking to address climate change adaptation and resilience opportunities. Those issues are acknowledged throughout strategies in this plan; however, they are not discussed in depth.

This section provides an overview of the science behind climate change and its effects, focusing on the implications for Fairfax County. It also describes how Fairfax County is taking a lead on climate change, introduces the CECAP process and its origins, and explains the core values that guided the development of the plan.

Climate Change Impacts in Fairfax County

Climate change is already occurring in Fairfax County, and it is impacting our environment, health, infrastructure, and daily lives. The scientific evidence demonstrating global climate change is clear and growing. The evidence indicates that human activities—such as burning fossil fuels, land use change, and waste management—are overwhelmingly responsible for causing climate change. Certain activities, such as burning fossil fuels, emit GHGs, including carbon dioxide (CO_2), that enter the atmosphere and trap heat. Over time, the trapped heat slowly increases global temperatures, causing cascading climate effects, such as altered precipitation patterns, extreme storms, extreme temperatures, and much more. Climate change impacts are expected to increase over the coming years, even if drastic action is taken to reduce GHG emissions and apply significant resources to the problem to address the crisis, given the longevity of GHGs in the atmosphere.

Figure 1: Flash flooding event in Fairfax County, Va. in July 2019 (Tysons Reporter/ via @SteveML9022/Twitter)

In recent years, extreme weather-related disasters have become more frequent and intense. Like many parts of the United States, Fairfax County is expected to experience increased climate change risks and impacts in the coming decades. Fairfax County is already experiencing the following climate changes:

- Changes in precipitation patterns, including more droughts and heavy rainfalls
- Hotter average temperatures, including more extremely hot days
- Changing growing seasons and conditions, such as earlier springs and later winters

These changes have resulted in impacts on Fairfax County citizens and industries in many ways, including the following:

- Increased adverse health impacts due to greater heat stress and a lengthened pollen season.
- Increased range of vectors and diseases, such as Lyme disease and West Nile virus spread by ticks and mosquitoes, respectively.
- Increased energy demand and costs, which can threaten the reliability of energy supply.
- Altered wildlife habitat and biodiversity.

Specific illustrations of climate change impacts and needed action in western Fairfax County are documented in the 2020 *Reston Association State of the Environment Report (RASER)* and the 2019 report *Climate Change Implications for Reston, VA*.

To avoid the more dire impacts of climate change, we must take action, we must do so now, and we must do so boldly. Current and past local actions have contributed to global climate change; however, the county can change those actions and adopt new ones to become part of the solution rather than part of the problem. Doing so will improve the environment and the lives of Fairfax County residents and help to limit climate change impacts.

Projected Climate Impacts on Virginians

The typical number of **heat wave days** in Virginia is projected to **increase from more than 10 to nearly 60 days** a year by 2050.

Today, Virginia has 164,000 people **at risk of coastal flooding**. By 2050, an **additional 137,000 people** are projected to be at risk due to sea level rise.

Source: Climate Central: States at Risk – Virginia Profile

The cost of inaction grows every day. The projected economic losses due to climate change, such as infrastructure damage and service disruptions due to extreme weather events, and the negative health impacts, such as increased mortality and chronic illness, are likely to increase every year we fail to act. This is the "social cost of carbon"—a financial estimation of the cost of the damage from GHG emissions, and what it is worth to avoid those emissions.[4] The proverb that "an ounce of prevention is worth a pound of cure" is an apt analogy in this case—we cannot continue to treat the increasingly costly symptoms of climate change; instead, we must address the root cause. Therefore, Fairfax County recognizes that climate change is an existential problem that affects everyone in the county, but also around the world, and that the county can play a part in solving the problem, to the benefit of everyone.

[4] U.S. EPA. 2010. Working Paper: The "Social Cost of Carbon" Made Simple. https://www.epa.gov/environmental-economics/working-paper-social-cost-carbon-made-simple.

Reducing Emissions

There is no simple and elegant solution to reduce GHG emissions. Instead, the solution will comprise multiple strategies and will require unified commitment and action from all stakeholders across our society. To take effective climate action, Fairfax County residents, businesses, and organizations must tackle the root cause: activities that emit GHGs and activities that reduce natural CO_2 sequestration, such as clearing forests. In addition, we must undertake activities that will help consume GHGs, such as creating more green space. The Fairfax County CECAP Working Group (see textbox below) has set GHG emissions reduction goals to help guide local reductions, described in Greenhouse Gas Reduction Goals.

The key sources of GHG emissions in Fairfax County are carbon dioxide from fuel combustion in transportation and commercial and residential buildings; methane from water treatment, solid waste, and agriculture; and process and fugitive GHG emissions from industrial facilities and energy supply systems. There are opportunities to reduce GHG emissions from each of these sources and thereby reduce the local contribution to global climate change. For each emissions source, there are many potential actions that can reduce emissions. Some actions are less expensive, easier, and faster to deploy than others. Some actions reduce emissions a great deal, while others may reduce emissions to a lesser degree; however, every action helps. Some actions may have additional co-benefits, such as improved health outcomes or increased equity. These and other factors were considered by the CECAP Working Group in selecting and prioritizing actions that the community can undertake. This plan includes community-informed actions to reduce GHG emissions and creates a foundation for Fairfax County leadership in climate action planning by describing what schools, businesses, nonprofit organizations, and residents can do to be part of the solution. These actions are described in detail in Emissions Reduction Strategies and Actions.

Why Develop a CECAP?

The Fairfax County Board of Supervisors, through the Office of Environmental and Energy Coordination (OEEC), coordinated development of CECAP to:

- Develop a roadmap for Fairfax County to reduce GHG emissions and provide a way to engage the community in GHG emissions reduction efforts, while giving the first opportunity to add individual efforts to existing county, state, and federal emissions reduction efforts.
- Provide citizens and local stakeholders a voice in the climate planning process to ensure the plan addresses local priorities and needs.

CECAP Working Group

The Fairfax County Board of Supervisors selected community members to serve on nine district-level Focus Groups and a Task Force. These 10 groups ultimately merged to form the **CECAP Working Group**, which served as the community decision-making body for CECAP. Read more about the CECAP planning process in CECAP Process and Methodology.

The community-driven nature of the plan is unique. Many state and local jurisdictions across the country have developed or are developing climate action plans, but many do not engage the community throughout the entire process. Because more than 95% of all GHG emissions in the county come from sources other than government and school operations, everyone must get involved to significantly reduce Fairfax County's emissions.

CECAP focuses on strategies and actions that community residents and businesses can take to reduce their GHG emissions. The plan educates the community members and leaders on actions they can take to reduce their own GHG emissions while also drawing attention to legislative and regulatory initiatives related to climate issues. Individual and organizational action is an important and necessary supplement to federal, state, and local laws and regulations intended to reduce GHG emissions. This plan is meant to guide behaviors; however, the strategies described in this plan are not currently mandated or legislated.

Fairfax County Government's Role

The Fairfax County government recognizes that about 5% of GHG emissions in Fairfax County come from government and school operations. The Fairfax County government can use policy tools and strategic investments to reduce the community's GHG emissions by creating programs, providing incentives, and planning smart infrastructure. Virginia is a Dillon Rule state: This means that state law is generally pre-emptive of local law unless the state confers specific powers to local government. The Dillon Rule is strictly interpreted so that if there is reasonable doubt about whether a power has been conferred to a local government, then that power is deemed not to have been conferred. In other words, the Dillon Rule limits the power of the Fairfax County government to roles that the state government has explicitly stated it has.

There are, however, areas that Fairfax County government can influence. In particular, Fairfax County government has greater influence over decisions such as local transportation planning, urban development, and waste management. A few examples of county action include the purple bin glass recycling program, as well as the development of activity centers, such as the Mosaic District. The Fairfax County government is actively taking measures to reduce its carbon footprint and to further reduce emissions through plans, programs, and policies such as the Fairfax County Operational Energy Strategy and the Fairfax County Environmental Vision, and the accompanying fiscal year (FY) 2020 Sustainability Initiatives report.

Examples of existing environmental programs and tools that can help the community in Fairfax County reduce GHG emissions include the following:

- Fairfax Employees for Environmental Excellence (FEEE)
- Fairfax County Energy Dashboard
- Energy Action Fairfax
- Solarize Fairfax County
- Fairfax County HomeWise Program
- Fairfax County Green Business Partners

See Current Policies and Programs/Implementation for a more detailed description of these and other policies, plans, and programs that will be part of the implementation of CECAP.

How Does CECAP Align with Fairfax County's Goals and Values?

CECAP aligns with the Metropolitan Washington Council of Governments (COG) regional GHG goals and Fairfax County's strategic goals and values, as well as the Board of Supervisors' Environmental Vision and the county's One Fairfax Policy.

The Fairfax County Board of Supervisors updated its Environmental Vision in 2017 to better protect and enhance the environment. The vision is centered on two principles:

1. The conservation of limited natural resources must be interwoven into all government decisions.
2. The Board must provide the necessary resources to protect and improve the environment for quality of life now and for future generations.

The **One Fairfax Policy** is a joint social and racial equity policy of the Fairfax County Board of Supervisors and School Board. It commits the county and schools to intentionally consider equity when making policies or delivering programs and services. The policy declares that all residents deserve an equitable opportunity to succeed, regardless of any personal characteristics (Fairfax County, n.d.).[5]

Furthermore, the vision is focused on seven core service areas: land use, transportation, water, waste management, parks and ecological resources, climate and energy, and environmental stewardship (Fairfax County Board of Supervisors, 2017).[6] These service areas are reflected in the sectors included in CECAP, and the principles of the vision are infused throughout CECAP.

[5] One Fairfax Policy. https://www.fairfaxcounty.gov/topics/one-fairfax.
[6] Fairfax County Environmental Version. 2017. https://www.fairfaxcounty.gov/environment/sites/environment/files/assets/documents/pdf/environmental-vision-2017.pdf.

CECAP incorporated the One Fairfax policy in its development process and in the final plan by applying an equity lens to the analysis and decision-making aspects of the process. Each action included in CECAP was assessed for its impact on equity, and the CECAP Working Group considered equity in the selection and prioritization of emissions reduction strategies and actions, and in the identification of activities for implementation. The approach taken worked to solicit feedback and input through community surveys which were published in four languages—English, Spanish, Vietnamese, and Korean. It is important to maximize equitable outcomes because climate planning actions can and have had disparate and disproportionate impacts on different people and communities. When climate planning is designed equitably, everyone benefits, and this can lead to additional benefits such as stronger economic growth and a thriving community.

In addition to aligning with Fairfax's values, CECAP aligns with the goals of other local jurisdictions in the region and COG's regional goals. COG is an independent, nonprofit association comprised of 300 elected officials representing 24 local governments, the Maryland and Virginia state legislatures, and U.S. Congress. COG serves as a regional partnership by creating a network for policy and planning officials to work cohesively to discuss and address the region's top priorities. To this end, COG developed the Region Forward vision, which sets ambitious goals for a more prosperous, accessible, livable, and sustainable future.[7]

COG's priorities are focused on improving the housing, equity, and economic competitiveness of the region, and strengthening the Metro system, which all factor into climate action planning. More specific to the environment, COG is committed to clean air, land, and water, and fostering a more sustainable region. To achieve these outcomes, COG and member governments have focused efforts on ensuring safe water supply, revitalizing local waterways though improved wastewater and stormwater management, promoting energy conservation and alternative energy sources, supporting recycling and waste reduction efforts, and preserving forestry and agriculture resources.

[7] Metropolitan Washington Council of Governments. *Region Forward Vision*. https://www.mwcog.org/regionforward/.

CECAP PROCESS AND METHODOLOGY

In 2018, the Board of Supervisors Environmental Quality Advisory Council recommended that Fairfax County create a CECAP to reduce GHG emissions in the private sector to ensure a transparent and collaborative planning process. In addition to being transparent and collaborative, CECAP is informed by the community and other stakeholders, ensuring that they have a voice in the process and final plan. This makes the process more inclusive, promotes discussion of topics that may be otherwise unchallenged or critically analyzed, and generates greater buy-in from stakeholders. In the end, the iterative process among community groups, local organizations, and other stakeholders resulted in a well-informed roadmap for the community to achieve its GHG emissions reduction goals.

The CECAP planning process, including key actors and their roles, is outlined below. For more information on the process, visit https://www.fairfaxcounty.gov/environment-energy-coordination/cecap-process.

Key Contributors and Roles

The key contributors involved in the development of CECAP, and their roles are described below:

- **OEEC** led the process, coordinated among all the various contributors, and provided content for the final CECAP report.
- **ICF** supported climate action planning, technical analyses, facilitation of meetings with the community, and the development of the final CECAP report.
- **Metropolitan Washington Council of Governments (COG)** led the update of the greenhouse gas (GHG) inventory and development of emissions models and goals.

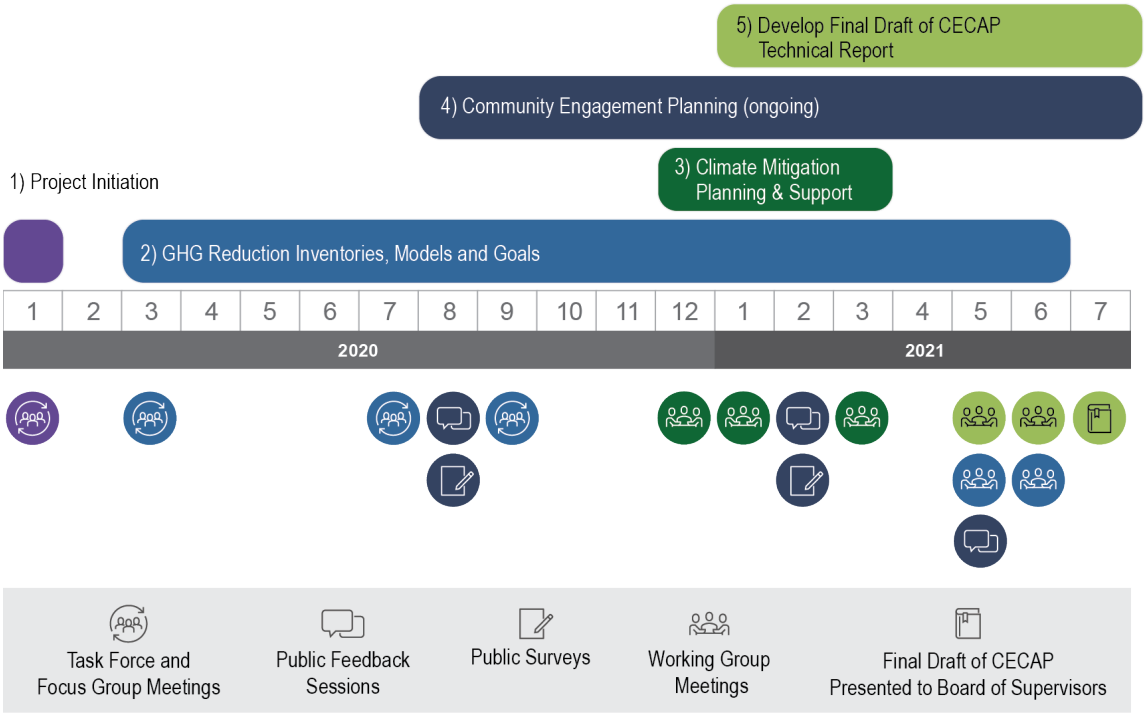
- The **CECAP Working Group** (or "Working Group") served as the community decision-making body and provided key input, content, and recommendations for the final CECAP report. The evolution of the Working Group is described below.
  - At the beginning of the process, members of the Task Force were chosen by organizations identified by the Board of Supervisors and nine district-level Focus Groups were nominated by their Supervisors based on their demonstrated interest and/or experience in energy and climate work. The Task Force served in a decision-making capacity and the Focus Groups served as the voice of each of Fairfax County's nine districts in an advisory capacity to the Task Force. The Task Force and Focus Groups were dissolved in October 2020 and members were invited to join the CECAP Working Group. This decision was made to allow equal participation among members of the Focus Groups and Task Force.
  - The CECAP Working Group ("Working Group") was comprised of members of both the Task Force and Focus Groups, and served in a decision-making role. The process shifted to a Working Group model, with two sector-based subgroups, to allow for more voices to actively participate and to allow for sector-based discussions to occur in smaller groups.
- The **Board of Supervisors** was notified of progress and process changes on a regular basis and provided key input on the process.

Note on the use of "Working Group" and "Task Force" in the report. When there is discussion of a specific decision in this report, the name of the group that made that decision—either the Task Force or the Working Group—is used.

Timeline

There were five main steps in the CECAP development process. Each step had a distinct purpose and included several supporting actions. The five steps are shown in Figure 2 and are described in detail below.

Figure 2: The CECAP Process



Step 1: Project Initiation

To commence the project, the Board of Supervisors selected members of the community to serve on the nine district-level Focus Groups, while organizations identified by the Board of Supervisors nominated members to serve on the CECAP Task Force. Members were selected based on their demonstrated interest and/or experience in energy and climate work. In November and December 2019, OEEC developed a number of guiding documents and charters to inform the process and the formation of the Task Force and Focus Groups, and in January 2020 hosted kickoff meetings for each group, in coordination with ICF and COG.

Step 2: GHG Reduction Inventories, Models, and Goals

The purpose of Step 2 was to take stock of historical and current GHG emissions to then project the likely emissions of future years and to set a goal for future emissions reductions. To accomplish this, COG prepared a comprehensive GHG inventory for Fairfax County, incorporating available data for the period 2015–2018. Based on that data, COG and ICF created four emissions models, including a business-as-usual (BAU) model that estimated future annual emissions under the assumption that no new policies or actions

would be made beyond those being implemented as of 2020. Each of the models included an emissions reduction goal and key strategies that could meet the goal.

In March 2020, the COVID-19 pandemic disrupted daily life across the county and country. To overcome the health and logistical challenges presented by the pandemic, the CECAP planning team transitioned first to a virtual webinar-style model and then to electronic meetings for the remainder of the process as a means of engaging the various community groups, stakeholders, and project team members and to complete the process. Meetings and public forums were hosted via WebEx, a videoconferencing software that allowed CECAP project teams, the Working Group, and the public to gather virtually and to continue the CECAP planning process effectively and safely.

Next, the Task Force provided their preference for the long-term emissions reduction goal, guided by the emissions reduction models. To gather input from stakeholders on goal selection, the models were presented to the Focus Groups and the broader community was engaged through public meetings in August 2020. All input from the Focus Groups and the community was documented, along with the inventory and modeling results, in a summary analysis that was shared with the Task Force. The Task Force then reviewed feedback from the Focus Groups and broader community and voted on the long-term emissions reduction goal and interim goal to be included in CECAP. These goals are described in Greenhouse Gas Reduction Goals.

Step 3: Emissions Reduction Planning and Support

Step 3 began in October 2020 with a shift in the planning approach, dissolving the Task Force and nine Focus Groups and transitioning to a Working Group model that was retained for the remainder of the CECAP planning process. The CECAP Working Group included members of the Focus Groups and Task Force, and was divided into sector-specific subgroups, one that was focused on energy and another that was focused on transportation, development, and waste. The transition to a different planning model was intended to improve the efficiency and efficacy of the CECAP process and to provide an equitable opportunity for all voices to be heard. Additionally, the sector-specific Working Group model is a climate action planning best practice and allowed the group to leverage the sector-specific expertise and interests of the Working Group members.

The purpose of Step 3 was to clearly define the actions and strategies that the community could implement to meet the emissions reduction goals set in Step 2. ICF developed an initial set of 20 potential emissions reduction actions for the various sectors mentioned previously. The set of strategies and actions was then presented to the Working Group to review and discuss which to select, and also to recommend any additional options. Once the actions and strategies were selected, ICF analyzed the economic, environmental, and social impacts of each and presented the results to the Working Group, along with a set of evaluation criteria to help the Working Group prioritize the actions and strategies. The Working Group reviewed the analysis results and applied the evaluation criteria to develop a final list of emissions reduction actions and strategies for the community.

Step 4: Community Engagement Planning

OEEC undertook Step 4 to ensure that the broader community was included in the CECAP planning process and to welcome input from all voices. To do so, the county developed messaging and outreach tools, including online materials to present the results of Step 2, and deployed targeted, strategic, and evidence-based outreach campaigns, including surveys, to collect and assess public opinions on the plan. Finally, public meetings were held in August 2020, February 2021, and May 2021 to provide an open and inclusive dialogue and to gather additional feedback on the plan. This community engagement will be ongoing past the planning stage into the implementation of CECAP.

Step 5: Final CECAP Technical Report Development

The purpose of Step 5 was to compile all of the data gathered and to develop a cohesive plan describing how Fairfax County would implement the selected actions and strategies to achieve the emissions reduction goals. To accomplish this task, ICF, COG, and OEEC drafted this CECAP technical report, which include the GHG inventory, goals, actions, and strategies approved by the Working Group. This draft was reviewed by the Working Group and updated to integrate the group's feedback. OEEC shared the products of CECAP—goals, strategies, and action—with the broader community to foster discussion and to solicit additional feedback. The Working Group reviewed that feedback and then decided on the final revisions to the report. The final product of Step 5 and the entire CECAP process is this technical report, which outlines the selected strategies and actions.

GREENHOUSE GAS EMISSIONS

This section describes the community-wide GHG emissions inventory developed for Fairfax County by the Metropolitan Washington Council of Governments (COG). After providing an overview of the results, it identifies and discusses the inventory sectors responsible for GHG emissions in the county—principally building energy use and transportation. This section then discusses six emissions reduction scenarios that were developed for the Working Group to consider in determining an appropriate emissions reduction goal. In addition to a business-as-usual scenario, five more scenarios were modeled, with resulting emissions reductions by 2050 ranging from 33% to 82%, depending on the assumptions made. In response to the Working Group's request, an additional scenario that projected an 87% reduction in emissions by 2050 was also modeled.

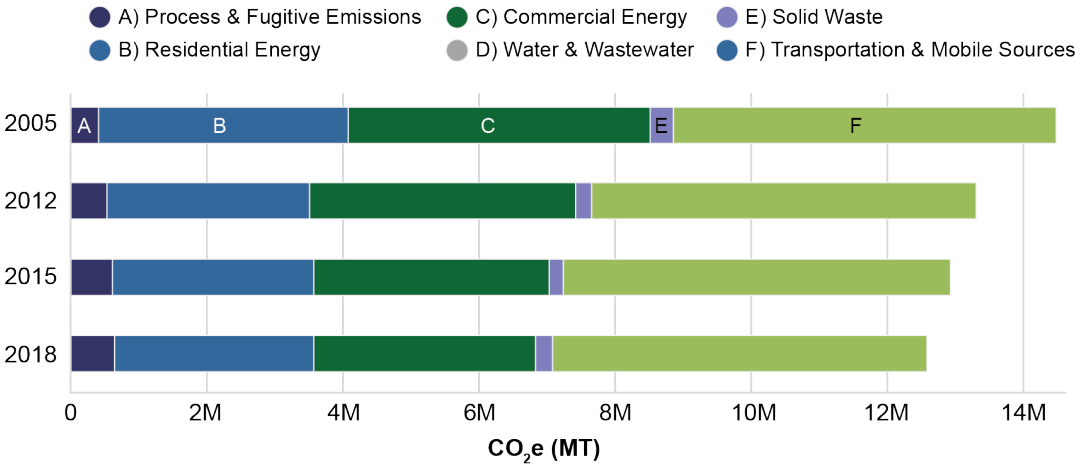
Overview: 2005–2018

The community-wide GHG inventory measured GHG-emitting activities undertaken by residents, businesses, industry, and government located in Fairfax County, as well as emissions from visitors. This inventory provided a snapshot of GHG emissions in Fairfax County in 2018, as measured in million metric tons of carbon dioxide equivalent (MMT CO_2e).

The first inventory of Fairfax County's community-wide GHG emissions was conducted in 2005. Between 2005 and 2018, the county experienced a 15% growth in population, increasing from about 1.03 million to nearly 1.2 million. The 2018 inventory results show that despite this growth, over this period, total GHG emissions decreased 13%, from 14.52 MMT CO_2e in 2005 to 12.56 MMT CO_2e in 2018. Per capita emissions decreased 24%, dropping from 14.5 metric tons of carbon dioxide equivalent (MT CO_2e) per capita in 2005 to 11.0 MT CO_2e per capita in 2018.

According to the 2018 inventory, more than 90% of GHG emissions were the result of residential and commercial building energy consumption and transportation. As shown in Figure 3, building energy consumption (residential and commercial) accounted for 49% of emissions, while transportation accounted for 44%. The remainder of emissions comes from other activities and sources, including solid waste, wastewater treatment, and process and fugitive emissions, including those associated with the release of hydroflurocarbons.

Figure 3: Fairfax County GHG Emissions by Activity



Community Inventory Methodology: 2005–2018

COG's Climate, Energy and Environment Policy Committee (CEEPC), created by the COG Board in 2009, has made it a priority since its inception to track progress toward local and regional GHG emissions reduction goals. COG has completed local and regional GHG inventories for all COG members, including Fairfax County, and Metropolitan Washington for 2005, 2012, 2015, and 2018.

COG community-wide GHG inventories are compliant with the U.S. Communities Protocol for Accounting and Reporting Greenhouse Gas Emissions, Global Protocol for Community-Scale Greenhouse Gas Inventories, and the Global Covenant of Mayors for Climate and Energy reporting framework guidance. COG uses Local Governments for Sustainability (ICLEI's) ClearPath Community Scale Inventory Module for preparing GHG inventories, which is consistent with U.S. and global protocols and guidance. COG inventories use global warming potential factors from the Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC AR4).[8]

[8] ICLEI. 2019. *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.2*. Retrieved from https://icleiusa.org/publications/us-community-protocol/.

ICLEI. 2020. ClearPath Web page. Retrieved from https://icleiusa.org/clearpath/.

World Resources Institute, C40, and ICLEI. 2014. *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories*. Retrieved from https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities.

In conducting its GHG emissions inventories, COG makes every effort to capture a complete and accurate picture of local GHG trends and provide for a consistent methodology that is replicable across communities and inventory years. COG inventories use public data readily available on a consistent basis for all its local government members. COG inventories follow an *activities-based approach*, meaning that emissions are calculated based on the result of activities undertaken by residents, businesses, industry, and government located in the jurisdiction, as well as emissions from visitors.

The broad categories of emission types covered by COG's GHG inventory work include the built environment (residential and commercial energy), transportation and mobile emissions, wastewater treatment, agriculture, solid waste treatment, and some process and fugitive emissions. These emission types are further broken down into 16 emissions activities and 22 separate inventory records that are calculated and added together to obtain total emissions by type and overall emissions. The gases calculated within these inventory records include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

For a detailed description of the methodology, see Appendix C. The link provided in the appendix contains the methodologies of COG's GHG inventory work, providing for completeness, consistency, accuracy, replicability, transparency, and quality control.

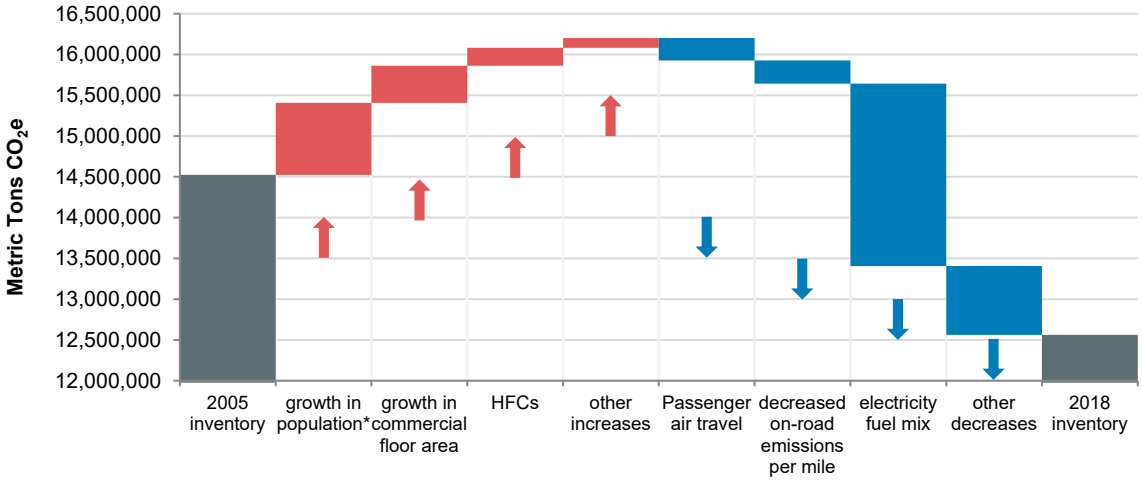
Drivers of GHG Change: 2005–2018

ICLEI, a global network of more than 2,500 local and regional governments committed to sustainable urban development, has created a GHG Contribution Analysis tool to evaluate the biggest drivers influencing the GHG performance of cities, counties, and regions. The tool provides for a deeper understanding of the factors driving emissions changes between community-wide GHG inventory years, thereby helping to identify and prioritize more effective actions to reduce GHG emissions.[9]

The GHG Contribution Analysis results for Fairfax County between inventory years 2005 and 2018 are shown in Figure 4. The main drivers increasing emissions, which are shown by the red bars, are primarily growth in population, commercial space, and emissions from HFCs. Factors reducing emissions, which are shown by the blue bars, are primarily a less carbon-intensive electric grid, decreased commercial electricity energy intensity, and less-polluting cars.

[9] ICLEI. 2018. GHG Contribution Analysis Web page. Retrieved from https://icleiusa.org/ghg-contribution-analysis/.

Figure 4: Drivers of GHG Changes in Fairfax County



Sources: ICLEI's Contribution Analysis Model and COG GHG Inventories

Components of the Emissions Inventory: Specific Inventory Sectors

In Fairfax County, GHG emissions are primarily attributable to energy use by buildings and by vehicle use. Together, these categories account for 93% of the community's GHG emissions. The remaining 7% of emissions are due to process and fugitive emissions and solid waste.

Building Energy Use

In 2018, energy consumption by Fairfax County's residential and commercial building stock accounted for 49% of GHG emissions. The use of electricity to light, heat, and cool buildings and to power appliances and electronics accounted for 35% of total GHG emissions in 2018. Natural gas consumption, primarily for heating and cooking applications, accounted for 14% of total GHG emissions in 2018. Less than 1.5% of energy-related GHG emissions in Fairfax County were due to the use of fuel oil and liquified petroleum gas, including propane.

The primary providers of electricity to the Fairfax County Building Inventory sector are state-regulated electric utilities. According to data from the U.S. Energy Information Administration, in 2019, Virginia's electricity net generation was supplied primarily by natural gas (60%), followed by nuclear power (30%), biomass and other renewable resources (6%), and coal (4%). Virginia law grants electric utilities virtual monopolies in their defined service areas, so Fairfax County customers currently have only a limited ability to select their electric provider based on the provider's mix of generation resources. Nonetheless, Fairfax County residents and businesses are pursing renewable energy, with onsite solar growing significantly over the past decade. In 2010, there were 52 onsite solar systems installed in the county with a total capacity of 242 kilowatts (kW). By 2019, that figure had grown to 1,239 onsite systems with a total capacity of more than 8 megawatts (MW).

The Virginia Clean Economy Act, enacted in 2020, puts Virginia on a path to a carbon-neutral Electricity Inventory sector. It mandates new measures to promote energy efficiency, sets a schedule for closing old fossil fuel power plants, and requires electricity provided by the state's largest electric utilities to be generated from 100% renewable sources, such as solar or wind. As vehicle technology transitions to electricity as a fuel source, this Act will affect not only the Building Inventory sector, but also the Transportation Inventory sector, driving demand for power generated by renewable sources.

Transportation

Fairfax County's transportation emissions accounted for about 44% of total GHG emissions in 2018, with on-road mobile emissions being the largest contributor, at about 37% of the county's total GHG emissions. The remaining 7% of transportation emissions are due to off-road mobile emissions, rail transportation including emissions from the Virginia Railway Express commuter trains, and air passenger travel emissions.

All vehicle movement on Fairfax County roads are accounted for in the community-wide GHG inventory. This includes all passenger cars, passenger trucks, motorcycles, school buses, transit buses, intercity buses, refuse trucks, light commercial trucks, motor homes, single-unit short-haul trucks, single-unit long-haul trucks, combination short-haul trucks, and combination long-haul trucks. The inventory accounts for all travel occurring on the roadways in Fairfax County, regardless of where the trips originate and terminate. Vehicles that start or stop a trip in the county or pass through the county are incorporated into the emissions inventory.

The category of off-road mobile emissions captures emissions from non-road equipment using gasoline, diesel, compressed natural gas, and liquefied petroleum gas. Non-road mobile sources include lawn and garden equipment, light commercial equipment, industrial equipment, construction equipment, agricultural or farm equipment, recreational land vehicles or equipment, and railroad maintenance equipment.

Commercial aircraft emissions are calculated for air passenger trips originating in the region. This includes all air passengers leaving Fairfax County that fly out of Baltimore/Washington International Thurgood Marshall Airport (BWI), Ronald Reagan Washington National Airport (DCA), and Washington Dulles International Airport (IAD). This includes personal travel and business travel by people who live, work, or were visiting Fairfax County.

Process and Fugitive Emissions

Process and fugitive emissions accounted for about 5% of Fairfax County's 2018 GHG emissions. These emissions include HFC emissions commonly used in air conditioning and refrigerants, as well as fugitive emissions, which are mainly attributable to leaks in the natural gas distribution systems serving Fairfax County.

HFCs are potent GHGs—3,830 times more potent than CO_2—with high global warming potentials. They are comprised of several organic compounds, including hydrogen,

fluorine, and carbon, which are produced synthetically. Because they have an ozone depletion potential of zero, they have gradually replaced chlorofluorocarbons. Local HFC emissions are estimated by downscaling national numbers calculated by the U.S. Environmental Protection Agency (EPA).

While leaks in natural gas distribution systems are the primary source of fugitive emissions, there are two other sources: water and wastewater treatment, including septic and sewer systems in Fairfax County, and agriculture. Each of these two categories accounted for less than 0.1% of total 2018 Fairfax County emissions.

Solid Waste

Municipal solid waste (MSW) combustion accounted for the remaining Fairfax County 2018 GHG emissions, at almost 2%. Fairfax County no longer landfills solid waste; instead, it disposes of it at a commercially operated waste-to-energy (WTE) facility located within the county that generates electricity from waste incineration. In 2018, local jurisdictions in the region sent approximately 1.07 million tons of MSW to this WTE facility, with Fairfax County contributing approximately 58% of the total.

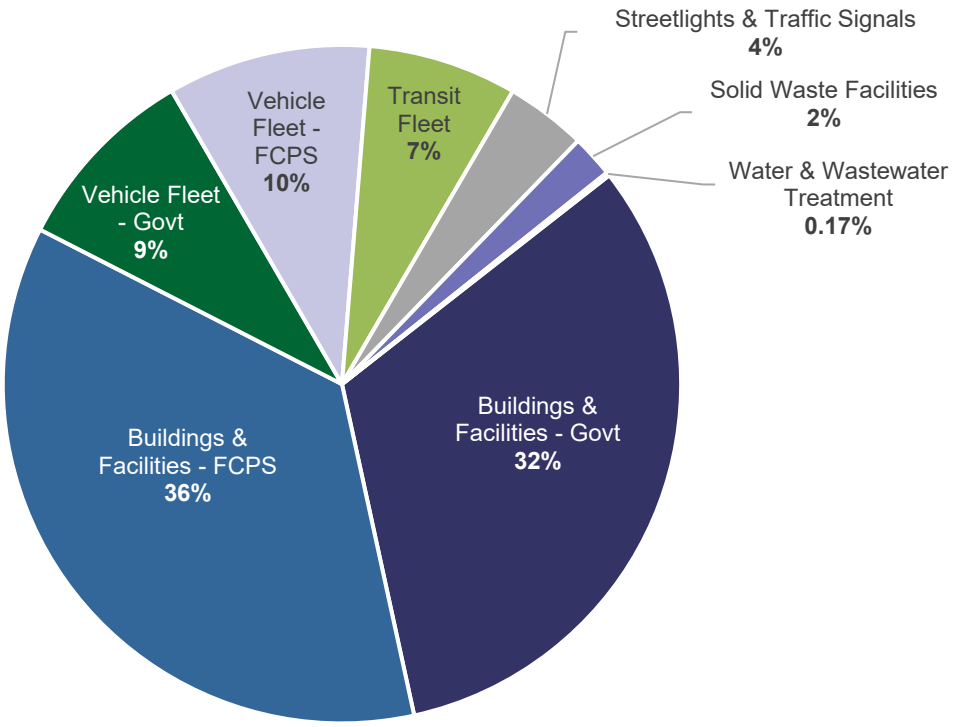
County Operations Emissions Inventory

The emissions inventory also measured GHG-emitting activities attributable to the Fairfax County government and the Fairfax County Public Schools (FCPS), following ICLEI's Local Government Operations Protocol. Inventory results showed that approximately 4% to 5% of Fairfax County's community-wide GHG emissions result from government operations, or 562,439 MT CO_2e.

The inventory of local government operations addressed five categories, with the results shown in Figure 5 and described below:

- The built environment, which accounted for 68% of total county operational emissions, with:
  - 36% attributable to FCPS buildings, and
  - 32% attributable to Fairfax County government buildings and facilities.
- Transportation emissions, which accounted for 26% of total county operational emissions, with:
  - 10% from the FCPS vehicle fleet,
  - 9% from the county government vehicle fleet, and
  - 7% from the transit fleet.
- The remaining 6% of total county operational emissions were attributable to solid waste treatment for both county government and schools (4%); streetlights, traffic signals, and outdoor lighting (2%); and fugitive emissions from wastewater treatment (0.17%).

Figure 5: Fairfax County 2018 Government and Schools GHG Emission Sources



Modeled Scenarios for Consideration in Goal Setting

Several scenarios were modeled to assist the Working Group in setting goals for GHG emissions reduction. A business-as-usual scenario allowed the Working Group to consider emissions levels in the absence of significant change in policies, technologies, practices, and behaviors. Five emissions reduction scenarios were developed to analyze the potential of mitigation actions that could be taken to reach certain percentage reductions in GHG emissions by 2030 and 2050.

Business-As-Usual Projections and Methodologies[10]

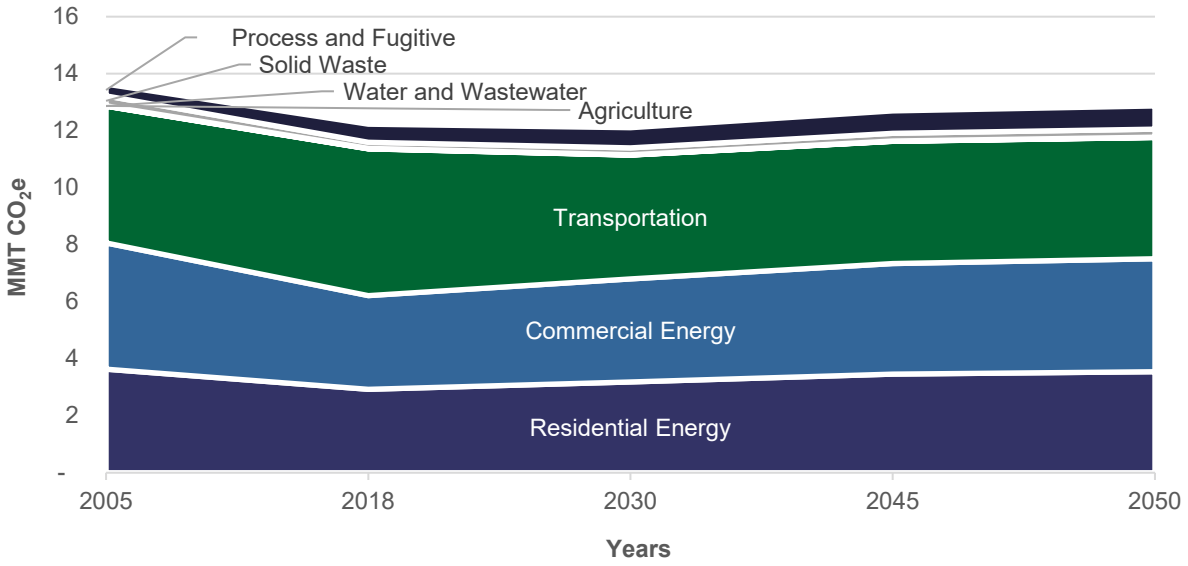
Business-as-usual (BAU) projections provide a baseline scenario for evaluating future GHG emissions. BAU projections take into account driving factors such as growth in population, housing and commercial development, and the impact they will have on future GHG emissions. BAU projections reflect policies, technologies, and practices that have been in place and implemented to-date to reduce GHG emissions, but do not assume or incorporate any additional GHG emissions reductions from anticipated future action (e.g., the Virginia Clean Economy Act of 2020). BAU projections assume that there will be no significant change in the public's attitudes and behaviors.

[10] Intergovernmental Panel on Climate Change. 2018. AR5 Annex II Glossary. Retrieved from https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-AnnexII_FINAL.pdf.
Metropolitan Washington Council of Governments. 2019. Climate Planning Work Session Meeting Documents. Washington, D.C. Retrieved from https://www.mwcog.org/events/2019/11/20/climate-planning-work-sessions/.

A Fairfax County BAU scenario was developed to project emissions out to 2030 and 2050. Figure 6 shows Fairfax County's anticipated BAU emissions projected out to 2050. Results indicate that on-road transportation emissions decrease from 2018 until about 2030, but are offset by increases in building energy consumption, as well as passenger air travel.

The sections below describe the methodology used to derive BAU projections for each of the Inventory Emissions sectors.

Figure 6: Fairfax County Business-as-Usual Projections



Note: Includes the effects of population on residential energy, vehicle-miles traveled, and waste generation.

Building Energy Emissions

Energy projections for both residential and commercial buildings include electricity, natural gas, fuel oil, and liquefied petroleum gas for existing buildings, as well as new construction.

Energy consumption for existing residential and commercial buildings for all fuel types was held constant from 2018 to 2050.

For new construction, projections regarding annual electricity and natural gas consumption differed, depending on whether the building was residential or commercial:

- Projections for residential buildings were derived from household growth in conjunction with a composite household energy use intensity (EUI). This composite EUI factors in average site energy consumption by housing unit type and the distribution of housing types in the county.
- Projections for commercial buildings were derived from anticipated commercial growth in conjunction with commercial EUI statistics. Commercial building space per 1,000 jobs was estimated for 2018, then used along with employment projections to project new commercial space by year. EUI was then applied to estimate projected energy consumption.

Total electricity emissions projections for residential and commercial buildings were calculated by applying the 2018 electric grid emissions factor to total residential and commercial electricity consumption projections from 2019 to 2050, respectively.

Similarly, total natural gas emissions projections were calculated by applying the existing natural gas emissions factor to total residential and commercial natural gas consumption projections from 2019 to 2050, respectively.

Transportation Emissions

The BAU forecast for on-road transportation utilizes Fairfax County summary data for vehicle-miles traveled (VMT) and MT CO_2e as estimated by EPA's Motor Vehicle Emission Simulator (MOVES) model to 2045. These are used to derive simple MT CO_2e/mi rates that vary across the region as a result of the differences in road network and other factors among counties. As there is currently no official projection for 2050 VMT or GHG emissions from on-road transportation, the trends from the MOVES model were used to project the final five years.

The emissions rate from off-road mobile sources was held constant from inventory year 2018.

Passenger air travel emissions in the region were based on COG's 2013 Washington-Baltimore Regional Air Passenger Origin/Destination Forecast Update report. In this report, airport enplanement forecasts by county were used to estimate enplanement growth rates by airport (BWI, DCA, and IAD) through 2040. For the purposes of the GHG BAU, enplanement growth rate projections from 2040 to 2050 follow the trend set by the forecasts from 2015 to 2040. GHG emissions were projected by applying enplanement growth rates to Fairfax County's contribution to GHG emissions by airport.

Commuter rail emissions were projected forward based on expected annual percentage increases in transit ridership from 2018 to 2030. This same annual percentage increase was used to project emissions growth from 2030 to 2050.

Process and Fugitive Emissions

Fugitive HFC emissions are based on emissions per capita, multiplied by expected population increases. Natural gas fugitive emissions are projected using the annual natural gas consumption in therms taken from residential and commercial gas estimates and an emissions rate from the 2018 inventory.

As noted, the two remaining sources of process and fugitive emissions in Fairfax County—wastewater and agricultural emissions—are de minimis, accounting for approximately 0.2% of total emissions. Wastewater emissions for both septic and sewer treatment were based on emissions per capita and the percentage of the population using the treatment method, multiplied by expected population increases. Changes in agricultural emissions were based on recent trends in acres of land in production as a proxy.

Solid Waste Emissions

Solid waste combustion emissions projections were based on waste generation per capita, multiplied by expected population growth, similar to wastewater treatment projections. These projections assume no change in disposal practices.

The 2050 Emissions Reduction Scenarios[11]

Fairfax County's GHG emissions reduction scenarios were developed by the COG emissions team to analyze the potential of mitigation actions that could be taken by county residents and businesses to reach certain percentage reductions in GHG emissions by 2030 and 2050. These scenarios leverage a previous scenario analysis conducted in 2015 by the COG Multi-Sector Working Group (MSWG). The work of the MSWG, which included professionals from COG member jurisdictions, included identifying viable, implementable local, regional, and state actions with respect to buildings, energy, transportation, and land use.

The MSWG results were updated based on new data and progress since the MSWG completed its work. In addition, based on the assumptions made in the MSWG report:

- Reduction estimates related to energy efficiency, grid improvements, and renewable energy were applied only to the electricity segment of the building energy categories, equating to approximately 58% of residential energy GHG emissions and 82% of commercial energy GHG emissions.
- Reduction estimates applied to transportation were focused on improvements to on-road mobile emissions, which accounts for 92% of mobile emissions, with improvements further focused on improvements to light-duty vehicles, which account for 64% of on-road transportation emissions.

Five main emissions reduction scenarios were developed for 2030 and 2050 milestone years. The five initial scenarios produced emissions reductions by 2050 from 2005 levels that ranged from 33% to 82%. These five scenarios, described in order of increasing level of resulting emissions reductions, are:

[11] Metropolitan Washington Council of Governments. 2016. *Multi-Sector Approach to Reducing Greenhouse Gas Emissions in the Metropolitan Washington Region, Final Technical Report.* Washington, D.C. Retrieved from https://www.mwcog.org/documents/2016/08/01/multi-sector-approach-to-reducing-greenhouse-gas-emissions-in-the-metropolitan-washington-region-final-technical-report/.

Metropolitan Washington Council of Governments. 2019. *The Future of Housing in Greater Washington*. Washington, D.C. Retrieved from https://www.mwcog.org/documents/2019/09/10/the-future-of-housing-in-greater-washington/.

National Renewable Energy Laboratory. 2018. *Electrification Futures Study: Scenarios of Electric Technology Adoption and Power Consumption for the United States*. Golden, CO. Retrieved from https://www.nrel.gov/analysis/electrification-futures.html.

Derived from ICF. 2020. *Study on the Use of Biofuels (Renewable Natural Gas) in the Greater Washington, D.C. Metropolitan Area*. Fairfax, VA. Retrieved from https://washingtongasdcclimatebusinessplan.com/.

- **Scenario A: Low-moderate reduction scenario** for both energy and transportation (both 2030 and 2050), resulting in a 33% emissions reduction below 2005 levels by 2050.

  Key assumptions: By 2050, (i) a 43% reduction in emissions from the electric grid, and (ii) growth in low-carbon transportation improvements leading to a 41% emissions reduction for light-duty vehicles.

- **Scenario B: More aggressive reduction scenario than Scenario A** for both energy and transportation (both 2030 and 2050), resulting in a 37% emissions reduction below 2005 levels by 2050.

  Key assumptions: By 2050, (i) a 52% reduction in emissions from the electric grid, and (ii) a more rapid expansion of low-carbon transportation leading to a 47% emissions reduction for light-duty vehicles.

- **Scenario C: Net zero grid and low-carbon transportation scenario** (only 2050), resulting in a 59% emissions reduction below 2005 levels by 2050.

  Key assumptions: By 2050, (i) a net zero grid (i.e., an electric grid powered 100% by renewable generation), and (ii) near-complete expansion of low-carbon transportation for light-duty vehicles, resulting in an 85% emissions reduction in transportation emissions.

- **Scenario D: Net zero grid, low-carbon transportation, and low/high penetration of low-carbon gas scenario** (only 2050), resulting in a 71% emissions reduction below 2005 levels by 2050. This scenario differs from Scenario C in that it assumes significant use of renewable natural gas.

  Key assumptions: By 2050, (i) a net zero grid, (ii) near-complete expansion of low-carbon transportation for light-duty vehicles, and (iii) a high penetration (50%) of resource-recovered gas.[12]

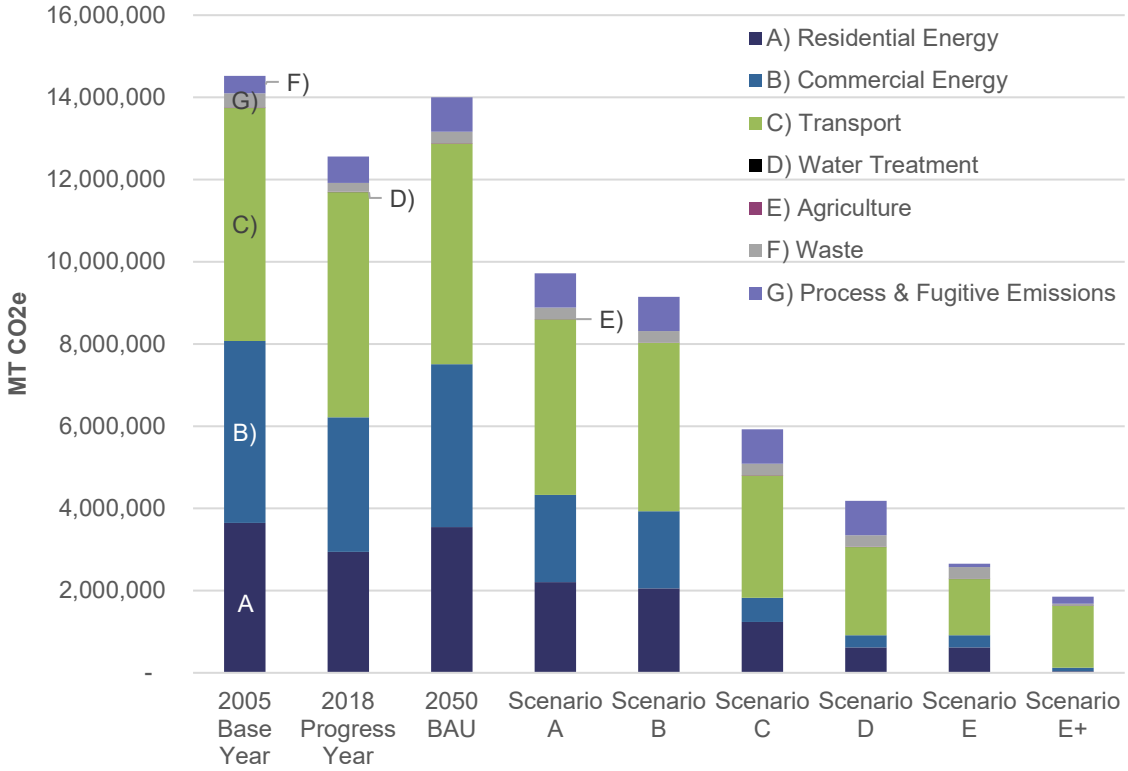
- **Scenario E: An 80% total emissions reduction by 2050 (80x50) scenario** (only 2050). Although captioned as "80x50," the result of the actions undertaken in this scenario resulted in an 82% emissions reduction below 2005 levels by 2050.

  Key assumptions: By 2050, (i) a net zero grid, (ii) low-carbon transportation penetration for both on-road and off-road vehicles and equipment leading to a75% emissions reduction in mobile emissions, (iii) a 50% penetration of resource-recovered gas, and (iv) the phase-out of hydrofluorocarbons.

After these scenarios were presented, the Working Group requested an even more aggressive emissions reduction scenario. In response to this request, the COG team developed **Scenario E+**, which resulted in an 87% total GHG emissions reduction by 2050, or an additional emissions reduction of 5% as compared to Scenario E. Scenario E+ supplemented Scenario E by (i) increasing the penetration of resource-recovered gas from 50% to 97% for residential use and to 85% for commercial use, and (ii) assuming an 80% reduction in solid waste emissions. The results and emissions reduction impacts of scenarios A through E+ are illustrated in Figure 7.

[12] Resource-recovered gas (commonly referred to as renewable natural gas) refers to biogas created from decomposed organic matter.

Figure 7: Fairfax County's 2050 GHG Emissions Reduction Scenario Results



GREENHOUSE GAS REDUCTION GOALS

This section presents the goal-setting process and the long-term, interim, and sector-specific goals selected by the CECAP Working Group, with input from the community and key stakeholders. The selected goals will guide emissions-related activities in the county for decades to come.

Goal-Setting Approach

Fairfax County's GHG reduction goals were developed through a deliberative, evidence-based, and communal process to ensure that the final goals were based on science, community priorities, and stakeholder input. The GHG inventory, the BAU projections, and GHG scenario modeling are critical data for goal setting as they indicate the most recent historical emissions levels and the likely future emissions levels given certain assumptions. Given this historical data and considering the various future scenarios, the Task Force, and later the Working Group, determined goals that struck the right balance between what was ambitious and science-based, and what was technically feasible and realistic, and was able to identify key emissions sources on which to focus reduction efforts.

Base year: The historical year against which the future reduction goal will be compared.

Target year: The future year by which the communities aim to achieve their goal.

Goal boundary: Defines which emissions sources are included in the base and target years.

In addition to the inventory and scenario data, the county used the internationally accepted GHG goal-setting framework developed by the Greenhouse Gas Protocol[13] to effectively set its GHG reduction goals. This process includes selecting a base year, a target year, the goal boundary, and the goal type. The base year is the historical year against

[13] GHG Protocol. Mitigation Goal Standard. https://ghgprotocol.org/mitigation-goal-standard.

which the future reduction goal will be compared. The target year is the future year by which the communities aim to achieve their goal. The goal boundary defines what emissions sources are included in the base and target years. Multiple target years can be set—often jurisdictions set a long-term goal (e.g., for 2050) and one or several interim goals (e.g., 2030 or 2040) that act as milestones guiding the trajectory to the long-term goal. Once the base year, target year, and boundaries were set, the Working Group decided what kind of goals to set, and if they wanted multiple goals and sector-specific goals (i.e., goals that track key metrics for different economic areas, such as transportation, energy, and natural resources).

Selected Goals

The Task Force set two goals—a long-term goal for 2050 and an interim goal for 2030. Later in the goal-setting process, the Working Group set a 2040 interim year goal. The Working Group also identified a series of sector-specific goals to keep Fairfax County on track to meet their GHG reduction targets.

Ultimately, the following goals were selected.

Long-term target goal: Fairfax County will aim to achieve carbon neutrality by 2050, with at least an 87% reduction in GHG emissions as compared with 2005 levels. Carbon neutrality, as defined during the CECAP Working Group's goal-setting process, refers to achieving net zero GHG emissions by balancing GHGs released with an equivalent amount sequestered or offset through carbon credits.

A **2005 base year** was selected for GHG reduction goals in order to align with international emissions reduction targets, such as the Paris Agreement, and to be consistent with and comparable to other jurisdictions.

Interim year goal for 2030: Fairfax County will reduce GHG emissions by 50% by 2030, from a 2005 base year.

Interim year goal for 2040: Fairfax County will reduce GHG emissions by 75% by 2040, from a 2005 base year.

Sector-specific goals: The sector-specific goals set by the Working Group include the following:

- All new, eligible buildings will have a commitment to green building.
- Retrofit at least 100,000 housing units with energy efficiency measures by 2030.
- Increase transit and non-motorized commuting to 30% (including teleworking) by 2030.
- Increase plug-in electric vehicles (PHEVs) and battery electric vehicles (BEVs) to at least 15% of all light-duty vehicle registrations by 2030.

- Expand the tree canopy to 60% with a minimum of 40% tree canopy coverage in every census block by 2030 and a minimum of 50% tree canopy coverage in every census block by 2050, prioritizing areas of highest socioeconomic need first.
- Achieve zero waste by 2040, defined as at least 90% waste diverted from landfill/incineration, in alignment with the definition by the Zero Waste International Alliance.

Further information about each goal and the Working Group's decision-making process are provided below.

Long-Term Target and Interim Year Goals

During the goal-setting process, several Task Force members voiced a preference for a carbon neutrality goal that emphasizes actual emissions reductions over the use of carbon offsets. Carbon offsets comprise a range of emissions reduction measures not directly covered in a defined emissions reduction policy framework that can be used to "offset" emissions that are deemed difficult and or costly to reduce under the policy scheme. The scenario modeling conducted by COG and ICF determined that an 87% reduction in emissions was technically feasible given today's technologies, and future technologies may offer additional reduction opportunities. It is for this reason that the community's long-term goal specifies at least an 87% reduction in actual emissions.

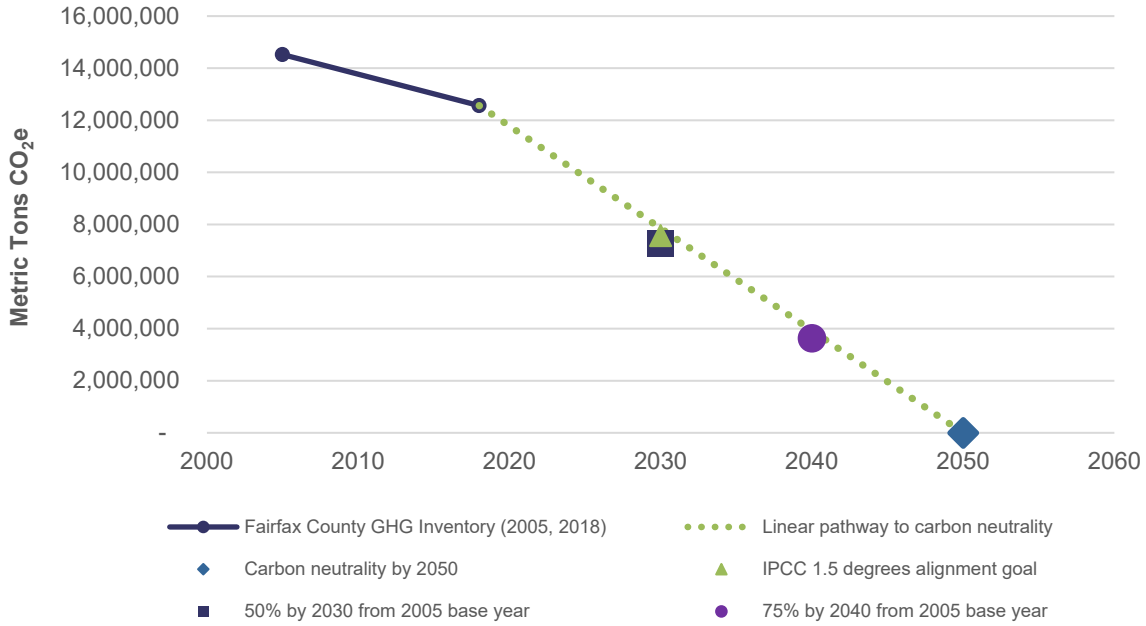
The 2030 interim goal was selected because it aligns with the Intergovernmental Panel on Climate Change's (IPCC) finding that a science-based goal should consider the level of decarbonization required to keep global temperatures below a 1.5 degrees Celsius increase. Keeping temperatures below this threshold will avert the more dangerous impacts of climate change (IPCC, 2018).

Community members weighed in on the initial progress via online surveys and at three community meetings. Nearly 2,000 individual responses were received from across the county. See Community Engagement for more information about this process. In September 2020, the Task Force met and reviewed the public input and additional data before discussing the various options. Finally, after discussions were completed, the Task Force voted on initial GHG reduction goals for Fairfax County.

At the May 2021 Working Group meeting, the Working Group selected a 75% reduction as the interim goal for 2040 from a 2005 base year. This aligns with the long-term target of carbon neutrality by 2050 from a 2005 base year, with at least 87% coming from GHG emissions reductions.

The long-term goal and interim goals are illustrated in Figure 8 below.

Figure 8: Fairfax County Long-Term and Interim Targets



Sector-Specific Goals

The Working Group chose to set sector-specific goals to further emphasize the importance of specific GHG reduction strategies and to identify focus areas for implementation. Task Force members initially indicated interest in setting sector-specific goals for the Transportation and Energy sectors. In later discussions at the May 2021 Working Group meetings, members of the Working Group echoed this preference to focus sector-specific goals on green building, building energy efficiency, and transportation, and also decided to select a goal for the Natural Resources sector. At the final Working Group meeting in June 2021, Working Group members added a Waste sector goal.

In all, two goals were selected that relate to buildings and energy efficiency, two goals related to transportation, one goal related to natural resources, and one goal related to waste. A goal for the Energy Supply sector was not selected by the Working Group because the Virginia Clean Economy Act (VCEA) will drive renewable energy generation across Virginia, including Fairfax County, by establishing 100% clean energy targets for the state's largest utilities by 2050 and by 2045 for most of Fairfax County. Renewable energy in the energy supply is addressed in Strategy 4: Increase the Amount of Renewable Energy in the Electric Grid and Strategy 5: Increase Production of Onsite Renewable Energy.

Furthermore, the Working Group considered a sector-specific goal for reducing emissions from fugitive refrigerants with high global warming potential. This goal was not discussed due to time constraints. However, GHG reductions from this sector are difficult to influence given the little control that county residents, stakeholders, and county government have over this source of emissions, and the need for federal action to reduce refrigerant emissions, as is reflected under the Working Group-Recommended Activities for Implementation for Strategy 2.

Reducing emissions from refrigerants is addressed in Action 2c: Reduce the Use of High Global Warming Potential Refrigerants.

Feedback from the broader public on the sector-specific goals was solicited at the May 2021 public feedback sessions. Overall, the members of the public who joined the public feedback sessions did not have objections to the goals. Certain members of the public asked for clarity around definitions used in the goals.

Each sector-specific goal is described further below.

All new, eligible buildings will have a commitment to green building.

This goal focuses on emissions reductions in the high-emitting Buildings sector. "Eligible" buildings refer to any building that triggers the green building policy in the Comprehensive Plan. Fairfax County's green building policy currently leverages various green building certifications, including Leadership in Energy and Environmental Design (LEED), EarthCraft, and the National Green Building Standard (NGBS), as well as proprietary systems. The Working Group also discussed that a clear definition of green buildings is needed, but that the definition will be intentionally left vague to be defined in the implementation phase and capture a range of green building activity.

Fairfax County's Green Building Policy

The county's Comprehensive Plan includes a green building policy, which encourages green building in areas of the county where it is most appropriate. In September 2020, this policy was updated, setting a goal for Fairfax County capital projects to achieve a minimum of LEED Gold certification for new construction and major renovations. The policy has a goal of improving energy performance by a minimum of 30% compared with a baseline building for projects beginning design in FY 2021, to 50% in FY 2027, and being Net Zero-ready by 2031.

See Current Policies and Programs/Implementation for more on the county's green building policy.

Retrofit at least 100,000 housing units with energy efficiency measures by 2030.

This goal focuses on progress in the high-emitting Buildings sector and builds capacity (contractor and programs) for deeper work. Currently, Fairfax County has 415,000 housing units, a number that is projected to grow to more than 550,000 housing units by 2050. As a result, the 100,000 housing units encompassed in this goal are equivalent to roughly one-fourth of existing housing units being retrofitted.

Fairfax County currently does not track this measure and would need to create either new methods and/or partnerships to track progress toward this goal. For example, the county could partner with Dominion Energy to measure participation rates and the impacts of the

utility's energy efficiency programs. During implementation of energy efficiency programs, the Working Group emphasized an interest in focusing resources on low- and moderate-income homeowners and equity considerations. In addition, the specific actions that constitute a retrofit were intentionally left vague and are to be defined in the implementation phase of CECAP.

Increase transit and non-motorized commuting to 30% (including teleworking) by 2030.

This goal focuses on emissions reductions in the high-emitting Transportation sector and reducing emissions from single-occupancy vehicles is key to lowering emissions from the Transportation sector. In addition, commuting patterns are readily tracked and it will be easy to understand the progress. Finally, Fairfax County has significant transit infrastructure in place to build from.

As of 2018, about 8% of commuters were taking public transit (metro, bus, or rail), slightly above the U.S. average; another 0.3% commuted by bike and 1.4% by walking. In total, the percentage of commuting via transit and non-motorized vehicles, including teleworking, was 14% in 2018. COVID-19 has depressed transit ridership considerably and the impacts on future service and ridership are highly uncertain through at least 2023. The Working Group agreed that the percentage identified in this target is not binding, and that Fairfax County should aim to exceed these target percentages, if possible, by 2030.

The term "non-motorized commuting" in the goal refers to walking, biking, and micro-mobility modes (e.g., electric bikes, scooters, other emerging forms of personal transportation).

Increase plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs) to at least 15% of all light-duty vehicle registrations by 2030.

This goal focuses on emissions reductions in the Transportation sector. Vehicle electrification greatly improves local air quality and advances carbon neutrality goals. EVs already have a significantly lower carbon footprint per mile than internal combustion engines in Virginia and the gap will continue to grow as more clean electricity is brought about through the VCEA. In March 2021, Virginia became the 13th state to adopt the California-led zero-emission vehicle (ZEV) program.[14] Consequently, EVs will be more readily available at local dealerships. The legislature also passed a bill to implement a $2,500 rebate for EV purchases and allows income-eligible drivers to receive an additional $2,000.

Data on electric vehicle (EV) registrations for light-duty vehicles are readily available for tracking progress. As of 2019, 0.8% of light-duty vehicle registrations were PHEVs and BEVs.

In terms of implementation, increasing EV registrations may require a variety of different strategies, including increasing charging access by installing new EV charging equipment, reducing charging time, incentives for purchasing EVs, and educational campaigns.

[14] California Air Resources Board. Zero-Emission Vehicle Program. https://ww2.arb.ca.gov/our-work/programs/zero-emission-vehicle-program/about.

Expand the tree canopy to 60% with a minimum of 40% tree canopy coverage in every census block by 2030 and a minimum of 50% tree canopy coverage in every census block by 2050, prioritizing areas of highest socioeconomic need first.

This goal focuses on emissions reductions in the Natural Resources sector and aligns with Fairfax County's existing Tree Action Plan.[15] Preserving and expanding tree canopy is an important emissions reduction measure because trees sequester carbon. Fairfax County's trees have an estimated 7.5 million tons of carbon within their tree biomass (Tree Action Plan, 2019). Tree canopy also provides numerous co-benefits, such as the reduced urban heat island effect and reduced air pollution. For example, Fairfax County's current tree canopy is estimated to save $34.3 million in energy use costs each year through shade and wind speed reductions (Tree Action Plan, 2019). Finally, this goal was selected because of its relation to land use and land use change as any increases in impervious surface in the county will make it harder to reach this goal.

Tree canopy is currently tracked by the Fairfax County government. As of 2017, Fairfax County's tree canopy was at 57%, so this goal focuses on expanding the tree canopy overall and ensuring that there is a minimum tree canopy coverage across all census blocks. The goal also prioritizes areas of high socioeconomic need first so that these areas can experience the benefits of tree canopy.

Achieve zero waste by 2040, defined as at least 90% waste diverted from landfill/ incineration, in alignment with the definition by the Zero Waste International Alliance.

This goal focuses on emissions reductions in the Waste sector. This goal aligns with interest in zero waste from both the Fairfax County School Board and Fairfax County Board of Supervisors.

Currently, 48% of waste generated in Fairfax County is diverted from landfill/incineration.[16] The Zero Waste International Alliance (ZWIA) defines zero waste as the conservation of all resources by means of responsible production, consumption, reuse, and recovery of products, packaging, and materials without burning and with no discharges to land, water, or air that threaten the environment or human health.[17] In terms of percentage diversion, ZWIA defines "zero" waste as achieving at least 90% diversion from landfills, incinerators, and the environment and a commitment to reducing the amount of materials discarded overall.[18]

This goal aims to reduce emissions from waste within the county, but it also will support GHG reduction efforts globally through emissions reductions from reduced raw material extraction and transportation of material goods.

[15] Tree Action Plan. 2019. https://www.fairfaxcounty.gov/publicworks/sites/publicworks/files/assets/documents/treeactionplan.pdf.
[16] Fairfax County Department of Public Works & Environmental Services. 2021. Annual Recycling Rate Fairfax County. https://www.fairfaxcounty.gov/publicworks/sites/publicworks/files/assets/documents/tonnage.pdf.
[17] U.S. EPA. https://www.epa.gov/transforming-waste-tool/how-communities-have-defined-zero-waste.
[18] Zero Waste International Alliance. https://zwia.org/zero-landfill-is-not-zero-waste/.

EMISSIONS REDUCTION STRATEGIES AND ACTIONS

CECAP includes strategies and associated actions that Fairfax County residents, businesses, and organizations can take to reduce emissions. CECAP was developed by the Working Group, in consultation with county staff, ICF, and the broader public. See CECAP Process and Methodology for more on the planning process.

Within this framework, the terms *sector*, *strategy*, *action*, *implementation*, and *impact* have specific meanings and are defined in the textbox to the right.

This section provides background on the CECAP strategy framework and is followed by a discussion of each of the strategies and associated actions and implementation activities to reduce emissions.

CECAP Framework

The framework includes 5 sectors, 12 strategies, and 37 actions. Each action impacts the community differently and has different implementation methods. Each strategy and its associated actions are described in greater detail in the following sections.

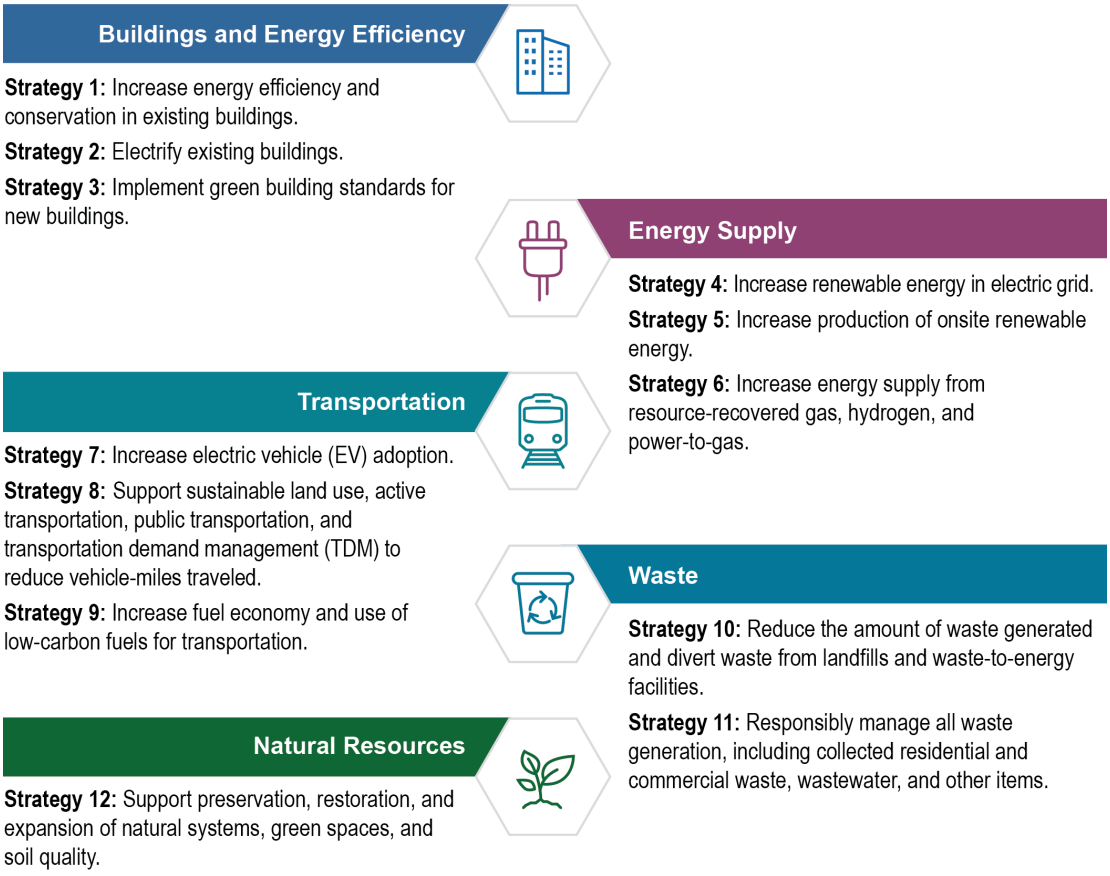
Sector: An area of emissions focus or an economic sector that generates GHG emissions from its energy use or economic activity.

Strategy: A broader set of actions or set of subsector work that can be modeled to understand emissions reduction.

Action: A project or specific technology that impacts greenhouse gas emissions within a strategy or sector.

Impact: The effect of a strategy or action on a specific value or indicator.

Implementation: Programs or policies that support the realization of actions.



Impact Categories

All of the actions described in CECAP will need to be undertaken in order to achieve emissions reduction goals. Still, Fairfax County residents, businesses, county government, and other stakeholders (e.g., organizations, commuters, state and federal governments) have diverse priorities and values that may lead to the selection of one action over another. To help community members and decision makers inside and outside of Fairfax County prioritize which actions to take, each action section describes the action's potential impacts in various categories. The impact categories assessed include:

- **Greenhouse gas (GHG):** A measure of the total GHG reduction potential from each strategy. GHG emissions were estimated based on ICF's quantitative modeling of the various strategies and actions. For each strategy, ICF estimated the GHG impact measured in metric tons of carbon dioxide equivalent (MT CO_2e), which represents the fully implemented technical potential.
- **Public health:** A measure of how the action benefits the health of Fairfax County residents and visitors by improving air or water quality, increasing active commuting, or supporting wellness.
- **Environmental resources:** A measure of how the action impacts the preservation, improvement, and restoration of environmental resources, such as air, water, and land;

this impact category does not encompass GHG emission impacts since that impact is captured under the GHG impact category.

- **Economic opportunity:** A measure of how the action might lead to local or regional job and/or business growth in the economy.
- **Equity (i.e., One Fairfax):** A measure of how and whether the action has an impact on eliminating social and/or racial inequities in alignment with Fairfax County's One Fairfax policy.
- **Payback:** A measure of total costs divided by savings from the action. A simple payback is meant to serve as a proxy for cost-effectiveness. The payback is based on the cost to the typical individual or organization that pays for the action.
- **Cost to community members:** A measure of initial investment of dollars spent by a community member (i.e., the typical individual) to implement the action at one location or in one instance. The community member is the individual who pays for the action.
- **Timeframe:** An indicator of technological maturity and availability to be installed or deployed on a significant scale. Some technologies and actions are already available in the customer marketplace, while others are not yet deployed at scale, not yet available at all, or currently are restricted by either local or state policy.
- **Other considerations:** A measure of other considerations specific to the action not included in other impact categories. This impact category is designed to cover considerations that are unique to a particular action or strategy. These may include a variety of considerations, such as feasibility and scalability; life cycle emissions impact (as opposed to annual emissions); impact on climate adaptation, resiliency, and/or hazard mitigation; and evaluation of whether the action is holistic in its approach (e.g., how it might influence and interact with another action) and how it aligns with other Fairfax plans and stakeholder work, among others.

Note on Costs: Not all actions selected by community members to reduce GHG emissions will incur costs. Some actions simply involve behavior change. To the extent that a cost is associated with an action, that cost can be recovered by the community member through the member's own resources (e.g., through savings that result as a result of the action) or through applicable programs, including federal, state, and local programs, such as grants, incentives, tax credits, and tax rebate programs. Available programs are expected to expand over time and will likely include governmental programs and programs offered by nongovernmental entities, including businesses (e.g., energy utilities), manufacturers, and other nongovernmental organizations (NGOs).

See Costs and Benefits Considerations in this section for more discussion of how costs were considered in this report and recommendations for future cost assessment.

Impact Category Notations

Each impact category was rated by ICF, with input from the CECAP Working Group. Each rating is visualized in the report using the notations presented in the table below.

Impact Indicators	Notation
Impact Indicators for Social Impacts	
Detrimental or unfavorable impact	--
Slightly detrimental or unfavorable impact	-
Neutral or no potential impact	=
Slightly beneficial or favorable impact	+
Beneficial or favorable impact	++
Impact Indicators for Payback	
Not Applicable	N/A
Quick Payback (1–3 years)	1–3 years
Medium Payback (3–7 years)	3–7 years
Slow Payback (more than 7 years)	> 7 years
Impact Indicators for Cost to Community Members: All costs presented are based on the costs as of the writing of this report, without projecting for reductions from efficiency, technology, or other cost improvements.	
Not Applicable: A cost that is not incurred by an individual community member and instead is incurred by either a business or some other entity.	N/A
No Cost: No cost, or no additional cost beyond baseline costs, is incurred through this action by an individual community member.	$0
Low Cost: A low cost for an individual community member, which either occurs as a small regular outlay through utility or energy bills; local, state, or federal taxes; or other cost increases.	$
Moderate Cost: A moderate cost or investment for an individual community member in modest-cost products or equipment, or an incremental cost increase to a larger financial investment.	$$
High Cost: A high cost or investment for an individual community member into new equipment, a vehicle, or a retrofit that requires a capital outlay or financial investment of many thousands of dollars.	$$$
Impact Indicators for Timeframe: Timeframe provides an indicator for the technological maturity and availability to be installed or deployed on a significant scale.	
Action/Technology is currently available and is being commercially deployed on a significant scale.	Immediate (available presently)
Action/Technology is currently available, but not yet commercially deployed on a significant scale (1–10 years from broad implementation).	Soon (available before 2030)
Action/Technology is not yet available, emerging technology (more than 10 years from broad implementation).	Future (available after 2030)

Costs and Benefits Considerations

Cost and benefit assessments can be an important step in making decisions about how to efficiently allocate resources to reduce GHG emissions.

The Emissions Reduction Strategies and Actions section provides a qualitative assessment of costs and benefits (represented as "impact categories," as discussed above). The rating scales provide a rough order of magnitude of the costs to a community member (e.g., the cost of technology purchases, fuel savings, public health costs) of specific actions using the following scale: not applicable, no cost, low cost, moderate cost, or high cost. Social impacts (e.g., public health and equity) were rated using the following scale: unfavorable, slightly unfavorable, neutral, slightly favorable, or favorable. The impact ratings informed prioritization of strategies by the Working Group during the development of CECAP. Additionally, the impact categories are meant to provide community members with a list of decision-making criteria to effectively prioritize and decide on actions to pursue to reduce GHG emissions in Fairfax County.

The CECAP planning process and report were not intended to provide a quantitative cost-benefit impact assessment. Throughout the development of CECAP, Working Group members emphasized both the importance of analyzing the costs and benefits of the strategies and actions included in the report. Although some Working Group members raised concerns about high costs or the need to conduct a detailed quantification of costs at times, other Working Group members often countered with the need to also quantify the benefits of the climate actions and the cost of not taking action. A key output of the CECAP process was the desire of the Working Group for a detailed quantification of costs and benefits from the strategies and actions in the CECAP report.

As a next step in the CECAP process, the Working Group recommends an in-depth analysis of costs and benefits to further support prioritization and decision making to take action to reduce GHG emissions. This analysis could take various forms, including:

- **Conducting a cost-benefit analysis:** This analysis involves estimating a monetary value for strategy investments and a monetary value for all benefits, including items such as reduced hospital costs and jobs created. Useful metrics for long-term climate action planning include lifetime net present value, cost per ton relative to the social cost of carbon, and net cash flow.
- **Conducting a cost-effectiveness analysis:** Cost-effectiveness studies provide consistent methods for quantitatively comparing scenarios based on the implementation of actions, including policies, programs, and projects, by calculating net costs, savings, and net benefits, typically using a net present value calculation. To determine net costs, the study compares the proposed action with a baseline action. The study also estimates benefits, sometimes combining multiple benefit streams, over the life of the measure, and typically applies a discount rate to calculate the present value of benefits, so that costs and benefits can be compared in present-day terms. Benefits are then divided by net costs to obtain a cost-effectiveness ratio. A benefit-cost ratio of 1.0 or greater is generally

considered to be cost-effective. For example, if implementing an energy efficiency measure has a front-end cost of $1,100, and the baseline action would cost $700, and the measure saves $500 in energy bills over its life (using a 3% discount rate), then:

Net costs: $1,100 – $700 = $400
Benefits (net present value): $500
Benefit-cost ratio: 1.25 and $125 per case of asthma avoided

If this measure also avoided one case of asthma based on reduced air pollution, the cost-effectiveness analysis on the investment would result in $125 per case of asthma avoided. In some instances, energy bill savings may not exceed net costs, but the health benefits could be calculated to understand the measure's cost-effectiveness.

- **Developing a marginal abatement cost (MAC) curve:** This analysis estimates the cost of emissions reductions on a dollar per unit of carbon dioxide equivalent (CO_2e) and the potential GHG reduction in CO_2e in a specific year. The dollar value is typically taken from the net benefits calculation illustrated above; in cases where benefits exceed costs, the cost per ton can be negative on the MAC curve. The results are often visualized in blocks on a chart where each block represents an individual or set of GHG emissions reduction measures. For each block, the width indicates the amount of potential GHG emissions reduced while the height estimates the marginal cost of the GHG emissions abatement in dollars per unit of CO_2e. Blocks are ordered with the lowest cost options on the left, with higher cost options on the right. MAC curves can be useful at visualizing cost-effective reduction measures up to a specific dollar per carbon, or level of emissions reductions.

Implementation Categories

Recommended activities for implementation were developed by the Working Group in consultation with county staff and ICF. Each recommended activity for implementation is grouped into one of five categories, which indicate where the ability to impact change might exist. These implementation categories were developed because Virginia is a Dillon Rule state.

The **Dillon Rule** declares that state law is pre-emptive of local law unless the state confers the power to a local government. The Dillon Rule is strictly interpreted so that if there is reasonable doubt about whether a power has been conferred to a local government, then it has not been.

Working Group-recommended activities for implementation may fall into one or more of the following categories.

Recommended Activities for Implementation for All Actors: Actions that are applicable to all actors, including individuals and organizations, the county, state government, and federal government.

Recommended Activities for Implementation for Individuals and Organizations: Actions that individuals, businesses, and organizations can take now.

Recommended Activities for Implementation for the County: County measures and programs that the Fairfax County government can do right now. The recommended measures and programs in this category were specifically noted by the Working Group for action by the Fairfax County Board of Supervisors.

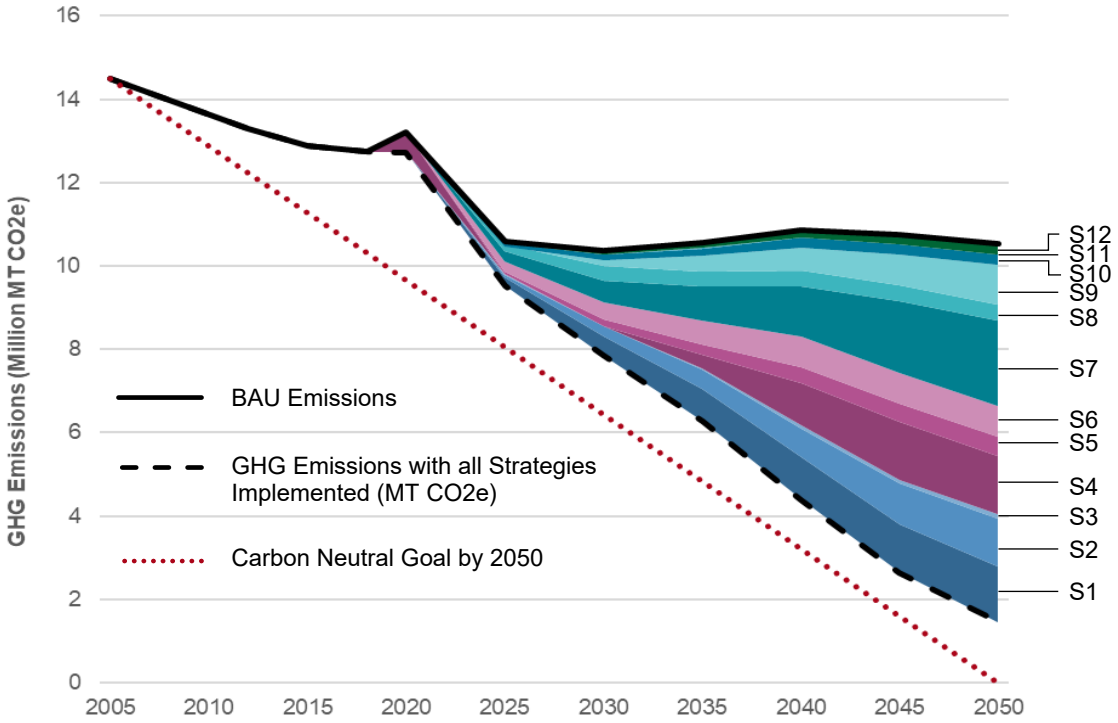
Recommended Activities for Implementation for the County Requiring State-Enabled Legislation: County programs and policies that the county might someday be able to do with state enabling legislation. The county and its stakeholders can advocate for items in this section at the state level.

Recommended Activities for Implementation for State and Federal Governments: State and federal measures and programs that the county will likely not have the authority to do on its own. The county and its stakeholders can advocate for these items at the state, regional, or federal level.

Greenhouse Gas Emissions Reduction Modeling

Actions taken within each of the strategies in the CECAP framework will help Fairfax County to achieve the selected GHG goals. Each of the 12 strategies were modeled to show the emissions reduction potential in terms of metric tons of carbon dioxide equivalent (MT CO_2e) by 2050. In general, GHG reductions were estimated by applying the technical potential of full implementation for each strategy as compared with a business-as-usual case. The assumptions underlying full implementation are based on actions prioritized by Working Group members and in consultation with industry experts. The actual and modeled GHG emissions reductions from each strategy are presented in Figure 9: Modeled GHG Emissions Reduction by Strategy from 2005 to 2050. Even with all Strategies implemented by 2050, members of the Fairfax County community will need to rely on a portion of either emerging technologies, or carbon offsets to meet the goal of carbon neutrality. GHG modeling assumptions are described in each strategy section and further outlined in Appendix D.

Figure 9: Modeled GHG Emissions Reduction by Strategy



S1: Increase energy efficiency and conservation in existing buildings
S2: Electrify existing buildings
S3: Implement green building standards for new buildings
S4: Increase the amount of renewable energy in the electric grid
S5: Increase production of onsite renewable energy
S6: Increase energy supply from resource-recovered gas, hydrogen, and power-to-gas
S7: Increase electric vehicle (EV) adoption
S8: Support sustainable land use, active transportation, public transportation, and transportation demand management (TDM) to reduce vehicle-miles traveled
S9: Increase fuel economy and use of low-carbon fuels for transportation
S10: Reduce the amount of waste generated and divert waste from landfills and waste-to-energy facilities
S11: Responsibly manage all waste generated, including collected residential and commercial waste, wastewater, and other items
S12: Support preservation, restoration, and expansion of natural systems, green spaces, and soil quality

Impact Category Summary Matrix

Due to the ambitious nature of the GHG goals, all strategies and actions must be part of the solution. Community members are encouraged to prioritize which actions to take based on the various impact categories, and how those impact categories align with their resource levels and values. For example, if a member of the community wants take action to reduce emissions at a low cost while enhancing public health, they might consider Action 8a. Support the use and improvement of bicycle and pedestrian infrastructure, which has two plus signs (++) indicating a favorable impact on public health, has a short payback from 1–3 years, and has a low cost to the community member.

Table 1 provides the impact categories and symbols by action and GHG impact by strategy. Further details about each impact are provided in each action section.

Table 1: Summary of All Impact Categories by Action

No.	Description	GHG ($MT CO_2e$) Reduced in 2050	Public Health	Environ-mental Resources	Economic Opport-unity	One Fairfax	Pay-back (yrs)	Cost to Comm-unity Members	Timeframe
S1	**Increase energy efficiency and conservation in existing buildings**								
1a	Increase energy efficiency in residential buildings	1,324,000 $MT CO_2e$	+	+	++	=	3–7	$$$	Immediate
1b	Increase energy efficiency in commercial buildings		+	+	++	=	3–7	N/A	Immediate
1c	Increase energy efficiency in local government existing buildings and streetlights		+	+	+	+	3–7	$	Immediate
1d	Develop and expand district energy and CHP systems		+	+	+	=	3–7	N/A	Immediate
1e	Expand gas and electricity demand flexibility		=	+	=	=	1–3	$	Immediate
S2	**Electrify existing buildings**								
2a	Electrify existing residential buildings	1,145,000 $MT CO_2e$	+	++	+	=	3–7	$$$	Immediate
2b	Electrify existing commercial buildings		+	++	+	=	> 7	N/A	Immediate
2c	Reduce the use of high-GWP refrigerants		=	=	=	=	N/A	No Cost	Soon
S3	**Implement green building standards for new buildings**								
3a	Increase building code stringency for residential and commercial buildings	129,000 $MT CO_2e$	+	+	=	=	1–3	$$	Immediate
3b	Support all-electric new residential and commercial construction		+	+	=	=	> 7	$$	Immediate
3c	Support green building principles and practices		+	+	+	=	N/A	N/A	Immediate
3d	Support reuse of existing buildings		=	++	=	=	N/A	N/A	Immediate
S4	**Increase the amount of renewable energy in the electric grid**								
4a	Develop large offsite grid renewable energy	1,390,000 $MT CO_2e$	+	++	++	=	N/A	$	Immediate
4b	Develop grid storage		=	=	++	=	N/A	$	Soon
4c	Maintain nuclear generation at current levels		=	=	=	=	N/A	No Cost	Immediate
S5	**Increase production of onsite renewable energy**								
5a	Expand solar PV on existing buildings	462,000 $MT CO_2e$	+	+	++	=	> 7	$$$	Immediate
5b	Support solar PV in all new construction		+	+	++	=	> 7	$$	Immediate
5c	Support Community Solar		+	+	++	+	N/A	$	Soon
5d	Develop battery storage projects		=	+	++	=	> 7	$$$	Soon

No.	Description	GHG ($MT CO_2e$) Reduced in 2050	Public Health	Environ-mental Resources	Economic Opport-unity	One Fairfax	Pay-back (yrs)	Cost to Comm-unity Members	Timeframe
S6	**Increase energy supply from resource-recovered gas, hydrogen, and power-to-gas**								
6a	Expand the supply and use of resource-recovered gas, hydrogen, and power-to-gas	733,000 $MT CO_2e$	+	++	+	=	N/A	$	Future
S7	**Increase electric vehicle (EV) adoption**								
7a	Leverage county assets to expand EV use across on-road vehicles and off-road equipment	2,044,000 $MT CO_2e$	++	=	+	=	1–3	N/A	Immediate
7b	Increase EV adoption by residents, businesses, and private fleets		++	=	+	+	3–7	$$$	Immediate
7c	Install EV chargers in new buildings		++	=	+	+	> 7	N/A	Immediate
S8	**Support sustainable land use, active transportation, public transportation, and transportation demand management (TDM) to reduce vehicle-miles traveled**								
8a	Support the use and improvement of bicycle and pedestrian infrastructure	392,000 $MT CO_2e$	++	++	+	++	1–3	$	Immediate
8b	Support the use and improvement of public transportation and commuter services		++	+	+	++	1–3	$	Immediate
8c	Support smart-growth and transportation demand management (TDM) strategies		+	+	+	+	N/A	$	Soon
S9	**Increase fuel economy and use of low-carbon fuels for transportation**								
9a	Support low-carbon fuels for transportation	946,000 $MT CO_2e$	+	=	=	+	3–7	$$$	Immediate
9b	Support improvements to fuel efficiency		++	=	=	+	3–7	$$$	Immediate
9c	Support low-carbon fuels for aviation		++	=	=	+	N/A	N/A	Future
S10	**Reduce the amount of waste generated and divert waste from landfills and waste-to-energy facilities**								
10a	Reduce overall waste generation	251,000 $MT CO_2e$	+	+	+	+	1–3	No Cost	Immediate
10b	Increase waste diversion from landfills and waste-to-energy facilities through recycling and composting		+	+	+	=	1–3	$	Immediate
S11	**Responsibly manage all waste generated, including collected residential and commercial waste, wastewater, and other items**								
11a	Capture and use energy generated at landfills and waste-to-energy facilities	4,000 $MT CO_2e$	-	=	+	=	1–3	N/A	Immediate
11b	Explore alternative options for long-term waste management		+	+	=	=	3–7	No Cost	Soon
11c	Capture and use energy generated by wastewater treatment processes		=	=	+	=	1–3	N/A	Immediate

No.	Description	GHG ($MT CO_2e$) Reduced in 2050	Public Health	Environ-mental Resources	Economic Opport-unity	One Fairfax	Pay-back (yrs)	Cost to Comm-unity Members	Timeframe
S12	**Strategy 12: Support preservation, restoration, and expansion of natural systems, green spaces, and soil quality**								
12a	Conserve existing tree canopy, green spaces, and soil quality	251,000 $MT CO_2e$	++	++	=	=	N/A	No Cost	Immediate
12b	Expand tree canopy and green spaces, and improve soil management		++	++	+	+	N/A	$	Immediate
12c	Create a cross-disciplinary county staff team to strengthen climate change and natural resources policies and programs		++	++	=	=	N/A	N/A	Immediate

Summary of Working Group Priorities

During the development of CECAP, Working Group members participated in a prioritization exercise to emphasize and/or de-emphasize each of the 12 strategies of CECAP.

Of the six strategies in the Buildings & Energy Efficiency and Energy Supply sectors, the Working Group prioritized energy efficiency first, followed by renewable energy. The Working Group chose to de-emphasize Strategy 6: Increase energy supply from resource-recovered gas, hydrogen, and power-to-gas. These priorities correlate to the following two strategies in CECAP:

Of the six strategies in the Buildings & Energy Efficiency and Energy Supply sectors, the Working Group prioritized **Strategy 1** and **Strategy 4**. Of the six strategies in the Transportation, Waste, and Natural Resources sectors, the Working Group prioritized **Strategy 7, Strategy 8, Strategy 9,** and **Strategy 12**.

- Strategy 1: Increase Energy Efficiency and Conservation in Existing Buildings
- Strategy 4: Increase the Amount of Renewable Energy in the Electric Grid

The Working Group emphasizes these strategies because of the potential of these strategies to significantly reduce GHG emissions.

Of the six strategies in the Transportation, Waste, and Natural Resources sectors, the Working Group prioritized the following:

- Strategy 7: Increase EV Adoption
- Strategy 8: Support Sustainable Land Use, Active and Public Transportation, and Transportation Demand Management (TDM)
- Strategy 9: Increase Fuel Economy and Use of Low-Carbon Fuels for Transportation
- Strategy 12: Support Preservation, Restoration, and Expansion of Natural Systems, Green Spaces, and Soil Quality

The Working Group emphasizes these strategies because of their GHG reduction potential, as well as the possibility of promoting equity through access to job centers, transit, affordable housing, and green spaces.

Overall, Working Group members noted that there are both synergies and tradeoffs between strategies, and that actions taken during implementation should seek to balance the strategies' varied tradeoffs and maximize synergies. See the Working Group Priorities textboxes throughout the report for more information and see Appendix F for more on the Working Group's prioritization exercise and discussion.

How to Read the Strategy and Action Sections

Each action impacts the community differently and has varied implementation activities recommended by the Working Group. Detailed descriptions of the strategies and actions are provided in the sections that follow.

A **strategy** is a broader set of actions or set of subsector work that can be modeled to understand emissions reduction. Each **strategy section** includes the following:

- A description of the strategy, including the technologies and actions to be used.
- The GHG emissions reduction potential for each strategy by the year 2050. The percentage provided demonstrates the reductions needed from the 2050 business-as-usual projection to reach the county's carbon neutrality goal.
- Cost considerations for the strategy, such as whether the strategy is currently cost-effective or challenged by cost barriers.
- A Working Group Priorities textbox, which summarizes opinions and priorities called out by the Working Group. The priorities serve as an indicator for what the community and Board of Supervisors should focus on during implementation of CECAP.

An **action** is a project or specific technology that impacts GHG emissions within a strategy. Each **action section** includes the following:

- A description of the action
- A rating for each impact category and a discussion of the rating

Finally, a list of **Working Group-Recommended Activities for Implementation**, as identified by the CECAP Working Group, is provided for each strategy. These five categories include recommended activities for implementation for all actors, individuals and organizations, the county government, county government with state-enabling legislation, and state and federal governments.

Figure 10: Strategy and Action Roadmap

A) Review Strategy Description and Associated Actions

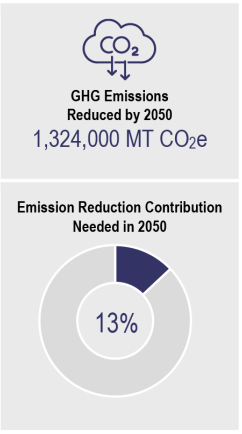
BUILDINGS AND ENERGY EFFICIENCY

Strategy 1: Increase Energy Efficiency and Existing Buildings

Energy efficiency and energy conservation are cost effective and proven strategies that produce significant co-benefits while also improving the effectiveness of future strategies. Energy efficiency encompasses technology enhancements that improve building energy performance (that is, delivering the same services with fewer Btus). Energy conservation includes behavioral enhancements that improve building energy performance (that is, services are adjusted to reduce Btus). This strategy includes the following actions:

- Action 1a: Increase energy efficiency in residential buildings,
- Action 1b: Increase energy efficiency in commercial buildings,
- Action 1c: Increase energy efficiency in local government buildings and streetlights,
- Action 1d: Develop and expand district energy and combined heat and power (CHP) systems, and
- Action 1e: Develop and expand gas and electricity demand programs.

B) Review Emissions Reductions Associated with the Strategy



C) Review each Action Description

Action 1a: Increase Energy Efficiency in Residential Buildings

This action supports energy efficiency and energy conservation in existing single-family and multifamily residential buildings.

Timeframe: Immediate. The technology is currently available and is being commercially deployed at significant scale.

Technology considerations: Building energy efficiency can employ many technologies and target various end uses depending on scope and budget. Efficiency measures can be sensitive to occupant behavior. In residential buildings, occupant comfort and preferences are very important to consider. Renters have less ability to make meaningful upgrades, while long-time homeowners can face significant energy cost burdens.

D) Review Impact Category Results

Public Health	+
Environmental Resource	+
Economic Opportunity	++
One Fairfax	=
Payback	3-7 years
Cost to Community Member	$$$
Timeframe	Immediate

E) Review Working Group-Recommended Activities for Implementation

Working Group-Recommended Activities for Implementation for Strategy 1

Implementation for this strategy may include a combination of incentive programs, financing tools, education and outreach, support for business growth, pilot programs, and regulations and other mandates. Recommended activities for implementation for this strategy were developed by the Working Group and include:

Recommended Activities for Implementation for All Actors

Education

Energy efficiency and, in particular, energy conservation will affect residents' interactions with the buildings they live in, work in, and visit. Individuals will need to learn how to use and maintain different building systems. Many of these interactions will be seamless, however educational programs can help earn broad understanding of the changes and why they are happening and may help to realize higher adoption rates. Education programs should leverage existing tools such as EPA's ENERGY STAR which including appliance labeling, and building and home performance tools. Additional educational programs include:

BUILDINGS AND ENERGY EFFICIENCY

Strategy 1: Increase Energy Efficiency and Conservation in Existing Buildings

Energy efficiency and energy conservation are cost-effective and proven strategies that produce significant co-benefits while also improving the effectiveness of future strategies. Energy efficiency encompasses technology enhancements that improve building energy performance (i.e., delivering the same services with fewer British thermal units spent). Energy conservation includes behavioral enhancements that improve building energy performance (i.e., services are adjusted to reduce the amount of British thermal units). This strategy includes the following actions:

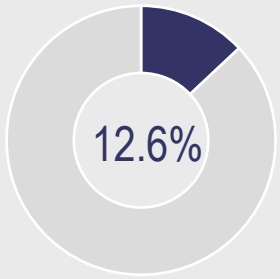
- Action 1a: Increase Energy Efficiency in Residential Buildings
- Action 1b: Increase Energy Efficiency in Commercial Buildings
- Action 1c: Increase Energy Efficiency in Local Government Buildings and Streetlights
- Action 1d: Develop and Expand District Energy and Combined Heat and Power (CHP) Systems
- Action 1e: Develop and Expand Gas and Electricity Demand Programs

This strategy results in lower GHG emissions from residential, commercial, and local government buildings as it reduces overall energy consumption. Additionally, district energy and CHP systems lower GHG emissions from reduced transmission and distribution losses and improved system efficiency. This strategy also includes geothermal technology as an energy efficiency technology.

GHG Emissions Reduced in 2050

1,324,000 MT CO_2e

Percent Contribution to Emissions Reductions Needed in 2050



This strategy aligns with the **Buildings and Energy Efficiency Sector Goal** to retrofit at least 100,000 housing units with energy efficiency measures by 2030. See Greenhouse Gas Reduction Goals.

GHG Reductions

This strategy results in GHG reductions of 1,324,000 MT CO_2e in 2050. This strategy is anticipated to account for 13% of the emissions reduction needed to achieve the long-term carbon neutrality goal by 2050.

Working Group Priorities

The Working Group emphasized that reducing energy use is an important first step in the plan. Importantly, it can provide immediate, tangible co-benefits to owners and occupants, including reduced operating costs and improved comfort. However, members of the Working Group voiced concern over owner preferences, especially in residential buildings, which could impede implementation. Additionally, COVID-19 guidance from the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Centers for Disease Control and Prevention, and other organizations call for increased ventilation, which, with certain technologies, can offset or reverse energy improvements.

Cost Considerations for This Strategy

Overall, this strategy is considered very cost-effective. Market trends currently show that technological and infrastructure improvements to energy efficiency cost more upfront than a less energy-efficient technology; however, those costs are recouped by reduced energy use costs. The time it takes to recoup the starting costs for these innovations depends on the ease of retrofitting the existing building, the availability of incentives, financing, the building size and use, and the availability of the technology.

Action 1a: Increase Energy Efficiency in Residential Buildings

This action supports increasing energy efficiency and energy conservation in existing single-family and multifamily residential buildings.

Timeframe: Immediate. The technology is currently available and is being commercially deployed on a significant scale.

Technology considerations: Building energy efficiency can employ many technologies and target various end uses, depending on scope and budget. Efficiency measures can be sensitive to occupant behavior. In residential buildings, occupant comfort and preferences are important to consider. Renters have less ability to make meaningful upgrades, while long-time homeowners can face significant energy cost burdens.

Public Health	+
Environmental Resources	+
Economic Opportunity	++
One Fairfax	=
Payback	3–7 years
Cost to Community Members	$$$
Timeframe	Immediate

Impacts

- **Public health:** This action benefits regional air quality by reducing the demand for energy generated by combustion at power plants. Lower levels of air pollution are associated with improved public health outcomes, such as reductions in asthma attacks and cardiovascular disease. Additionally, this action may benefit indoor air quality by reducing the demand for onsite combustion and its associated pollutants.
- **Environmental resources:** This action benefits environmental resources by reducing air pollution through reducing the demand for both onsite fuel combustion and electricity generation.
- **Economic opportunity:** This action strongly benefits local businesses and jobs since improving building efficiency is labor-intensive work that must be performed locally. Upgrades also can improve the value of a building.
- **One Fairfax:** This action does not have a significant impact on One Fairfax as improvements to air quality and related public health impacts will be experienced by all population groups in the county. However, existing racial and social inequities should be considered in the design of programs and policies. For example, while low- and moderate-income (LMI) households may receive more gains in comfort and utility bill savings, costs may be disproportionately burdensome.

Economic Benefits and Costs

- **Payback:** Medium-term (3–7 years). However, this is highly dependent on selected measures and financing methods (if applicable) and incentives. Certain lighting projects can pay back in a few months; high-performance heating, ventilation, and air conditioning (HVAC) systems can take several years; and building envelope improvements or geothermal loops may take a decade or more. Many successful projects blend short- and long-term payback measures to achieve deeper energy savings with a moderate payback. With incentives and low-cost financing, many efficiency investments can provide positive economic outcome for the consumer.
- **Cost to community members:** High cost ($$$). To complete a deep energy efficiency retrofit, there are high upfront costs and downstream maintenance costs for both homeowners and multifamily building owners, who may pass these costs on to tenants. Incremental residential energy efficiency improvements can vary greatly in their cost, with some low and no cost options for homeowners and renters.

Other considerations: Residential energy efficiency can take a lot of forms. In all households, it may include light-emitting diode (LED) lighting for indoor and outdoor fixtures, or smart thermostats that set back energy usage when no one is home. For homeowners, it might include new insulation, windows, doors, and weatherization; changes to higher efficiency appliances and HVAC equipment; or a new geothermal exchange system. The ENERGY STAR program provides a one-stop shop of resources for homeowners and renters looking to pursue energy efficiency in their residence.

Action 1b: Increase Energy Efficiency in Commercial Buildings

This action serves to improve the energy efficiency and energy conservation of existing commercial buildings.

Timeframe: Immediate. A robust offering of building efficiency measures is available in the market with a variety of financing mechanisms as described in the Working Group-Recommended Activities for Implementation for Strategy 1 section.

Technology considerations: Building energy efficiency can employ many technologies and target various end uses, depending on scope and budget. Technologies may include lighting retrofits, HVAC changes, building envelope improvements, building commissioning, building controls, and other retrofits. Efficiency measures can be sensitive to occupant behavior and even the most sophisticated energy systems can be undermined by overrides forced by hot or cold occupants.

Public Health	+
Environmental Resources	+
Economic Opportunity	++
One Fairfax	=
Payback	3–7 years
Cost to Community Members	Not Applicable
Timeframe	Immediate

Impacts

- **Public health:** This action benefits regional air quality by reducing the demand for energy generated by combustion at power plants. Lower levels of air pollution are associated with improved public health outcomes, such as reductions in asthma attacks and cardiovascular disease. Additionally, this action may benefit indoor air quality by reducing the demand for onsite combustion and its associated pollutants.
- **Environmental resources:** Improving building efficiency benefits environmental resources by reducing the demand for both onsite fuel combustion and electricity generation, regardless of generation technology.
- **Economic opportunity:** Improving building efficiency strongly benefits local businesses and jobs since it is labor-intensive work that must be performed locally. Upgrades also are an investment, improving the value of the building.
- **One Fairfax:** This action does not have a significant impact on One Fairfax as improvements to air quality and related public health impacts will be experienced by all population groups in the county. Still, existing racial and social inequities should be considered in the design of programs and policies to not disproportionately burden disadvantaged businesses or neighborhoods.

Economic Benefits and Costs

- **Payback:** Medium-term (3–7 years). However, this is highly dependent on selected measures and building typologies. Certain lighting projects can pay back in a few months, high-performance HVAC systems can take several years, and building envelope improvements or geothermal loops may take a decade or more. Many successful projects blend short- and long-term payback measures to achieve deeper energy savings with a moderate payback. Incentives and financing mechanisms can significantly shorten the payback period for energy efficiency projects.
- **Cost to community members:** Not applicable since the typical community member does not own and operate a commercial building. Businesses will incur costs associated with energy efficiency differently than a typical community member, depending on their lease or ownership structure.
- **Other considerations:** Some advanced energy efficiency technologies require significant changes to maintenance of buildings. Training of maintenance staff is crucial to the success of this action.

Action 1c: Increase Energy Efficiency in Local Government Buildings and Streetlights

This action supports increasing energy efficiency and energy conservation in existing local government buildings and streetlights.

Timeframe: Immediate. A robust offering of building efficiency measures is available in the market with a variety of financing mechanisms as described in the Working Group-Recommended Activities for Implementation for Strategy 1 section.

Technology considerations: Building energy efficiency can employ many technologies and target various end uses, depending on scope and budget. Efficiency measures can be sensitive to occupant behavior and even the most sophisticated energy systems can be undermined by hot or cold occupants. Additionally, streetlight specifications should consider color, temperature, lumen output, and Dark Sky compliance,[19] as well as networked or "smart" streetlight options.

Public Health +
Environmental Resources +
Economic Opportunity +
One Fairfax +
Payback 3–7 years
Cost to Community Members $
Timeframe Immediate

[19] The International Dark Sky Places is a conservation program that recognizes and promotes excellent stewardship of the night sky. https://www.darksky.org.

Impacts

- **Public health:** This action benefits regional air quality by reducing the demand for energy generated by combustion at power plants. Lower levels of air pollution are associated with improved public health outcomes, such as reductions in asthma attacks and cardiovascular disease. Additionally, this action may benefit indoor air quality by reducing the demand for onsite combustion and its associated pollutants.
- **Environmental resources:** Improving building efficiency benefits environmental resources by reducing the demand for both onsite fuel combustion and electricity generation, regardless of generation technology.
- **Economic opportunity:** Improving building efficiency benefits local businesses and jobs since it is hands-on work that must be performed locally. Upgrades also are an investment, improving the value of the building.
- **One Fairfax:** This action would benefit One Fairfax as long as implementation prioritizes improvements in disadvantaged neighborhoods. Overall improvements to air quality and related public health impacts will be experienced by all population groups.

Economic Benefits and Costs

- **Payback:** Medium-term (3–7 years). However, this is highly dependent on selected measures. Certain lighting projects can pay back in a few months, high-performance HVAC systems can take several years, and building envelope improvements or geothermal loops may take a decade or more. Many successful projects blend short- and long-term payback measures to achieve deeper energy savings with a moderate payback. Incentives and financing mechanisms can significantly shorten the payback period for energy efficiency projects.
- **Cost to community members:** Low cost ($) since upgrade costs to local government infrastructure are diffused across the tax base.

Other considerations: Streetlight ownership has the potential to complicate upgrades. However, the county does not need direct ownership of lights to enact upgrades as there are strategies for navigating this challenge. A useful resource is the U.S. Department of Energy's Outdoor Lighting Accelerator Toolkit. The county is part-way through a five-year plan to transition streetlights to LEDs. Some advanced energy efficiency technologies require significant changes to maintenance of buildings. Traning of maintenance staff is crucial to the success of this action.

Action 1d: Develop and Expand District Energy and Combined Heat and Power Systems

This action encourages the implementation of district energy systems, including CHP facilities. District energy systems come in a variety of forms and sizes. Thermal systems can provide district heating and/or cooling via steam, hot water, or chilled water. Meanwhile,

microgrids provide local power generation to supplement grid power, sometimes with the ability to fully disconnect and "island" from the grid.

Timeframe: Immediate. This technology is currently available and is being commercially deployed on a significant scale, however district energy systems require significant planning before implementation can occur.

Technology considerations: All district energy systems increase resilience by providing local energy supply systems and increase efficiency by reducing generation, transmission, and distribution losses. CHP, in particular, converts heat from local power generation systems into useful thermal energy for heating/cooling. CHP can serve as a standalone system or part of a district energy solution.

District energy systems are best-suited for dense clusters of large energy consumers. Construction of a new system is a major infrastructure project that could significantly disrupt businesses and residents in the project area. The entity proposing the district energy system would need to work closely with stakeholders, residents, and the County to determine appropriate areas for district energy systems. Any future district energy systems should align with electrification consideration by targeting major consumers, such as hospitals, universities, large commercial, and government facilities.

Public Health	+
Environmental Resources	+
Economic Opportunity	+
One Fairfax	=
Payback	3–7 years
Cost to Community Members	NA
Timeframe	Immediate

Impacts

- **Public health:** District energy systems benefit regional air quality by reducing the demand for energy generated by combustion at power plants—district energy and CHP systems are significantly more efficient than grid generators. Lower levels of air pollution are associated with improved public health outcomes, such as reductions in asthma attacks and cardiovascular disease.
- **Environmental resources:** District energy systems benefit environmental resources by reducing the demand for both onsite fuel combustion and electricity generation, regardless of generation technology.
- **Economic opportunity:** District energy systems benefit local businesses and jobs since the construction is hands-on work that must be performed locally. The systems also are an investment that improves the value of the district.
- **One Fairfax:** This action does not have a significant impact on One Fairfax as improvements to air quality and related public health impacts will be experienced by all population groups in the county. However, existing racial and social inequities should be considered in the design of programs and policies to increase local government

building efficiency. For example, siting of new CHP facilities should be carefully considered so as not to further burden disadvantaged neighborhoods.

Economic Benefits and Costs

- **Payback:** Medium payback (3–7 years), with high upfront costs offset by significant utility savings in future years. District energy systems typically involve complex financing and work to provide competitive prices to customers, with possible price premiums if they are designed to provide added resilience.
- **Cost to community members:** Not applicable for the typical community member.

Other considerations: District energy systems generate electricity locally that would previously be provided from the regional electricity grid. While most district energy systems will lower GHG emissions and improve air quality overall, they have the potential to locally increase air pollution by creating new combustion sites in the county.

Action 1e: Expand Gas and Electricity Demand Flexibility

This action encourages the implementation of gas and electricity demand flexibility in buildings. Demand flexibility is related to energy efficiency; however, while efficiency tends to reduce usage across daily or seasonal periods, demand management reduces electricity or gas demand during peak usage periods. Demand flexibility can include direct load control programs that, for example, cycle off water heaters during peak hours, and dynamic pricing options, such as reducing rates during lower demand periods and increasing them at peak times. Such options will be increasingly important in managing peak loads from new electric heating, and also can encourage electric vehicle use by offering lower off-peak charging rates. Utilities run demand-side management (DSM) programs to provide incentives and means for their customers to shift demand.

Public Health	=
Environmental Resources	+
Economic Opportunity	=
One Fairfax	=
Payback	1–3 years
Cost to Community Members	$
Timeframe	Immediate

Timeframe: Immediate. This technology is currently available and is being commercially deployed on a significant scale.

Technology considerations: Demand flexibility programs are a mature offering provided by many utilities across the country, more typically for electricity. Coupled with electrification strategies, demand flexibility programs could prove increasingly valuable. The future of gas demand flexibility is less clear; however, if resource-recovered gas[20] is available for end-use

[20] Resource-recovered gas (commonly referred to as renewable natural gas) refers to biogas created from decomposed organic matter.

applications, gas rates will likely rise, making gas energy management all the more important. As Virginia's grid evolves, with increased focus on grid-interactive efficient buildings, battery storage among other distributed energy resources can become an important tool for managing both customer energy costs and grid resilience.

Impacts

- **Public health:** Gas and electricity demand programs will not have a significant impact on public health.
- **Environmental resources:** Gas and electricity demand programs will benefit environmental resources by reducing the demand for both onsite fuel combustion and electricity generation, regardless of the generation technology.
- **Economic opportunity:** Gas and electricity demand programs will not have a significant impact on economic opportunity.
- **One Fairfax:** Gas and electricity demand programs do not have a significant impact on One Fairfax. However, existing racial and social inequities should be considered in the design of programs and policies to increase local government building efficiency.

Economic Benefits and Costs

- **Payback:** Quick payback (1–3 years). In some cases, individuals can manage their own demand to immediately save money. State utility regulators apply detailed cost-effectiveness tests to utility DSM programs. Historically, these programs tend to support faster payback measures.
- **Cost to community members:** Low cost ($) to program participants of utility DSM programs since the annual cost on typical energy bills is small. For program participants, energy savings from DSM programs typically exceed these small billing charges. There is no cost for community members to manage their own demand.

Other considerations: Demand response programs typically need approval from regulatory bodies, such as the Virginia State Corporation Commission. Additionally, the Virginia Clean Economy Act is creating new funding for lower income Virginia residents; the Department of Housing and Community Development will be administering these funds, which also could be coordinated with existing Dominion low-income programs to direct new funding to disadvantaged communities. In Virginia, district energy systems on a campus site with a single owner (e.g., George Mason University campus) are generally feasible; however, systems involving multiple parcels and/or owners may violate state law restricting the retail sale of electricity (i.e., with few exceptions, only Dominion is permitted to sell electricity on a retail basis).

Working Group-Recommended Activities for Implementation for Strategy 1

Implementation for this strategy may include a combination of incentive programs, financing tools, education and outreach, support for business growth, pilot programs, and regulations and other mandates. Recommended activities for implementation for this strategy were developed by the Working Group and include the following:

Recommended Activities for Implementation for All Actors

Education

Energy efficiency and, in particular, energy conservation will affect residents' interactions with the buildings they live in, work in, and visit. Individuals will need to learn how to use and maintain different building systems. Many of these interactions will be seamless; however, educational programs can help achieve broad understanding of the changes and why they are occurring and may help to realize higher adoption rates. Education programs should leverage existing tools, such as EPA's ENERGY STAR, which includes appliance labeling, and building and home performance tools. Additional educational programs include the following:

- Public education events by neighborhoods, homeowners' associations, schools, and libraries on a variety of subjects (e.g., technologies, financing, audits).
- Contests, competitions, and awards for energy efficiency. These can be showcased for homes and businesses or be performance-based.
- Educational videos, websites, and other media content.
- School programming and youth education.
- Tenant engagement programs.
- Auditing equipment checkouts at libraries.

Across implementation, energy efficiency and conservation measures should consider biophilic and regenerative design elements (e.g., green roofs) to improve occupant health and comfort while reducing HVAC requirements. The U.S. Green Building Council's Sustainable Sites Initiative (SITES™) certification is a best practice.

Recommended Activities for Implementation for Individuals and Organizations

Business and Job Growth

- Expand existing businesses—energy service companies (ESCOs), energy-as-a-service (EaaS) providers, technology providers, and more—to provide bulk services to homes and businesses, thereby reducing overhead costs for businesses while servicing multiple properties.

- Encourage the incubation of startup businesses, contractors, and vendors to provide energy services locally.
- Establish or strengthen job training programs through community colleges, trade unions, or via apprenticeships to provide energy services locally.

Innovation and Pilots

- Implement technology pilots to scale solutions and incorporate emerging solutions with the goal of growing the market and demonstrating the technology's use and effectiveness. Electrochromic glass, phase change materials, or bi-level street lighting could be some examples.

County Programs, Rules, and Regulations

- Support the use of building energy codes in local development projects as building energy codes can be one of the most significant drivers of efficiency improvements, in renovation as well as in new construction.
- Incorporate biophilic design principles into the renovation of existing buildings to maximize carbon sequestration capacity and improve public health.
- Encourage building recommissioning (after the building is constructed) to ensure that buildings operate as designed and with optimal energy efficiency.

Recommended Activities for Implementation for the County

Incentives

- Establish new energy efficiency and conservation incentive programs to complement existing programs (see the Did You Know? textbox below), such as high-performance building density zoning bonuses, permit streamlining, property tax incentives, audit programs, and accelerated permitting or review for certain technologies or programs.

County Programs, Rules, and Regulations

- Require energy code compliance for all major renovations in addition to new construction.
- Develop a county code enforcement officer training program to better equip officers for enforcing building codes.
- Create an energy audit program within Fairfax County Land Development Services to review and inspect the energy use of commercial buildings.

Partnerships with Businesses, Non-Governmental Organizations (NGOs), and Government

- Partner with existing businesses—ESCOs, EaaS providers, technology providers, and more—to provide bulk services to homes and businesses, thereby reducing overhead costs for businesses while servicing multiple properties.
- Partner with the community to encourage the incubation of startup businesses, contractors, and vendors to provide energy services locally.

- Partner with the community to strengthen or establish job training programs through community colleges, trade unions, or via apprenticeships to provide energy services locally.

Financing

- Support the establishment of a local green bank, financing program, or Residential Property Assessed Clean Energy (R-PACE), allowing tax assessment financing in residential buildings. R-PACE is currently facing restrictive federal policies; however, it may become more viable in the future.
- Continue to support the county's Commercial Property Assessed Clean Energy (C-PACE) program.
- Leverage existing public/private partnerships for loan provisions.

Innovation and Pilots

- Implement technology pilots to scale solutions in government buildings and incorporate emerging solutions to grow the market and demonstrate the technology's use and effectiveness. Example technologies include electrochromic glass, phase change materials, and bi-level streetlights.

Recommended Activities for Implementation for the County Requiring State Enabling Legislation

County Programs, Rules, and Regulations

- Authorize local jurisdictions to provide monetary incentives for energy efficiency.
- Authorize local jurisdictions to mandate the use of certain technologies (e.g., electrification readiness), or certain technology bans or specifications.
- Authorize local jurisdictions to adopt more stringent energy efficiency codes for new construction and major renovations.
- Authorize local jurisdictions to use stretch codes in local development projects, such as the 20% and 40% codes developed via the Zero Cities Project.
- Authorize local jurisdictions to require energy benchmarking and disclosure of both existing and new government, commercial, and multi-unit residential buildings.
- Authorize local jurisdictions to implement building energy performance standards for government, commercial, and multi-unit residential buildings.

Recommended Activities for Implementation for State and Federal Governments

Incentives

- Develop and expand utility-sponsored programs through Virginia's Grid Transformation and Security Act of 2018 and Virginia Clean Economy Act (VCEA), and use of Regional Greenhouse Gas Initiative (RGGI) funding for low-income energy efficiency.
- Create new or expand existing state-level incentive programs and funding for energy efficiency.

Financing

- Provide for new federal and state financing tools, including R-PACE.

State/Federal Legislation and Programs

- Support and implement more stringent building codes.
- Pass state and federal carbon fees, taxes, and related programs.
- Implement building energy performance programs, such as energy benchmarking and disclosure programs; real estate point-of-sale requirements, such as audits, benchmarking, energy ratings, and disclosure; building energy retuning programs; energy efficiency retrofit requirements or building energy performance requirements; and Time of Use regulations for lighting and HVAC.

Did You Know?

Energy efficiency and conservation incentive programs are already in place, including Virginia's property tax exemption for energy-efficient buildings and the WarmWise Home Savings Program. In addition, the Virginia SAVES Green Community Program provides subsidized financing to commercial and local government borrowers for efficiency projects. Furthermore, C-PACE, a form of financing that provides financing through a tax assessment, already finances projects for commercial buildings.

The Regional Greenhouse Gas Initiative (RGGI) is a partnership of Northeastern and Mid-Atlantic states that aims to cap and reduce carbon emissions from fossil fuel-fired power plants. In Virginia, nearly 63% of electricity generation comes from fossil fuels. Since 2005, RGGI states have reduced carbon pollution from electricity generation by 45%. Virginia joined RGGI in 2021 and authorized specific uses for its funding, including low-income energy efficiency programs, the new Community Flood Preparedness Fund, and overall program management.

Strategy 2: Electrify Existing Buildings

Electrification reduces emissions by switching fuels from fossil fuels to electricity, which reduces net GHG emissions as grid carbon intensity falls. This strategy includes incentivizing residential and commercial building electrification (especially heating and hot water, which are the largest fuel-using end uses). This strategy includes the following:

- Action 2a: Electrify Existing Residential Buildings
- Action 2b: Electrify Existing Commercial Buildings
- Action 2c: Reduce the Use of High Global Warming Potential (GWP) Refrigerants

This strategy results in lower GHG emissions from residential and commercial buildings as buildings switch from using fossil fuels to electricity, especially as the electric grid becomes cleaner in accordance with the VCEA of 2020. Lower GHG emissions from hydrofluorocarbon (HFC) HVAC refrigerants also are expected as federally mandated lower GWP alternatives come into use for new equipment, and as reduced refrigerant leakage is attained through improved installation and service practices.

GHG Reductions

This strategy results in GHG reductions of 1,145,000 MT CO_2e in 2050. This strategy is anticipated to account for 11% of the emissions reduction needed to achieve the long-term carbon neutrality goal by 2050.

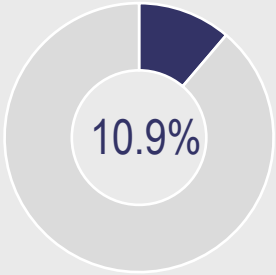
Cost Considerations

Broad-based electrification is still challenged by cost concerns. Air source heat pumps are a cost-effective solution; however, forcing HVAC replacements before the end of their service lives can be costly. Retrofits are most cost-effective when equipment is at the end of its useful life. Where air handling and duct systems have been sized for fuel furnace performance, modifications to the duct systems for building electric service may be needed to accommodate all-electric solutions. Maintaining fuel furnace capacity in dual-

GHG Emissions Reduced in 2050

1,145,000 MT CO_2e

Percent Contribution to Emissions Reductions Needed in 2050



Electrification of Fairfax County Buildings by the Numbers

If modeling projections for existing building are met in this strategy, **by 2030**, electrification could occur in 69,000 single-family homes (20% of total) and 12,000 multifamily homes (10%), and 12 million ft^2 of commercial buildings (5% of total square footage). **By 2050,** 304,000 single-family homes (70%), 71,000 multifamily homes (50%), and 54 million ft^2 of commercial building (20% of total square footage) could be fully electrified.

fuel heating designs can be a solution in some cases. As consumer attitudes and policy changes to encourage further reductions in GHG emissions, electrification technologies are expected to become more cost-effective and gain market share.

Working Group Priorities

The Working Group emphasized that electrification of existing buildings is an important strategy for GHG reductions. However, members of the Working Group voiced concerns over the high cost of electrification strategies and potential reliability issues of switching to all electric. Working Group members also emphasized the importance of pairing this strategy with Strategy 4: Increase Renewable Energy in the Electric Grid, to ensure the use of clean electricity sources in electrified buildings. The Working Group noted that opportunities to leverage resources for electrification in lower income households are recommended and should be considered.

Action 2a: Electrify Existing Residential Buildings

This action includes retrofitting existing residential buildings through air source and ground source (geothermal) heat pumps and other cost-effective electrification technologies in both single-family and multifamily residential buildings. This strategy also includes a switch to electric heat pump water heating and to electric resistance or induction ovens and stovetops.

Public Health	+
Environmental Resources	++
Economic Opportunity	+
One Fairfax	=
Payback	3–7 years
Cost to Community Members	$$$
Timeframe	Immediate

Timeframe: Immediate. This technology is currently available and is being commercially deployed on a significant scale.

Technology considerations: Virginia's electricity grid has a low enough carbon intensity as of 2021 that an immediate reduction in GHG emissions will take place in typical residential buildings that switch to high-efficiency electric systems. Over time, as grid electricity moves to zero carbon emissions, buildings that have implemented electrification through heat pumps and other technologies will provide zero-carbon heating, hot water, and cooking.

Individual homeowners who implement electrification techniques by switching to electricity for heating, hot water, and cooking will see a variety of changes to their homes, and the implementation of electrification in homes would need to be supported by a variety of educational programs to help homeowners understand their options. Some homes will be easier to switch than others as upgrades to electrical service may be needed to allow some

residential buildings to install new equipment. Dual-fuel systems, where a fuel furnace is kept in place to serve the coldest hours, should be considered, where appropriate.

Heat pumps are a common primary heating source in Virginia as in many southern homes, and heat pump system efficiency and comfort performance continue to improve. Ground source heat pumps provide an even more efficient source of heating and cooling by using the ground's relatively moderate temperature as an advantage. Additional technologies, such as dual-fuel hybrid heat pumps, should also be considered.

Table 2: Description of the Types of Residential Building Retrofits That Homeowners Could Pursue Under Action 2a

Retrofit Type	Current Technology	Retrofitted to
Home Heating	Natural gas, fuel oil, and propane furnaces and boilers	Air and ground source heat pumps using ducted or ductless distribution
Domestic Hot water	Fossil fuel tank and tankless water heaters	Heat pump water heaters
Cooking	Gas and propane ranges and ovens	Electric resistance and induction stovetops and ovens

Impacts

- **Public health:** This action improves public health outcomes as gas systems are replaced with electric systems that increasingly rely on cleaner fuels in alignment with the VCEA. As residential building energy becomes less reliant on fossil fuels, improvements to both outdoor and indoor air quality will lead to better public health outcomes, such as fewer cases of asthma. Electric cooking also leads to cleaner indoor air due to the elimination of carbon monoxide and other pollutants from gas combustion.
- **Environmental resources:** This action benefits environmental resources use. As electric systems replace fuel systems and the electric grid becomes increasingly cleaner through the VCEA, fewer fossil fuels will be combusted in building systems and at the grid generation level. As fewer fossil fuels are combusted in the region, the county could see regional air quality improvements.
- **Economic opportunity:** This action provides job opportunities to replace current fuel-fired building systems with electric systems.
- **One Fairfax:** This action does not have an impact on One Fairfax as most public health impacts from improvements to air quality in the region will result from electricity grid changes and be experienced by all population groups in the county. However, programs and policies supporting electrification should be designed carefully to ensure that they do not exacerbate existing racial and social inequities.

Economic Benefits and Costs

- **Payback:** Medium payback (3–7 years). However, it varies based on specific building types. In some residential buildings, additional electrical upgrades will be needed to enable some technologies to be used, thereby increasing costs and the payback period. Over time, the cost for heat pumps and other electric technologies will likely decrease as policy and market forces increase their use.
- **Cost to community members:** High ($$$). The cost to community members from this action can be high as replacing existing HVAC systems with electric-only HVAC can be costly; however, if this action focuses on replacing existing equipment at the end of its useful life, the incremental costs can be relatively affordable. Ideally, heat pump installations would be accompanied or preceded by building envelope efficiency improvements, such as insulation upgrades and efficient windows, which both reduce the cost of HVAC system installation and reduce total energy bills. In cases where the existing home has central air-conditioning (AC) and a fuel furnace, replacing the AC with a heat pump and retaining the furnace for dual-fuel heating capability, can be a cost-effective solution.

Other considerations: Implementation of electrification measures also should consider resilience issues as rapid expansion of electric heating, especially without efficiency measures installed in tandem, could strain the power grid. Northern Virginia relies on power transmission systems, and dense development already presents grid strain. If combined with energy efficiency to reduce total grid demand, onsite renewables, and/or energy storage, electrification can help increase grid resilience. Additionally, the Working Group noted that opportunities to leverage resources for electrification in lower income households are recommended and should be considered.

Action 2b: Electrify Existing Commercial Buildings

This action includes retrofitting existing commercial buildings with heat pumps, dual-fuel systems, ground source heat pumps (i.e., geothermal), and other electrification technologies. This strategy also includes switching to electric heat pump water heating and to electric resistance or induction ovens and stovetops.

Timeframe: Immediate. This technology is currently available and is being commercially deployed on a significant scale.

Technology considerations: Commercial buildings will require electrification options that are affordable and applicable on a large scale. Electrifying existing commercial buildings can be challenging or costly in cases where ducted HVAC systems are not present. Some advanced heat pump types do have short-term supply chain issues, but those do not affect the majority of the market. Combined technology strategies, including dual-fuel (sometimes referred to as hybrid) system technologies, should be considered for implementation as part of this action.

Impacts

- **Public health:** This action leads to a positive outcome for public health as electrifying existing commercial buildings decreases onsite fuel combustion, which reduces local air pollutants and improves local air quality.
- **Environmental resources:** The electrification process has a significant positive impact on environmental resources as it lessens the use of non-renewable fuel types.
- **Economic opportunity:** This action represents an opportunity for economic growth and development as additional local jobs will be necessary to retrofit buildings.
- **One Fairfax:** This action is not anticipated to have a significant impact on One Fairfax.

Public Health	+
Environmental Resources	++
Economic Opportunity	+
One Fairfax	=
Payback	> 7 years
Cost to Community Members	NA
Timeframe	Immediate

Economic Benefits and Costs

- **Payback:** Slow payback (> 7 years). Electrification technologies are mature, but are not yet cost-effective in all building and system types. The payback for this activity depends on the existing heating system type, and can take more than seven years in some cases. With broader adoption of electrification technologies, costs should decrease and commercial electrification adoption should increase. Additionally, the electrification of existing commercial buildings may change operations and maintenance costs. If technology changes are carried out slowly, the payback period may be longer as each new technology has a different break-even period.
- **Cost to community members:** Not applicable, since the typical community member does not own and operate a commercial building. Businesses will incur costs associated with electrification differently than a typical community member, depending on their lease or ownership structure.

Other considerations: As the electric grid becomes cleaner with a higher proportion of renewable energy, electrified buildings will lead to additional GHG emissions reductions. Some electrification technologies require significant changes to maintenance of buildings. Training of maintenance staff is crucial to the success of this action.

Action 2c: Reduce the Use of High Global Warming Potential Refrigerants

HFCs are potent GHGs with a global warming potential that can be hundreds to thousands of times greater than carbon dioxide. This action promotes the transition to safer alternative substances through the American Innovation and Manufacturing Act, enacted in 2020, which gives EPA the authority to phase down HFC production and consumption, manage HFCs and their substitutes, and facilitate the transition to next generation technologies.

Public Health	=
Environmental Resources	=
Economic Opportunity	=
One Fairfax	=
Payback	NA
Cost to Community Members	No Cost
Timeframe	Soon

Timeframe: Soon (available before 2030). This strategy will follow the Kigali Amendment[21] schedule (35% listed HFC reduction by 2025, 70% in 2029, 80% in 2034, and 85% in 2035), with reduction benefits starting in 2025.

Technology considerations: Low-GWP alternative refrigerants to HFCs exist in today's market that can be used as alternative refrigerants, and many other refrigerant technologies are under development.

Challenges to market entry exist for some technologies, including lack of technician and operator experience, energy efficiency concerns, flammability, toxicity, safety risks, and lack of market availability. While barriers to market entry exist, potential solutions exist and will likely require training and education, safety devices, changes to the engineering design of some products, and research and development. A suite of known alternative chemicals, emerging and new technologies, and better processing and handling practices will play a role in significantly reducing HFC consumption in both the near and long terms.[22]

Impacts

- **Public health:** This action does not have an impact on public health in the region. While refrigerants can damage the ozone layer, leading to health outcomes such as skin cancer, it is not expected that this action will reduce these health outcomes in a localized area (i.e., the county).
- **Environmental resources:** This action does not have an impact on regional environmental resources. Switching to low-GWP refrigerant alternatives does not increase the use of natural resources, such as water or land.

[21] The Kigali Amendment to the Montreal Protocol is an international agreement to gradually reduce the consumption and production of hydrofluorocarbons, which are high global warming potential gases.
[22] U.S. EPA. Transition to Low-GWP Alternatives in Commercial Refrigeration. https://www.epa.gov/sites/production/files/2015-07/documents/transitioning_to_low-gwp_alternatives_in_commercial_refrigeration.pdf.

- **Economic opportunity:** This action does not have an impact on economic opportunity in the county. Any increase in economic opportunity, such as jobs for the installation of new equipment, are expected to be negligible on a macro-scale.
- **One Fairfax:** This action does not have an impact on One Fairfax. There are no localized impacts expected from the transition to low-GWP alternatives, and the impacts of this are not expected to be experienced disproportionately by any population group.

Economic Benefits and Costs

- **Payback:** This action does not result in payback over time. Low-GWP alternatives are more expensive than HFCs at present.
- **Cost to community members:** No cost. There will be no cost to community members to implement this action. It is expected that incentives and other financing tools will be developed for retrofit and refrigerant costs.

Other considerations: No other considerations were identified for this strategy.

Working Group-Recommended Activities for Implementation for Strategy 2

Electrification incentives and programs are growing in popularity in the U.S. and can be offered by the state, county, or utility, depending on how they are designed. Implementation for this strategy may include a combination of incentive programs, financing tools, education and outreach, pilot programs, business development and partnerships, and regulations and mandates. Recommended activities for implementation for this strategy were developed by the Working Group and include the following:

Recommended Activities for Implementation for All Actors

Education

Education is key to advancing a variety of strategies, especially for electrification measures that use a variety of new technologies. As low-carbon strategies are implemented, residents, business owners, and visitors will see a variety of changes to their day-to-day life. Electrification will affect the buildings they live in, work in, and visit, and individuals will need to learn how to use and maintain different building systems. Many of these interactions will be seamless; however, educational programs can help achieve broad understanding of the changes and why they are happening and may help the county to realize higher adoption rates. Educational programs can take a lot of forms, including the following:

- Public education events by neighborhoods, homeowners' associations, schools, and libraries on a variety of subjects (e.g., technologies, financing, audits).
- Contests, competitions, and awards related to electrification. These can be showcases for homes and businesses, or be performance-related.
- Educational videos, websites, and other media content.
- School programming and youth education.
- Tenant engagement programs.
- Track progress and provide updates on community electrification efforts.

Recommended Activities for Implementation for Individuals and Organizations

Business and Job Growth

- Create job training programs, trade unions, and apprenticeships to support the electrification industry.

Financing

- Establish commercial lending programs to support implementation of electrification technologies.

Innovation and Pilots

- Implement technology pilots to scale solutions and incorporate heat pump solutions with the goal of growing the market and demonstrating the technology's use and effectiveness.

Recommended Activities for Implementation for the County

Incentives

- Establish electrification incentive programs that provide financial benefits. Examples include high-performance building density zoning bonuses, permit streamlining, and/or property tax incentives. For example, New York Clean Heat programs aim to implement solar water heating (outlined in Strategy 5) and air/ground source heat pumps.

Financing

- Expand existing financing programs that already support a variety of energy efficiency work to include electrification measures.
- Continue to support the county's C-PACE program.

Business and Job Growth

- Support existing businesses in providing bulk services providing electrification to homes and businesses.
- Support and educate installation contractors in the development of their offerings to include a broader set of electrification solutions, including controls and dual-fuel heating systems.
- Partner with the community to encourage the incubation of startup businesses, contractors, and vendors to provide energy services locally.

Partnerships with Businesses, NGOs, and Government

- Partner with the community to strengthen or establish job training programs through community colleges, trade unions, or via apprenticeships to provide energy services locally.
- Partner with building owners to conduct an analysis and work to reduce refrigerant emissions.

Recommended Activities for Implementation for the County Requiring State-Enabled Action

County Programs, Rules, and Regulations

- Authorize local jurisdictions to provide monetary incentives for electrification.
- Authorize the county to implement more stringent building efficiency regulations and mandates.

- Explore the feasibility and effectiveness of technology mandates for electrification technology (e.g., use of heat pumps, electric water heaters/cooktops) and explore the feasibility of fossil fuel use restrictions for new construction.
- Develop incentive programs to help finance building retrofits and equipment upgrades by working with local utilities and other actors.

Recommended Activities for Implementation for State and Federal Governments

Financing

- Establish a state-wide Residential Property Assessed Clean Energy (R-PACE) allowing tax assessment financing in residential buildings.
- Establish a statewide green bank to support various measures, including implementation of electrification technologies.

Innovation and Pilots

- Implement electrification and incorporate heat pump solutions in government buildings with the goal of growing the market and demonstrating the technology's use and effectiveness.

Natural Gas Hookups

Working Group members provided mixed feedback on how to address new natural gas connections. Some members expressed support for a new natural gas ban, while others were concerned that a switch to only electricity for heating could be very expensive and limit Fairfax County's solutions. For example, some Working Group members identified the value that dual-fuel heat pumps could provide by switching from electricity to gas on very cold weather days.

Incentive Programs

- Support new or expanded state-level incentive programs for electrification technologies.
- Require utilities to implement more aggressive electrification solutions through incentive programs. Models for statewide legislation and programming are available in a variety of states, including New York, Maine, and Vermont.

Strategy 3: Implement Green Building Standards for New Buildings

Green building standards for new buildings are an efficient and cost-effective method for reducing energy consumption in new buildings. The design and construction of a building inform the energy use over the building's lifetime. As a result, design and construction decisions made today have significant implications for energy consumption decades in the future. This strategy includes the following:

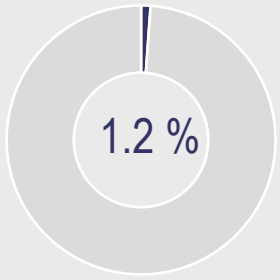
- Action 3a: Increase Building Code Stringency for Residential and Commercial Buildings
- Action 3b: Support All-Electric Residential and Commercial Construction
- Action 3c: Support Green Building Principles and Practices
- Action 3d: Support the Reuse of Existing Buildings

This strategy aligns with the Buildings and Energy Efficiency Sector Goal that all new, eligible buildings will have a commitment to green building. See Greenhouse Gas Reduction Goals.

GHG Emissions Reduced in 2050

129,000 MT CO_2e

Percent Contribution to Emissions Reductions Needed in 2050



GHG Reductions

This strategy results in GHG reductions of 129,000 MT CO_2e in 2050. This strategy is anticipated to account for 1% of the emissions reduction needed to achieve the long-term carbon neutrality goal by 2050.

Cost Considerations

Since green buildings may be more complex or incorporate newer technologies, they might cost slightly more during the design and construction phases than less sustainable buildings. However, those costs are often recovered through lower operating costs and thus provide net cost savings through lower energy bills for tenants and owners.

Working Group Priorities

The Working Group emphasized that Strategy 3 would be most effective if implemented with other concurrent improvements to building design, such as improved water efficiency. Additionally, Working Group members emphasized that it is less costly to incorporate new strategies into buildings during initial construction than during a retrofit. At the same time, members of the Working Group noted that a developer or building owner who is trying to save on the costs of construction or future building upkeep may already be likely to improve energy efficiency without additional intervention from the county.

Action 3a: Increase Building Code Stringency for Residential and Commercial Buildings

This action improves the efficiency of new construction and major retrofits of residential and commercial buildings by increasing the stringency of building energy codes.

Timeframe: Immediate. This action is currently available for implementation.

Technology considerations: Technology performance criteria in the International Energy Conservation Code (IECC) and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1 are proven, industry-approved methods for effectively reducing energy use while maintaining comfort and safety. Codes can only be applied to new buildings, major renovations, or other permitted projects that go beyond replacing existing equipment or components. Adoption of more stringent codes is critical to meeting GHG reduction goals because it keeps baseline energy use and emissions from growing faster than existing building upgrades can reduce it.

Public Health	+
Environmental Resources	+
Economic Opportunity	=
One Fairfax	=
Payback	1–3 years
Cost to Community Members	$$
Timeframe	Immediate

Impacts

- **Public health:** This action benefits regional air quality by reducing emissions from direct fuel use onsite, and from combustion at power plants. Lower levels of air pollution are associated with improved public health outcomes, such as reductions in asthma attacks and cardiovascular disease. Additionally, this action may benefit indoor air quality by reducing onsite combustion and its associated pollutants.

- **Environmental resources:** This action benefits environmental resources by reducing the demand for both onsite fuel combustion and electricity generation, regardless of generation technology.
- **Economic opportunity:** This action has a limited impact on economic opportunity, however there are some new job opportunities from this measure. Incremental building energy improvements create potential opportunities and the 2015 IECC and successive versions allow third-party compliance, which creates jobs for energy raters and similar professionals.
- **One Fairfax:** This action does not have a significant impact on One Fairfax as improvements to air quality and related public health impacts will be experienced by all population groups in the county.

Economic Benefits and Costs

- **Payback:** Quick payback (1–3 years). Energy codes provide an extremely fast payback (often under 1 year). Single-family residential buildings can see a payback of only 0.3 years, while most commercial buildings see an immediate payback.[23][24] Since most home purchases are mortgage financed, the typical buyer can experience lower total housing costs in the first year onward as energy savings exceed small mortgage payment increases.
- **Cost to community members:** Incremental construction costs average under $100 for single-family homes and $0.10/sqare foot across commercial buildings.

Other considerations: Virginia adopts new building energy codes at the state level. New code versions are considered every three years. The committee that governs code adoptions can weaken code provisions, and has done so in the past. Counties that want more stringent codes can seek more active engagement with the state adoption process toward this end.

Action 3b: Support All-Electric Residential and Commercial Construction

This action encourages the use of all-electric power and heat within new residential and commercial construction by strengthening building codes and GHG reduction targets at the state level and improving education about the benefits of all-electric buildings and electrified grids.

[23] PNNL. *Cost-Effectiveness Analysis of the Residential Provisions of the 2018 IECC for Virginia*. https://www.energycodes.gov/sites/default/files/documents/VirginiaResidentialCostEffectiveness_2018.pdf.
[24] PNNL. *Cost-Effectiveness of ASHRAE Standard 90.1-2016*. https://www.energycodes.gov/sites/default/files/documents/90.1-2016_State_Cost-Effectiveness_VA.pdf.

Timeframe: Immediate. This technology is currently available and is being commercially deployed on a significant scale.

Technology considerations: All-electric systems include heat pumps, geothermal exchange systems, induction and electric stovetops, and a variety of other technologies outlined in Strategy 2. New all-electric buildings must be designed to be able to repair and replace electric systems easily to keep up with new technologies and improvements and avoid costly retrofits later down the line.

Public Health	+
Environmental Resources	+
Economic Opportunity	=
One Fairfax	=
Payback	> 7 years
Cost to Community Members	$$
Timeframe	Immediate

Impacts

- **Public health:** This action has a positive impact on public health as an all-electric building would no longer combust fuels onsite, thereby lowering the emission of air pollutants from the building.
- **Environmental resources:** All-electric new structures have a positive effect on environmental resources as systems that only use electric power would reduce the use of fossil fuels.
- **Economic opportunity:** This action does not have a significant impact on environmental opportunity as it is unlikely that this action would increase the rate at which new structures are built, so the number of job opportunities related to construction of new buildings would stay the same.
- **One Fairfax:** This action does not have an impact on One Fairfax as the policies to encourage adoption of all-electric systems would apply to new structures without geographic limitations. The county must take care that any actions used to encourage all-electric systems are equitably available to all communities.

Economic Benefits and Costs

- **Payback:** Slow payback (> 7 years). This action can be cost-effective, depending on the baseline system design. Installing a heat pump system can be less expensive than a central air-conditioning plus furnace system, and the builder also saves money by avoiding gas service extension costs.
- **Cost to community members:** Moderate cost ($$). All-electric technologies for residential homes tend to cost more during construction and installation than conventional, low-efficiency technologies.

Other considerations: Aggressive electrification of building heating systems can increase electric grid peak loads, which can reduce system reliability and resilience. Efficient building envelopes and HVAC systems; load flexibility strategies, such as demand response and battery storage; and dual-fuel heating designs can help reduce such risks.

Action 3c: Support Green Building Principles and Practices

This action encourages green building principles in building design, construction, and operation. Green buildings are designed to reduce energy use, water use, and waste generation; provide for clean indoor air quality; use local and sustainable materials in construction; and be located near public transit and mixed-use development to encourage sustainable transportation and efficient land use.

Public Health	+
Environmental Resources	+
Economic Opportunity	+
One Fairfax	=
Payback	NA
Cost to Community Members	NA
Timeframe	Immediate

Timeframe: Immediate. Building developers in Fairfax County can begin immediately by incorporating green building principles into projects.

Technology considerations: Various green building certification programs exist to provide standards to guide the design, construction, and certification of green buildings. Green building certification programs in use by the Fairfax County Green Building Policy include LEED, EarthCraft, and NGBS. Increasingly, green buildings are being designed to be net zero energy (i.e., generate their own energy needs through onsite renewable energy), or even net positive energy (i.e., generate more than their own energy needs). Green infrastructure, such as green roofs and rain gardens, can be used to protect and expand local natural resources as well as biophilic design,[25] which connects building occupants with nature, and climate positive design,[26] which aims to remove carbon dioxide from the atmosphere.

Impacts

- **Public health:** This action has a positive impact on public health since green buildings have been shown to have a positive impact on overall well-being by reducing stress, enhancing indoor air quality, and increasing productivity. Green buildings also have been shown to reduce sick leave and lead to improved cognition in students and workers.
- **Environmental resources:** This action has a positive impact on local environmental resources by protecting and expanding natural resources, such as trees and green spaces in and around buildings. Native species of plants should be used to avoid the detrimental effects of invasive species.

[25] International Living Future Institute. Biophilic Design. https://living-future.org/biophilic-design-overview/.
[26] Climate Positive Design Initiative. https://climatepositivedesign.com/about/.

- **Economic opportunity:** This action has a positive impact on economic opportunity. As demand for green buildings continues to grow, there will be an increased demand for people with the knowledge and skills to design, build, and operate them.
- **One Fairfax:** This action is not anticipated to have a significant impact on One Fairfax.

Economic Benefits and Costs

- **Payback:** Not applicable since the typical community member will not design, construct, or operate a building. For those who will do so, green buildings tend to have lower day-to-day operating costs, shorter payback periods, and higher asset values over the life cycle of the building.[27] However, these savings are highly dependent on design choices.
- **Cost to community members:** No cost is anticipated to the average community member for this action. Because green buildings may be more complex or might test out new technologies, they might cost slightly more during the design and construction phases. However, those costs are often recovered through lower operating costs and shorter payback periods that save tenants and owners on utility bills.

Other considerations: When compared with traditional building practices, green buildings demonstrate multiple benefits that support the implementation of other strategies in CECAP. For example, by encouraging the location of buildings near public transit and mixed-use development, green buildings support sustainable land use and public and active transportation under Strategy 8. Green buildings also may have climate resilience benefits and lead to increased grid resiliency.

Action 3d: Support Reuse of Existing Buildings

This action includes supporting the reuse of existing buildings. While green building practices under Action 3a are an important tool for reducing GHG emissions from buildings, the greenest way to build is to reuse an existing building. "Adaptive reuse," or building reuse, preserves the existing building structure and adapts it for a new use. The extraction, production, and transportation of building materials, such as wood, cement, and steel, emit a significant amount of GHG emissions. Reusing building materials avoids the need to extract, produce, and transport new building materials, and therefore reduces overall GHG emissions.

Timeframe: Immediate. Building developers in Fairfax County can begin immediately by identifying buildings that are good candidates for reuse. This change of use requires a building permit and a certificate of occupancy/non-residential use permit to be issued even if no alterations are required.

Technology considerations: Adaptive reuse practices and technologies are well known.

[27] https://www.usgbc.org/press/benefits-of-green-building.

Impacts

- **Public health:** This action will not have an impact on public health. To the extent that reuse strategies result in remediation of existing hazards, such as asbestos or lead paint, they can improve the health of occupants.
- **Environmental resources:** This action preserves natural resources by preventing the extraction of resources in the first place. Building reuse also avoids the need to develop new, undisturbed land.
- **Economic opportunity:** This action is not anticipated to have a significant impact on job opportunities or economic well-being; however, it has been shown that neighborhoods are revitalized when vacant or abandoned buildings are reused.
- **One Fairfax:** This action is not anticipated to have a significant impact on One Fairfax.

Public Health	=
Environmental Resources	++
Economic Opportunity	=
One Fairfax	=
Payback	NA
Cost to Community Members	NA
Timeframe	Immediate

Economic Benefits and Costs

- **Payback:** Not applicable. For community members developing an adaptive reuse building, reusing an existing building often can cost less money than constructing a new building because the building's foundation and enclosure already exist.
- **Cost to community members:** No cost is anticipated to the average community member for this action.

Other considerations: Building reuse serves to preserve architecture, honor cultural heritage, and connect people to the history of the building and the community.

Working Group-Recommended Activities for Implementation for Strategy 3

Many options exist for improving building efficiency and conservation and green building. Recommended activities for implementation for this strategy were developed by the Working Group and include the following:

Recommended Activities for Implementation for All Actors

Education

Education is key to advancing a variety of strategies and increasing awareness of green buildings and the associated technologies is an important part of implementing this strategy. As more green buildings are built and used, residents, business owners, and visitors will see and experience their many benefits. In addition to lived experiences in green buildings, educational programs can help achieve broad understanding of the green building practices, materials, and principles. Educational programs can take a lot of shapes and forms, including the following:

Did You Know?

The county's Adaptive Reuse Program seeks to promote the reuse of existing buildings by providing incentives, guidance, and a reduced review timeframe.

- Public education events by neighborhoods, homeowners' associations, schools, and libraries on a variety of subjects (e.g., technologies, financing, audits).
- Contests, competitions, and awards related to green building. These can be showcases for homes and businesses, or be performance-related.
- Educational videos, websites, and other media content.
- School programming and youth education.

Recommended Activities for Implementation for Individuals and Organizations

Individual Actions and Partnerships with Businesses, NGOs, and Government

- Participate in voluntary building certification programs, such as net zero buildings, LEED, Green Globes, ENERGY STAR, and EarthCraft, among others.
- Promote green leasing models: Green leasing, or energy-aligned leasing, creates mutually beneficial landlord-tenant relationships that lead to high-performing buildings. More specifically, they are seen as a way to solve the "split incentive" barrier, wherein a building owner must invest in energy improvements, while tenants benefit from decreased utility costs. There are many case studies, guides, and sample language available through the Green Lease Leaders program.

- Prioritize adaptive reuse of existing buildings and focus on vacant or abandoned buildings.
- Promote green infrastructure in development projects to protect and expand local natural resources. Examples include green roofs, rain gardens, and pollinator gardens. Native species of plants should be used to avoid the detrimental effects of invasive species.
- Empower members of homeowners' associations, large-scale rental communities, and other communities to build and/or renovate using green building practices and to restore and expand trees and green spaces.

Recommended Activities for Implementation for the County

County Programs, Rules, and Regulations

- Continue to lead by example and push for more stringent green building policies under the county's existing Green Building Policy.
- Incorporate the county's own policies in planning and zoning guidelines such that developers are not required to do this, but get implicit incentives knowing that such practices are preferred.
- Develop a county code enforcement officer training program to better equip officers for enforcing building codes.
- Create an energy audit program within Fairfax Land Development Services to review and inspect energy use in commercial buildings.
- Encourage building commissioning to ensure that buildings are designed with optimal energy efficiency.

Incentives

- Establish new green building incentive programs in the form of high-performance building density zoning bonuses, permit streamlining, property tax incentives, audit programs, and accelerated permitting or review for certain technologies or programs.
- Provide expanded incentives to homebuilders for the construction of green buildings, such as ENERGY STAR Homes.
- Provide expanded incentives for adaptive reuse (i.e., rehabilitation and reuse of existing buildings).

Recommended Activities for Implementation for the County Requiring State-Enabled Legislation

There are additional programs and policies that would support county energy and climate goals; however, the county is currently unable to enact unilaterally. The Virginia legislature has the potential to provide Fairfax County with the ability to implement more stringent building efficiency regulations or mandates. The county can look to support these initiatives, which could include the following:

County Programs, Rules, and Regulations

- Authorize local jurisdictions to provide monetary incentives for green buildings.
- Authorize local jurisdictions to adopt "stretch" energy codes, such as the 20% and 40% codes developed via the Zero Cities Project.
- Authorize local jurisdictions to adopt energy modeling requirement for new buildings.
- Authorize local jurisdictions to enact municipal impact fees or escrows to ensure compliance with county green building policies.
- Authorize local jurisdictions to mandate the elimination of onsite natural gas or other combustion in new construction and major renovations.
- Authorize local jurisdictions to mandate electric hookup capabilities for residential kitchen appliances, HVAC equipment, and/or electric vehicles.

Recommended Activities for Implementation for State and Federal Governments

- Adopt more stringent statewide energy codes.
- Implement statewide GHG emissions requirements for new residential and commercial buildings via siting and permitting regulations.
- Implement green building incentive programs, similar to Virginia's allowance for local governments to offer property tax exemptions for energy-efficient buildings, and the WarmWise Home Savings Program.

ENERGY SUPPLY

Strategy 4: Increase the Amount of Renewable Energy in the Electric Grid

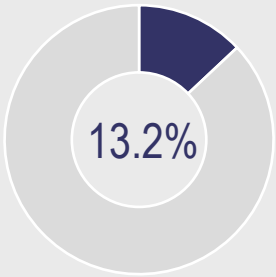
GHG emissions associated with electricity generation are mostly due to burning fossil fuels, such as coal and natural gas. This strategy includes increasing various sources of renewable energy in the electricity grid mix, specifically the following:

- Action 4a: Develop Large Grid-Scale Renewable Energy, Including Solar, On- and Offshore Wind, Hydroelectric, and Other Emerging Technologies
- Action 4b: Develop Grid Storage Technologies to Support the Integration of Renewable Electricity in the Grid
- Action 4c: Maintain Nuclear Generation at Current Levels

GHG Emissions Reduced in 2050

1,389,000 MT CO_2e

Percent Contribution to Emissions Reductions Needed in 2050



GHG Reductions

This strategy results in GHG reductions of 1,389,000 MT CO_2e in 2050. This strategy is anticipated to account for 13% of the emissions reduction needed to achieve the long-term carbon neutrality goal by 2050.

Cost Considerations

This strategy has the potential to moderate future energy costs to community members. The greatest increase in renewable energy generating capacity will come from grid-scale facilities, even though building-scale solar PV continues to grow on the "customer side of the meter." Capital costs for renewables, such as solar PV and wind, continue to fall; moreover, renewable power has no fuel costs and relatively low maintenance costs, making it competitive with traditional generation. One major constraint on renewable power growth on the grid is the ability to integrate variable renewable output. Furthermore, peak output from solar and wind facilities often does not coincide with peak grid demand. Battery storage can address this constraint by storing excess renewable generation for use during peak periods. To enable storage and other distributed energy resource strategies, grid operators need "smart grid" sensors, controls, and software to make grid operations more flexible.

Virginia Clean Economy Act and the Regional Greenhouse Gas Initiative

The Virginia Clean Economy Act (VCEA) and the Regional Greenhouse Gas initiative (RGGI) will drive renewable energy generation and help curtail fossil fuel generation across Virginia, including Fairfax County. VCEA establishes 100% clean energy targets for the state's largest utilities by 2050 and by 2045 for most of Fairfax County. To help meet these targets, Virginia will develop 5.2 gigawatts (GW) of offshore wind generation, 16.1 GW of solar and onshore wind generation, and 3.1 GW of energy storage.

RGGI is a partnership of states designed to cap and reduce carbon emissions from fossil fuel-fired power plants by putting a price on the carbon emissions. It requires power plants to pay that price for allowances and then channels the proceeds back to the states. In Virginia, funding is authorized for low-income energy efficiency programs, the new Community Flood Preparedness Fund, and overall program management.

Working Group Priorities

Working Group members emphasized the importance of increasing the renewable energy mix in the grid that powers Fairfax County, and how essential it will be to reaching GHG reduction goals—both short and long term. The Working Group discussed the importance of the clean energy purchasing option; however, they also noted how limited a scope of direct and immediate impact that county policy can have toward achieving this strategy, since most of the county's energy supply comes from sources located outside of the county.

Action 4a: Develop Large Offsite Grid Renewable Energy

This action includes developing offsite grid renewable energy in the region, including solar, on- and offshore wind, hydroelectric, and other clean energy technologies.

Timeframe: Immediate. This technology is currently available and is being commercially deployed on a significant scale.

Technology considerations: Some renewable energy technologies, particularly solar PV and wind, are mature and have been widely deployed in many areas of the country as their costs have dropped dramatically in recent years. The Virginia Clean Energy Act and other recent state legislation have both mandated clean grid performance and enabled utility investment in renewables. Some renewable generation projects may face hurdles in siting and permitting.

Impacts

- **Public health:** This action improves public health outcomes as electricity generation from fossil fuels is replaced with cleaner sources in alignment with the VCEA. As energy production becomes less reliant on fossil fuels, air quality improvements are expected that will lead to better public health outcomes, such as fewer cases of asthma and other respiratory diseases.
- **Environmental resources:** This action benefits environmental resources use. As fewer fossil fuels will be combusted in the region and renewable energy comprises an increasing portion of the total grid mix, Fairfax could see regional air quality improvements.
- **Economic opportunity:** This action provides job opportunities to build new renewable power systems, such as solar and on- and offshore wind.
- **One Fairfax:** This action does not have an impact on One Fairfax.

Public Health	+
Environmental Resources	++
Economic Opportunity	++
One Fairfax	=
Payback	NA
Cost to Community Members	$
Timeframe	Immediate

Economic Benefits and Costs

- **Payback:** Not applicable. This action is expected to result in either small additional costs or savings for electricity consumers, but will not offer a specific payback.
- **Cost to community members:** Low cost ($). This action will result in either small savings or costs to community members who will see the impact of renewable electricity costs on their utility bills.

Other considerations: Energy supply and grid operational reliability are priorities for utilities and regulators, and will remain so during and after the transition to renewable energy. In determining where to site renewable generation projects, current land use and the impact of land use changes could be considered to provide a broad view of project impacts on local communities. As solar expands, for example, competition with agricultural uses can become an issue.

Action 4b: Develop Grid Storage

This action includes increasing grid-scale storage technologies to support the growth of renewable electricity.

Timeframe: Soon (available before 2030). The technology is available and broad implementation is expected within 1 to 10 years.

Technology considerations: Grid storage technology has become a major focus of public research and development investment in the past decade. Virginia currently uses pumped-hydro storage, a technology using twin reservoirs where water is pumped to the upper reservoir in off-peak hours, and then is used to run hydroelectric generators during peak hours at the Bath County facilities. Pumped hydro, however, is both capital-intensive and site-limited; in recent years, battery storage has become commercially available, while other technologies (e.g., flywheels, compressed air storage, power-to-gas) are under development or not widely available commercially.

Virginia utilities can build and operate distribution-level storage facilities; however, larger grid-scale battery storage can be built by commercial entities for operation by regional transmission organizations (RTOs). PJM, the RTO in which Virginia participates, has already seen the commercial deployment of a substantial amount of large-scale battery capacity and significant additional energy storage is anticipated in alignment with the VCEA targets. Most battery storage projects are limited to short-term storage (i.e., a few hours) and are not intended to provide long-term generation support.[28]

Public Health	=
Environmental Resources	=
Economic Opportunity	++
One Fairfax	=
Payback	NA
Cost to Community Members	$
Timeframe	Soon

Lithium-ion batteries are a commonly used technology for energy storage, although new battery technologies are in active development. Barriers to energy storage deployment include regulatory barriers, market barriers, and data and analysis capabilities.[29] The cost of energy storage has decreased significantly in the past decade as well. Over the coming decade, batteries are forecasted to be increasingly competitive with traditional peaking generation technologies, making energy storage a more practical option as a substitute for fossil fuel generation.

Impacts

- **Public health:** This action does not result in any impacts to public health in the region.
- **Environmental resources:** This action has a mixed impact on environmental resources use. The actions result in less environmental resources use as renewable energy is able to replace fossil fuel combustion in the region at an increasing rate with increased capacity for storage. Still, the mining of materials critical to the manufacture of

[28] Environmental and Energy Study Institute. 2019. Energy Storage Fact Sheet. Available at https://www.eesi.org/papers/view/energy-storage-2019.
[29] National Renewable Energy Laboratory. 2019. Grid-Scale Battery Storage: Frequently Asked Questions. Available at https://www.nrel.gov/docs/fy19osti/74426.pdf.

batteries, such as lithium ion, is a concern in the environmental community and there are environmental trade-off issues involved.

- **Economic opportunity:** This action results in economic opportunity through job creation associated with the expanding energy storage infrastructure.
- **One Fairfax:** This action does not have an impact on One Fairfax.

Economic Benefits and Costs

- **Payback:** Not applicable. This action is expected to result in no or a small additional cost for electricity consumers, but will not offer a specific payback.
- **Cost to community members:** Low cost ($). This action may result in relatively low costs to community members who may see the impact of grid storage on their utility bills.
- **Other considerations:** Grid storage can increase the resilience, reliability, and security of energy systems.

Action 4c: Maintain Nuclear Generation at Current Levels

This action includes continued operation of existing nuclear electricity production in the region.[30] Nuclear power plants fuel 30% of electricity generated in Virginia, and nuclear is presently the primary non-fossil fuel source of electricity production.[31]

Timeframe: Electricity generation from nuclear facilities is currently occurring, and operations will continue.

Technology considerations: Nuclear power is a critical component of the current mix of Virginia's low-carbon electricity generation.[32] There are environmental considerations with nuclear power plant technology, especially the management of radioactive waste and used fuel, which are subject to federal regulations governing their handling, transportation, storage, and disposal to protect human health and the environment. Radioactive waste can remain harmful to human health for thousands of years.[33]

Public Health	=
Environmental Resources	=
Economic Opportunity	=
One Fairfax	=
Payback	NA
Cost to Community Members	No Cost
Timeframe	Immediate

[30] In May 2021, federal regulators approved a 20-year extension of Dominion Energy's Surrey plant.
[31] Energy Information Administration. 2020. Virginia State Energy Profile and Energy Estimates. Available at https://www.eia.gov/state/analysis.php?sid=VA.
[32] U.S. Department of Energy. 2021. Advantages and Challenges of Nuclear Energy. Available at https://www.energy.gov/ne/articles/advantages-and-challenges-nuclear-energy.
[33] Energy Information Administration. 2020. Nuclear power and the environment. https://www.eia.gov/energyexplained/nuclear/nuclear-power-and-the-environment.php.

Public perception is an important challenge to address as nuclear power may be viewed as environmentally risky.

Federal and industry research to develop advanced reactor technologies and improving the nuclear fuel cycle to increase its safety and sustainability are gaining increased funding as support grows for the view that nuclear will need to be part of a low-emissions energy future.

Challenging market conditions, including downward price pressure from high-efficiency natural gas and renewable generation in wholesale markets, have left the nuclear industry struggling in some states. In some cases, states are acting to provide policy incentives to keep nuclear in their generation mix, along with renewables, to drive down power sector emissions.

Impacts

- **Public health:** As a continuation of current activities, this action does not impact public health; however, radioactive waste poses a significant issue to human health.
- **Environmental resources:** As a continuation of current activities, this action does not impact environmental resources. There are environmental resources considerations with nuclear power plant technology, especially the management of radioactive waste.
- **Economic opportunity:** As a continuation of current activities, this action does not impact economic opportunity.
- **One Fairfax:** As a continuation of current activities, this action does not have an impact on One Fairfax.

Economic Benefits and Costs

- **Payback:** Not applicable. As a continuation of current activities, this action does not result in payback.
- **Cost to community members:** No cost. As a continuation of current activities, this action does not result in a cost to community members.

Other considerations: Support for the continued operation of existing nuclear plants was noted by the Working Group; however, members were not as supportive of new nuclear power plants or projects. Newer nuclear technologies are being researched and should be monitored for feasibility to provide low-carbon and low-cost electricity with enhanced safety features in the region. Concern for the economic feasibility of continuing existing nuclear operations also was noted.

Working Group-Recommended Activities for Implementation for Strategy 4

This strategy will be implemented over the course of decades, and the speed at which the strategy is implemented influences how fast clean energy sources can be developed in Virginia. In addition to policy targets, market forces will be critical in determining the mix of resources. To successfully expand grid renewable energy in alignment with requirements set forth by the VCEA, additional efforts will need to be employed. Recommended activities for implementation for this strategy were developed by the Working Group and include the following:

Recommended Activities for Implementation for All Actors

Education

- Education on renewable electricity options. Educational programs can take a lot of forms to broadly explain the technologies and barriers to new renewable electricity sources.
- Encourage the expansion of renewable energy generating capacity locally and regionally for its environmental and societal benefits.

Recommended Activities for Implementation for Individuals and Organizations

Partnerships with Businesses, NGOs, and Government

- Support the purchase of renewable energy projects and products through power purchase agreement and renewable electricity certificate purchases.

Recommended Activities for Implementation for the County

Partnerships with Businesses, NGOs, and Government

- Support the purchase of utility renewable energy projects and products by county government operations, such as power purchase agreements (PPAs) to purchase renewable electricity for the county.
- Incorporate opportunities for renewable energy by working with partners in land use and transportation planning (e.g., create zoning for small wind installations, enhance opportunities for solar installations by collaborating with the Virginia Department of Transportation).
- Educate community members on efforts to make the regional grid more sustainable and how they can help.

Financing

- Develop county-wide renewable energy projects and/or programs, such as a green bank.

Recommended Activities for Implementation for the County Requiring State-Enabled Legislation

County Programs, Rules, and Regulations

- Provide clear authority for Fairfax County to develop Community Choice Aggregation programs[34] to gain members and purchase renewable electricity.

Recommended Activities for Implementation for State and Federal Governments

State and Federal Legislation and Programs

- Advocate for increased participation in Regional Greenhouse Gas Initiative (RGGI) and other carbon electricity pricing schemes.
- Support accelerated grid transformation that goes beyond the renewable energy requirements set forth by the VCEA.
- Support and uphold grid mix requirements set forth by the VCEA.
- Pass further legislation requiring a higher proportion of renewable energy on the grid, or incentives and rebates for regions with more renewable energy generation and usage.

[34] Community solar is a more recently authorized program in Virginia and it might be a better route for Fairfax County. See https://www.scc.virginia.gov/newsreleases/release/SCC-Sets-Rules-for-Shared-Community-Solar-Projects.

Strategy 5: Increase Production of Onsite Renewable Energy

This strategy aims to increase the amount of onsite renewable energy production in Fairfax County, with a focus on solar photovoltaics (PV). This strategy considers the installation of solar and battery storage projects on existing buildings. Transitioning to renewable energy sources, such as solar, will help reduce GHG emissions in buildings and transportation, particularly as adoption of electric vehicles and transit increases.

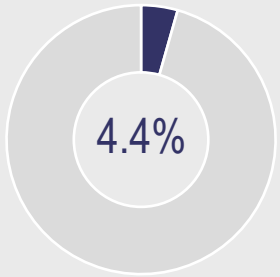
Specific actions under this strategy include the following:

- Action 5a: Expand Solar PV on Existing Buildings
- Action 5b: Support Solar PV in All New Construction
- Action 5c: Support Community Solar
- Action 5d: Develop Battery Storage Projects

GHG Emissions Reduced in 2050

462,000 MT CO_2e

Percent Contribution to Emissions Reductions Needed in 2050



GHG Reductions

This strategy results in annual GHG reductions of 462,000 MT CO_2e in 2050. This strategy is anticipated to account for 4% of the emissions reduction needed to achieve the long-term carbon neutrality goal by 2050. Full implementation of this strategy would result in a cumulative installed rooftop solar capacity of 112 megawatts (MW) by 2050 (Table 3).

Table 3: Assumed Cumulative Capacity of Installed Rooftop Solar by 2030 and 2050 (MW)

	2030	2050
Rooftop Solar Capacity (MW)	46	112

Cost considerations: Onsite solar PV technology is already well developed, and installation costs have dropped significantly in recent years.[35] Additional cost reductions are expected, particularly for soft cost items, such as permitting, siting, and design.[36] Battery storage is currently more expensive than backup fuel generators; however, rapid advances in battery storage technology are expected.[37]

[35] The cost to install solar has dropped by more than 70% over the past decade. See the 2021 Solar Energy Industries Association report. https://www.seia.org/solar-industry-research-data.
[36] National Renewable Energy Laboratory. 2016. Soft Costs 101: The Key to Achieving Cheaper Solar Energy. https://www.energy.gov/eere/articles/soft-costs-101-key-achieving-cheaper-solar-energy.
[37]BREAKTHROUGH BATTERIES Powering the Era of Clean Electrification. Rocky Mountain Institute 2019 https://rmi.org/wp-content/uploads/2019/10/rmi_breakthrough_batteries.pdf

Working Group Priorities

The Working Group strongly emphasized the increased production of onsite renewable energy as an important strategy by noting the benefits of distributed energy sources and that solar can be used on impervious surfaces that would not otherwise be productive. Members of the group advocated for increased wind energy and noted the potential of microturbine technology. Members also highlighted that, during siting and installation, efforts should be made to prioritize and preserve tree canopy. Members of the group cautioned that space on roofs, as well as issues of safety and long-term maintenance of systems, would need to be addressed for implementation. Finally, it was noted that the high cost of this strategy requires incentives for implementation.

Action 5a: Expand Solar Photovoltaics on Existing Buildings

This action focuses on the installation of solar PV on existing buildings in Fairfax County. Solar PV panels generate clean, renewable electricity that can be used in buildings or exported to the grid when building energy demands are lower than PV production.

Timeframe: Immediate. Solar PV technology is currently available and is being commercially deployed on a significant scale. Installation of solar PV on existing buildings is currently being implemented in Fairfax County.

Technology considerations: This technology is already well developed, and installation costs have been dropping significantly over time.[38] Other forms of renewable energy besides solar PV have the potential to increase in Fairfax County. For example, there is potential for small onsite wind projects, or the production of energy from waste/biomass. This strategy focuses on solar because it has the greatest potential in Fairfax County. Some forms of efficient and renewable energy are included in other strategies. For example, geothermal heat pumps, technically an efficiency technology, are included in Strategy 1: Increase Energy Efficiency and Conservation in Existing Buildings.

Public Health	+
Environmental Resources	+
Economic Opportunity	++
One Fairfax	=
Payback	> 7 years
Cost to Community Members	$$$
Timeframe	Immediate

[38] The cost to install solar has dropped by more than 70% over the past decade. See the 2021 Solar Energy Industries Association report for more information: https://www.seia.org/solar-industry-research-data.

Impacts

- **Public health:** This action benefits regional air quality by reducing demand for energy generated by combustion at power plants. Lower levels of air pollution are associated with improved public health outcomes, such as reductions in asthma attacks and cardiovascular disease.
- **Environmental resources:** Installation of solar PV on existing buildings benefits environmental resources by reducing the demand for fossil fuel-based energy generation. It also benefits land resources; unlike solar farms and many other forms of energy generation, placing the solar panels on the rooftops of existing buildings does not require the use of additional land. While the creation of solar PV systems requires energy, the energy use during production is offset between 1 and 4 years after the systems begin operation, and the expected lifetime is 30 years. This means that 87% to 97% of the energy that PV systems generate are free of GHG emissions and the depletion of resources.[39]
- **Economic opportunity:** Encouraging the development of solar PV provides a positive benefit for local jobs since rooftop solar construction has a strong correlation with local job creation.
- **One Fairfax:** Installation of solar panels would not tangibly impact social or racial inequities as regional air quality improvements and related public health impacts will be experienced by all population groups in the county. However, existing racial and social inequities should be considered in the design of programs and policies to support solar PV. This action requires a financial investment upfront in order to benefit from reduced energy costs over time, and programs and policies should be designed to address that financial barrier and allow for equitable access to the long-term financial benefits of solar PV systems. Moreover, if solar PV is installed disproportionally at higher income homes and businesses, this creates upward pressure on electric rates, the burden of which would fall disproportionally on lower income utility customers.[40]

Economic Benefits and Costs

- **Payback:** Slow payback (> 7 years).[41] This action has a longer payback period due to the high upfront cost but will ultimately save on energy for community members.
- **Cost to community members:** High cost ($$$). Even with financial assistance or incentives from the county or other sources, a 3- to 10-kW residential solar installation will typically cost $8,000–$30,000.[42]

[39] U.S. DOE, Office of Energy Efficiency and Renewable Energy. PV FAQs. https://www.nrel.gov/docs/fy04osti/35489.pdf.
[40] The Commonwealth of Virginia currently promotes solar among low-income households. For example, VA Code 56-594.3 regarding Shared Solar has a program minimum requirement of 30% low-income customers and these customers are exempt from Dominion Energy's minimum bill requirements.
[41] Solarize Virginia. 2021 Pricing. https://solarizeva.org/pricing/.
[42] Using Solar in Fairfax County. https://www.fairfaxcounty.gov/environment-energy-coordination/using-solar.

Other considerations: The 2020 Solar Freedom Act[43] and the Clean Economy Act[44] in the Virginia legislature expanded solar PV opportunities in several ways, including the permitted size for residential and commercial buildings. Residential building-scale PV systems can be up to 25 kW (formerly 20 kW) and can be sized up to 150% of the home's needs, which is enough to run the vast majority of Virginia homes. Additionally, commercial building-scale PV can be up to 3 MW (formerly 1 MW).

Action 5b: Support Solar Photovoltaics in All New Construction

This action focuses on the installation of solar PV on new buildings in Fairfax County.

Timeframe: Immediate. Solar PV technology is currently available on a commercial scale; however, broad implementation of solar PV installation in all new construction may take time.

Technology considerations: This technology is already well developed, and installation costs have been dropping significantly over time.

Public Health	+
Environmental Resources	+
Economic Opportunity	++
One Fairfax	=
Payback	> 7 years
Cost to Community Members	$$
Timeframe	Immediate

Impacts

- **Public health:** This action benefits regional air quality by reducing demand for energy generated by combustion at power plants. Lower levels of air pollution are associated with improved public health outcomes, such as reductions in asthma attacks and cardiovascular disease.
- **Environmental resources:** Installation of solar PV on new buildings benefits environmental resources by reducing the demand for fossil fuel-based energy generation. It also benefits land resources; rooftop solar does not require the use of additional land, unlike solar farms and many other forms of energy generation.
- **Economic opportunity:** Encouraging solar PV or solar PV-ready construction provides a positive benefit for local jobs since rooftop solar construction has a strong correlation with local job creation.
- **One Fairfax:** Installation of solar panels would not tangibly impact social or racial inequities as improvements to air quality in the region and related public health

[43] HB 572 Distributed solar & other renewable energy; sales of electricity under third-party agreements. https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+HB572.
[44] SB 851 Electric utility regulation; environmental goals. Virginia Clean Economy Act. https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+SB851.

impacts will be experienced by all population groups in the county. However, existing racial and social inequities should be considered in the design of programs and policies to support solar PV.

Economic Benefits and Costs

- **Payback:** Slow payback (> 7 years). This action has a longer payback period due to the high upfront cost but will ultimately save on energy for community members.
- **Cost to community members:** Moderate cost ($$). This action has a moderate overall cost; however, upfront costs can be distributed between developers/businesses and community members. Costs also can be offset by financial incentives, tax credits, and other programs.

Other considerations: If costs are prohibitive for solar PV in the initial build, some new buildings can be built as "solar ready" with space for panels, conduit, and electrical equipment included in the design to allow for a quicker installation at a later date. Additionally, some sites will not be suitable for PV (e.g., forested areas or northern slopes); in such cases, provision for offsite renewable purchases can be made through renewable energy certificates (RECs) or similar mechanisms.

Action 5c: Support Community Solar

This action encourages the development of community solar projects in Fairfax County. Community solar projects, sometimes referred to as "shared solar," are projects where a group of participants or subscribers collectively purchase shares of the output from a solar facility.

Timeframe: Soon (available before 2030). Solar PV technology is currently available on a commercial scale; however, broad implementation of community solar projects is about 1 to 10 years out given that very few community solar projects are in operation in Virginia.

Technology considerations: This technology is already well developed.

Impacts

- **Public health:** This action benefits regional air quality by reducing the demand for energy generated by combustion at power plants. Lower levels of air pollution are associated with improved public health outcomes, such as reductions in asthma attacks and cardiovascular disease.

- **Environmental resources:** Community solar projects and increased energy generation from solar PV in general benefit environmental resources by reducing the demand for fossil fuel-based energy generation.
- **Economic opportunity:** Encouraging community solar projects creates new jobs locally since solar construction has a strong correlation with local job creation.
- **One Fairfax:** Community solar projects can increase access to solar energy for low-income communities, particularly if built with the support of government funding. This can help reduce inequities in household energy burdens, or the percentage of household income spent on energy bills. One example is VA Code 56-594.3, which creates a program minimum requirement for shared solar of 30% low-income customers, who are also exempt from Dominion's minimum bill requirements.

Public Health
+
Environmental Resources
+
Economic Opportunity
++
One Fairfax
+
Payback
NA
Cost to Community Members
$
Timeframe
Soon

Economic Benefits and Costs

- **Payback:** Not applicable. There is no payback associated with this action because community solar programs operate as a subscription model.
- **Cost to community members:** Low cost ($), assuming that there will be a cost to consumers to participate in the community solar project, as opposed to the project being fully funded by the county.

Other considerations: A new state-level shared solar program, enabled by state legislation, is anticipated to roll out in Virginia in 2023.[45] The program was developed in response to Senate Bill 629 from the 2020 General Assembly session,[46] which requires state utility regulators to establish a shared solar program that allows customers of Dominion Energy to purchase electric power through a subscription in a shared solar facility. The program emphasizes participation from low- and moderate-income consumers. The program also encourages smaller, distributed projects by mandating that no single project can exceed 5 MW.[47] State programs such as this one can support the expansion of community solar projects in Fairfax County and serve as a model for programs at the countylevel.

[45] Energy News Network. 2020. Available at "Netflix for solar": Virginia finalizing rules for solar subscription program.
[46] SB 629 Shared solar programs; electric utility regulation, etc. Available at LIS > Bill Tracking > SB629 > 2020 session (virginia.gov).
[47] Energy News Network. 2020. Available at "Netflix for solar": Virginia finalizing rules for solar subscription program.

Action 5d: Develop Battery Storage Projects

Public Health	=
Environmental Resources	+
Economic Opportunity	++
One Fairfax	=
Payback	> 7 years
Cost to Community Members	$$$
Timeframe	Soon

This action encourages the installation and operation of behind-the-meter batteries at existing residential, commercial, and institutional buildings. This would enhance the value of distributed generation, such as solar PV, while improving resilience for the local property. Deployed at scale and with the right incentives, both community and grid resilience could be greatly enhanced.

Timeframe: Soon. Battery technology is currently available on a commercial scale, but is currently expensive, so broad deployment of behind-the-meter storage is 5 to 10 years out.

Technology considerations: This action focuses on encouraging battery adoption, so tracking the development and adoption of battery storage in the county will be central to assessing whether this action was implemented successfully.

Battery storage is currently more expensive than backup fuel generators and its long-term performance remains uncertain, particularly under various charge and discharge cycles.

Since batteries allow for the storage and consumption of electricity generated by property-sited solar PV, they generally enhance the value of distributed solar projects, both to the property owner and to grid operators if their grid value is appropriately included.

Impacts

- **Public health:** This action does not have a significant impact on pollution or public health. It may displace fossil fuel emissions during emergency generator operation; however, those are typically brief events.
- **Environmental resources:** Deploying batteries in existing buildings benefits environmental resources by capturing excess distributed solar generation for use later in the day, thereby improving the overall value of PV, and reducing the demand for fossil fuel-based energy generation.
- **Economic opportunity:** Deploying batteries in existing buildings strongly benefits local businesses and jobs since it is labor-intensive work that must be performed locally. This type of asset also is an investment that can improve the value of the building.
- **One Fairfax:** This action, by itself, does not have a significant impact on One Fairfax. However, solar-plus-storage projects at strategically located sites could serve as community resilience hubs and have particularly beneficial impacts on disadvantaged neighborhoods.

Economic Benefits and Costs

- **Payback:** Slow payback (> 7 years). Under current conditions, financial payback is unlikely for community members, even when considering multiple value streams (demand charge and demand response). Power reliability and resilience are the primary benefits.[48,49]
- **Cost to community members:** High cost ($$$). This is one of the more expensive actions that community members can pursue. This action would be best deployed in select, strategic locations where power reliability and resilience are a top priority, such as hospitals.

Other considerations: Solar-plus-storage projects at strategically located sites could serve as community resilience hubs and have particularly beneficial impacts on disadvantaged neighborhoods. Another consideration is that local building codes must often be amended to accommodate battery storage. Fire safety precautions can prevent, or at least complicate, efforts to install and operate batteries.

[48] IEEE. An Investigation of a Domestic Battery Energy Storage System, Focusing on Payback Time. https://ieeexplore.ieee.org/document/9364576.
[49] National Renewable Energy Laboratory. REopt™ Lite. https://reopt.nrel.gov/tool.

Working Group-Recommended Activities for Implementation for Strategy 5

Solar PV technologies have made significant advancements in recent years; however, there are still a number of barriers to a widespread transition to solar energy. The recommended activities for implementation listed below can help reduce barriers and allow for successful transition toward renewable energy in Fairfax County, in alignment with the VCEA.

Recommended activities for implementation for this strategy were developed by the Working Group and include the following:

Recommended Activities for Implementation for All Actors

Education

- Education and outreach on the benefits of solar PV technologies, community solar fundamentals, solar financing, and vetted solar installers in the county.
- Education and outreach that promotes battery storage over fuel generators for backup power supply.
- Support research and development to improve solar PV technological advances.

Recommended Activities for Implementation for Individuals and Organizations

Individual Actions and Partnerships with Businesses, NGOs, and Government

- Install solar panels on the roofs of homes and businesses.
- Participate in a community solar program (or a shared solar project).
- Develop solar-ready homes and buildings.

Recommended Activities for Implementation for the County

County Programs, Rules, and Regulations

- Implement programs that lower the soft costs of solar PV by streamlining permitting, lowering permit fees, and maintaining by-right zoning (meaning that projects that comply with specific zoning standards receive approval without going through a discretionary review process). Currently, the county's Land Development Services

Did You Know?

Solarize Fairfax County aims to increase the percentage of available rooftop space with solar PV systems. Solarize campaigns provide residents and businesses with free onsite assessments, bulk discount prices, vetted contractors, and community workshops and support.

Additionally, in 2019, Fairfax County government officials announced a major solar power purchase agreement initiative, which will allow for the installation of solar PV arrays at Fairfax County government, school, and park sites, providing the potential for both substantial cost avoidance and environmental benefits over time.

division waives the permit fee for solar permit applications, and the county's Department of Tax Administration provides a solar energy equipment tax exemption.

- Support community solar projects by promoting to potential subscribers and by leveraging county land, buildings, and schools for the projects, and by promoting community solar projects to potential subscribers.
- Implement programs that connect with residents and private businesses to determine the best way to improve battery adoption.
- Build solar canopies at county-owned parking lots and depots

Incentive Programs

- Establish solar and battery technology incentive programs that provide financial benefits for installing onsite renewables or battery technologies (including solar PV cells). One major barrier to the adoption of solar power is the upfront cost required to install systems. Upfront costs can make it difficult for LMI households to access, even though LMI households could benefit the most from reduced energy bills in the long term.[50] LMI-specific financial incentives and PACE financing have been shown to be effective strategies for increasing solar installations in previously under-served low-income communities.[51] This could include solar incentive programs targeted toward multifamily affordable housing such as the California Solar on Multifamily Affordable Housing (SOMAH) program.[52]
- Provide financial incentives or policies to lower barriers to the development of community solar projects.

Recommended Activities for Implementation for the County Requiring State-Enabled Legislation

County Programs, Rules, and Regulations

- Authorize local jurisdictions to provide monetary incentives for solar and battery technology projects.
- Amend local building codes to accommodate battery storage, such as incorporating fire safety precautions in codes. Leading municipalities have begun to incorporate U.S. National Fire Protection Association 855 into local building codes to better prepare for battery deployment.
- Pursue state approval for solar or battery technology mandates for certain building and facility types (e.g., solar PV on all new construction or requiring solar-ready construction).

[50] Environmental and Energy Study Institute. Study Highlights Ways to Narrow the Solar Equity Gap. https://www.eesi.org/articles/view/study-highlights-ways-to-narrow-the-solar-equity-gap.
[51] U.S. Department of Energy, Lawrence Berkeley National Laboratory. The impact of policies and business models on income equity in rooftop solar adoption. https://emp.lbl.gov/publications/impact-policies-and-business-models.
[52] California Public Utilities Commission. Solar on Multifamily Affordable Housing. https://calsomah.org/.

Recommended Activities for Implementation for State and Federal Governments

State and Federal Legislation and Programs

- Support policies at the state, regional, and federal levels that facilitate connections between onsite renewable energy installations and strengthen the regional electricity grid.
- Track Virginia's recent shared solar program legislative changes and new rules to determine its effectiveness in growing community solar.
- Explore opportunities to expand retail electricity supplier competition as a pathway for expanded renewable energy, which would allow home and business owners to buy renewable electricity as part of the supply portion of their electricity bill.
- Support the continuation of tax credits available from the federal government for solar installation.

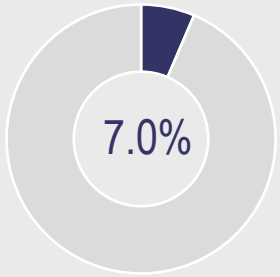
Strategy 6: Increase Energy Supply from Resource-Recovered Gas, Hydrogen, and Power-to-Gas

This strategy includes increasing the production and use of resource-recovered gas,[53] hydrogen, and power-to-gas (Action 6a).

GHG Emissions Reduced in 2050

733,000 MT CO_2e

Percent Contribution to Emissions Reductions Needed in 2050



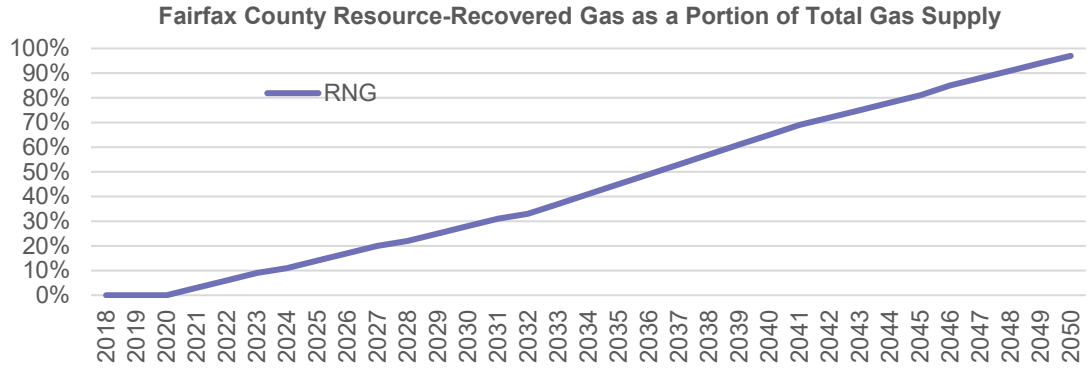
- Resource-recovered gas refers to biogas created from decomposed organic matter through specific processes. The term was defined by the Working Group over concerns that certain types of feedstocks and processes that produce gas, frequently referred to as "renewable natural gas," are problematic due to the feedstock sources. Renewable natural gas is a catch-all term commonly referenced for all biogas sources, which are cleaned for use in pipelines. Under this strategy, resource-recovered gas may be derived from municipal solid waste (MSW) landfill gas, anaerobic digestion (AD) of food waste and at municipal water resource recovery facilities, and thermal gasification from MSW. This strategy excludes AD at livestock farms, energy crops, and forestry and wood products, as the Working Group voiced concern that these particular biogas feedstocks could exacerbate environmental impacts, such as incentivizing the cutting down of trees for biomass.
- Hydrogen can be produced in "green" form by using excess or dedicated renewable power from wind or solar to produce hydrogen.
- Power-to-gas refers to the process of converting renewable energy into a synthetic gas, usually by first creating renewable hydrogen and then combining it with biologically derived carbon, to create a methane molecule equivalent to natural gas (which is methane).

By replacing high-carbon sources of energy, such as natural gas, with these kinds of lower carbon sources, GHG emissions in buildings and transportation may be reduced. While resource-recovered gas is considered largely carbon neutral if combusted, transmission and distribution leaks of gas release methane into the atmosphere, which is a potent GHG.

[53] Resource-recovered gas (commonly referred to as "renewable natural gas") refers to biogas created from decomposed organic matter through anaerobic digestion, thermochemical processes, or gasification; biogas may be sourced from landfills, livestock operations, or wastewater treatment plants.

GHG Reductions

This strategy results in GHG reductions of 733,000 MT CO_2e in 2050. This strategy is anticipated to account for 7% of the emissions reduction needed to achieve the long-term carbon neutrality goal by 2050. The graph below shows the portion of total gas that comes from resource recovered gas sources based on the GHG modeling for this strategy.



Cost Considerations

Resource-recovered gas is currently more expensive than conventional natural gas, and production and processing costs are high given the stage of development of various technologies at present. To be cost-competitive, these costs will need to decrease. Research and development efforts, as well as scaled deployment of resource-recovered gas collection sites, may lower costs and expand the use of the fuel. For high-heat applications, such as certain industrial processes and heating for existing large buildings, resource-recovered gas technologies can be more feasible and more cost-effective alternatives than electrification.

Hydrogen/power-to-gas technologies are not yet commercially deployed in the U.S. and so currently have relatively high costs. Research on hydrogen production and uses is being pursued in a variety of industrial and transportation sectors. While the cost of resource-recovered gas is also high, GHG reduction potentials are expected to be met largely with resource-recovered gas projects due to the current state of the technology.

Working Group Priorities

Working Group members cautioned that renewable natural gas is not renewable and therefore opted to use the term "resource-recovered gas" instead. Working Group members de-emphasized the technologies under this strategy in favor of renewable energy and electrification. Moreover, leakage of resource-recovered gas also was raised as a concern since the methane that is leaked is a high-emitting GHG. Still, other Working Group members highlighted the economic and equity benefits of this strategy in that the use of resource-recovered gas avoids the need to replace existing infrastructure and equipment, and therefore avoids increased energy costs that would have the most impact on low- and moderate-income populations.

Action 6a: Expand the Supply and Use of Resource-Recovered Gas, Hydrogen, and Power-to-Gas

This strategy includes increasing the production and use of resource-recovered gas, hydrogen, and power-to-gas. This strategy considers the replacement of natural gas with resource-recovered gas using landfill gas, wastewater resources, food waste, and non-biogenic municipal solid waste sources. Hydrogen would come from using excess renewable power generation to produce it using processes such as electrolysis, which extracts hydrogen from water.

Public Health	+
Environmental Resources	++
Economic Opportunity	+
One Fairfax	=
Payback	NA
Cost to Community Members	$
Timeframe	Future

Timeframe: Future (available after 2030). In the future, as many technologies for resource-recovered gas projects are emerging or are in the early stages of development. Broad implementation is expected in over 10 years.

Technology considerations: Many technologies for resource-recovered gas project implementation are still in early stages of development, and not yet commercially deployed. There also are varying specifications for resource-recovered gas injection into pipelines, as hundreds of independent gas systems make up the pipeline network in the U.S. and each system has its own requirements. Some requirements presently may effectively prohibit resource-recovered gas interconnection. Standardization of pipeline injection specifications will be necessary to provide clarity for project developers, in addition to equipment and technology providers. While some resource-recovered gas technologies are commercially developed, hydrogen and power-to-gas technologies are in the earlier stages of development. Pilot projects could be considered to experiment with these technologies.

Impacts

- **Public health:** Air quality improvements are expected from this strategy from the combustion of biofuels rather than fossil fuels, which will lead to better public health outcomes, such as fewer cases of asthma.
- **Environmental resources:** This action benefits environmental resources use. As resource-recovered gas projects increasingly replace the use of conventional natural gas, fewer fossil fuels will be combusted for energy in buildings and transportation. As fewer fossil fuels are combusted in the region, Fairfax County could see regional air quality improvements.
- **Economic opportunity:** This action provides employment opportunities related to resource-recovered gas projects and infrastructure for pipeline interconnection.
- **One Fairfax:** This action is not anticipated to have a significant impact on One Fairfax.

Economic Benefits and Costs

- **Payback:** Not applicable.
- **Cost to community members:** Low cost ($). Costs for resource-recovered gas, hydrogen, and power-to-gas project implementation are high; however, implementation will be spread out across many customers. Resource-recovered gas is currently more expensive than conventional natural gas, and production and processing costs need to be reduced to improve cost-competitiveness. While the costs of hydrogen and power-to-gas also are high, GHG reduction potentials are expected to be met largely with resource-recovered gas projects due to the current state of resource-recovered gas technology.

Other considerations: Combined heat and power (CHP) projects could be developed at many facilities where resource-recovered gas is produced and used to generate electricity onsite. Additionally, while resource-recovered gas feedstocks often include waste byproducts (e.g., landfill gas), the county should continue to divert waste sent to landfills and explore alternatives, particularly for organic waste, such as anaerobic digesters and composting programs. As waste continues to be sent to landfills, however, using landfill gas as a feedstock for resource-recovered gas is an opportunity to reuse landfill gas to increase the amount of renewable energy to meet the county's gas demand.

Working Group-Recommended Activities for Implementation for Strategy 6

Recommended activities for implementation for this strategy were developed by the Working Group and include the following:

Recommended Activities for Implementation for All Actors

Education

- Education and outreach can help facilitate adoption of resource-recovered gas. There is some public misconception about the quality of resource-recovered gas compared with conventional natural gas. Providing education can inform stakeholders and the public about resource-recovered gas and its development so that the benefits that can be realized from these projects are apparent.

Recommended Activities for Implementation for Individuals and Organizations

Innovation and Pilots

- Initiate or participate in pilot programs to expand the use of hydrogen and power-to-gas technologies.

Recommended Activities for Implementation for the County

Incentive Programs

- Establish resource-recoved gas incentive programs that provide financial incentive for non-county resource-recovered gas feedstock operators to provide an opportunity to encourage increased levels of adoption.

Recommended Activities for Implementation for the County Requiring State-Enabled Legislation

- No recommended activities specifically for individuals and organizations were identified for this strategy.

Recommended Activities for Implementation for State and Federal Governments

State and Federal Legislation and Programs

- Subsidize the upfront costs of equipment for resource-recovered gas feedstock operators to provide an opportunity to encourage increased levels of adoption.
- Streamline the interconnection process to improve and enhance the experience of interconnectors and company personnel, which can encourage feedstock operators to start resource-recovered gas operations onsite.

- Establish interconnection incentives and transparent biogas quality guidelines for pipeline injection to make it easier for developers to design the proper treatment processes that will meet quality specifications.[54]
- Implement a renewable gas standard at the state level.
- Develop and facilitate resource-recovered gas quality and outreach programs by the county and/or state to help educate the industry on gas quality standards and monitoring in Fairfax County.[55]

[54] U.S. EPA. 2020. An Overview of Renewable Natural Gas from Biogas. Available at https://www.epa.gov/sites/production/files/2020-07/documents/lmop_rng_document.pdf.
[55] SoCalGas. 2018. Getting the Facts on Renewable Natural Gas. Available at https://www.epa.gov/sites/production/files/2018-11/documents/7._deanna_haines-508.pdf.

TRANSPORTATION

Strategy 7: Increase Electric Vehicle (EV) Adoption

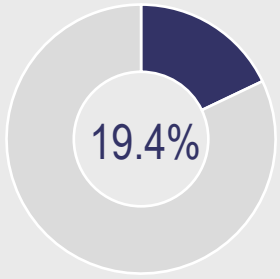
This strategy models an increase in EV adoption through three primary pathways:

- Action 7a: Leverage County Assets to Expand EV Use Across On-Road Vehicles and Off-Road Equipment
- Action 7b: Increase EV Adoption by Residents, Businesses, and Private Fleets
- Action 7c: Install EV Chargers in New Buildings

GHG Emissions Reduced in 2050

2,044,000 MT CO_2e

Percent Contribution to Emissions Reductions Needed in 2050



Vehicle electrification eliminates direct tailpipe emissions of both GHGs and short-lived air pollutants that are recognized environmental and public health hazards. While energy is needed to recharge EVs, EVs use less energy per mile driven compared with conventional vehicles due to the higher efficiency of the electric motor. Furthermore, the emissions associated with electricity generation for EV charging will incrementally decrease over time as the Power sector becomes cleaner nationwide and in Virginia in accordance with the VCEA of 2020. The investments necessary to implement this strategy will generate upfront costs to community members; however, the payback of EV adoption is expected to be quick as EV ownership is already cost-effective compared with conventional vehicles due to the lifetime savings in fuel and maintenance costs. Widespread vehicle electrification also is poised to generate local economic opportunities for the installation and maintenance of private and public EV charging infrastructure, as well as health costs savings from pollution reduction.

This strategy aligns with the Transportation Sector Goal to increase plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs) to at least 15% of all light-duty vehicle registrations by 2030. See Greenhouse Gas Reduction Goals.

GHG Reductions

This strategy results in GHG reductions of 2,044,000 MT CO_2e in 2050. This strategy is anticipated to account for 19% of the emissions reduction needed to achieve the long-term carbon neutrality goal by 2050.

This strategy assumes that the total market share of EVs in Fairfax County will amount to 15% in 2030 and 42% in 2050, corresponding to approximately 125,000 EVs in 2030 and

335,000 EVs in 2050 (light-duty EVs including passenger cars and trucks represent roughly 42% of the EVs on county roads in 2050). The resulting net GHG reductions by 2050 include GHG emissions from electricity generation needed for EV charging.

Cost Considerations

Light-duty EVs are rapidly approaching cost parity with conventional vehicles, while medium- and heavy-duty EVs still have a much higher upfront cost. However, costs are expected to continue to drop across all vehicle types as more models become commercially available as a result of both industry initiatives (e.g., automakers committing to phase out the combustion engine and manufacture only EVs by 2030 or 2035) and policy forces (e.g., emissions and EV targets at the state or federal level). Current data indicate that the upfront purchase cost of any EV is recovered through savings from fuel and maintenance over the vehicle's useful life.

Working Group Priorities

The Working Group emphasized the important role of widespread vehicle electrification to reduce transportation emissions and the associated public health impacts. Members of the Working Group pointed out the need to implement equitable vehicle electrification measures, such as supporting access to EV charging in multifamily housing and in public areas, and ensuring that EV ownership is not the only way residents of Fairfax County can access clean transportation. To this effect, the electrification of the transit and school bus fleets, the creation of carsharing programs that utilize EVs, and incentives for electric bikes can be measures to promote equitable access to EVs. On the other hand, the Working Group noted that a downside of this strategy is that continued reliance on vehicles encourages road infrastructure and vehicle-focused land development.

Action 7a: Leverage County Assets to Expand EV Use Across On-Road Vehicles and Off-Road Equipment

This action increases the use and adoption of EVs in the county fleet for both on-road vehicles and off-road equipment. The action encompasses electrifying the existing on-road fleet (e.g., medium- and heavy-duty vehicles such trash haulers, shuttles, street sweepers, transit, and school buses), off-road equipment (e.g., mowers, forklifts, leaf blowers), and installing EV charging at county facilities to encourage EV adoption among employees, coupled with solar canopies.

Timeframe: Immediate. EV technology is commercially available for many vehicle types, especially passenger cars. However, there are currently few commercially available options

for trucks, fire trucks, and police cars. The county can leverage existing federal and state incentives (e.g., Volkswagen Settlement Fund) while they last.

Technology considerations: It is cost-effective to replace conventional passenger vehicles with readily available EV models (either battery electric or plug-in hybrids). The county will have to monitor new EV types as they become available on the market while working with utilities and county departments to upgrade facilities, prepare the necessary charging infrastructure, leverage existing incentives to cover capital costs, and train personnel.

Public Health	++
Environmental Resources	=
Economic Opportunity	+
One Fairfax	=
Payback	1–3 years
Cost to Community Members	NA
Timeframe	Immediate

Impacts

- **Public health:** This action presents an opportunity to significantly reduce GHG emissions and bring about public health improvements. The largest direct health benefit will occur for community members who currently operate fossil-fueled equipment, especially heavy-duty vehicles (buses and trucks).
- **Environmental resources:** This action has a neutral impact on environmental resources use within Fairfax County.
- **Economic opportunity:** This action has a neutral effect on economic opportunities within the county.
- **One Fairfax:** The impact of this action on One Fairfax is uncertain and will depend on specific implementation activities.

Economic Benefits and Costs

- **Payback:** Quick payback (1–3 years), especially if incentives can lower the upfront capital costs for vehicle purchases and infrastructure investments. Conversion of fleets is more cost effective than it is for individuals.
- **Cost to community members:** Not applicable. This action has no applicable costs to the community.

Other considerations: Depending on the type of available equipment, longer implementation timeframes and higher costs (with medium paybacks) could be expected for certain types of on-road heavy-duty and off-road vehicles. In those cases, the county can seek low-carbon alternative fuels of hybrid electric retrofits. When appropriate, the county also can consider alternate business models, such as leasing, to expedite the implementation of zero-emission vehicles.

Action 7b: Increase EV Adoption by Residents, Businesses, and Private Fleets

This action includes increasing EV adoption by encouraging consumers and private fleets to upgrade to EVs and to install charging infrastructure.

Timeframe: Immediate. EV technology is commercially available for most vehicle types, and residents and private businesses can leverage existing federal, state, and private (e.g., utility) incentives for residential and commercial applications.

Technology considerations: EV technology is mature enough to allow for most conventional light-, medium-, and heavy-duty vehicles to be replaced with electric versions. However, successful EV adoption at scale requires deployment of EV charging infrastructure and other complementary technologies for smart charging and energy management. While EV adoption is the primary action considered here, EV use also can be advanced by incorporating EVs in other mobility platforms, such as carsharing and ridesharing programs.

Public Health	++
Environmental Resources	=
Economic Opportunity	+
One Fairfax	+
Payback	3–7 years
Cost to Community Members	$$$
Timeframe	Immediate

Impacts

- **Public health:** This action has significant public health benefits for households, businesses, and communities since EVs do not directly emit harmful pollutants.
- **Environmental resources:** This action has a neutral impact on environmental resources use within Fairfax County.
- **Economic opportunity:** This action creates a steady demand for EVs in the region, providing opportunities to create local jobs for EV charging installation, operation, and maintenance. Additional local jobs could be created over time through investments in EV manufacturing and the supply chain.
- **One Fairfax:** This action has a positive impact on One Fairfax as it reduces pollution that is especially harmful to frontline communities living near roadways. Further advancement of the One Fairfax policy can occur through the implementation of equitable measures in EV adoption (e.g., through low-interest loans, point-of-sale rebates, vouchers) and EV charging infrastructure siting.

Economic Benefits and Costs

- **Payback:** Medium payback (3–7 years). The payback from this action will require the creation of supporting infrastructure that needs to be developed at a county level.
- **Cost to community members:** High cost ($$$). This action relies on individual residents and businesses purchasing new EVs. Incentives can help lower the upfront costs of vehicles and infrastructure. If this action focuses on replacing vehicles at the end of their useful life and financing, the incremental costs can be relatively affordable, especially as most EVs have low operating costs.

Other considerations: Although this action is quick to implement for light-duty vehicles, longer timeframes are expected for medium- and heavy-duty uses, depending on the vehicle type, initial costs, and rates of vehicle replacement.

Action 7c: Install EV Chargers in New Buildings

This action encourages new buildings to install EV chargers or to be "EV-ready." The implementation will include leveraging available rebates and incentives for EV charger installation, supporting the use of the zoning and land use codes to require the installation of EV-ready charging infrastructure in new residential and commercial buildings, and working with utilities to implement demand-response programs to manage energy load.

Timeframe: Immediate. This action can have a long implementation timeline; however, key initiatives such as information gathering and engagement of relevant actors can be initiated immediately.

Technology considerations: This action will require that the county updates zoning and land use policies on new building designs by introducing incentives for EV charging, such as density bonuses or an EV-readiness ordinance that mandates a minimum of EV-ready parking spaces in new constructions. Property owners and homeowners' associations can work with utilities to implement energy management tools, such as price signaling and demand response to ensure that EV owners can charge their vehicles when electricity prices are low, without creating demand surges and price spikes.

Public Health	++
Environmental Resources	=
Economic Opportunity	+
One Fairfax	+
Payback	> 7 years
Cost to Community Members	NA
Timeframe	Immediate

Impacts

- **Public health:** By enabling EVs to be adopted by more people, this action benefits public health benefits by phasing out internal combustion vehicles across the county.
- **Environmental resources:** This action has a neutral impact on environmental resources use within the county.
- **Economic opportunity:** Installing EV chargers in all new buildings creates job opportunities for electricians and EV maintenance personnel, in addition to encouraging the growth of the EV market in the region.
- **One Fairfax:** This action has a positive impact on One Fairfax as it increases equity by giving access to EV charging to multifamily residents that face more barriers to EV adoption due to parking logistics and property ownership restrictions, especially if they are renting the property.

Economic Benefits and Costs

- **Payback:** Slow payback (> 7 years). This action has a potentially slow payback due to the multiple steps involved to modify the zoning code or enact an EV-readiness ordinance, and for the construction of EV-ready buildings to materialize.
- **Cost to community members:** Not applicable. This action has no applicable cost to the average community member. Because the installation of EV charging infrastructure during the building construction phase is four to five times less expensive than a retrofit, costs can be absorbed by the developer without being passed on to tenants.

Other considerations: No other considerations were identified for this action.

Working Group-Recommended Activities for Implementation for Strategy 7

Achieving vehicle electrification at scale requires implementing a suite of actions to lower the upfront costs of EV purchase and charging installation; increasing access to EV charging infrastructure; and educating the community on common issues, such as range anxiety and consumer confidence in EV technology. Equity should be incorporated in the design and implementation of programs and policies to facilitate EV adoption by disadvantaged communities.

Recommended activities for implementation of this strategy were developed by the Working Group and include the following:

Recommended Activities for Implementation for All Actors

Education

- Education that targets different aspects of vehicle electrification can be incorporated in all actions. Outreach activities and tailored messaging are effective strategies to advance the understanding of EV programs and achieve policy consensus; these could include a robust outreach process to real estate developers, homeowner and condo associations, and large-scale rental properties to build consensus around the need for charging stations at multifamily buildings.

The U.S. Environmental Protection Agency **Green Vehicle Guide** offers resources to learn about emerging options in transportation such as zero-emission vehicles (ZEVs), shared mobility, and self-driving cars. Visit www.epa.gov/greenvehicles.

Recommended Activities for Implementation for Individuals and Organizations

Individual Actions and Partnerships with Businesses, NGOs, and Government

- Leverage existing incentives and expertise to further EV adoption and access to EV charging while enabling emerging technologies and novel financing models.
- Take advantage of existing utility and state programs offering rebates for EV infrastructure installation at multifamily residences, workplaces, and other non-residential and commercial buildings.
- Work with utilities to implement energy management tools, such as price signaling and demand response, to ensure that EV owners can charge their vehicles when electricity prices are low without creating demand surges and price spikes.
- Educate residents, employers, or employees about EVs and EV charging through targeted programs or initiatives such Ride & Drive events in collaboration with local dealerships and nonprofit organizations.

Incentive Programs

- Utilize existing incentives, such as the federal tax credits for new EVs, to purchase an EV, and utility rebates—if available—to purchase EV charging infrastructure.

Recommended Activities for Implementation for the County

County Programs, Rules, and Regulations

- Review the county's transportation priorities, specifically the feasibility of electrification of the county's fleet.
- Consider how the Joint Environmental Taskforce (JET) recommendations to go all electric on county school buses and the non-bus fleet by 2035 and the county public transit by 2030 may be expanded for community use.
- Retire the most polluting diesel transit buses, impose a moratorium on buying new diesel transit buses, and accelerate the pace of electric transit bus acquisition.
- Meet existing diesel needs by rebuilding existing buses or leasing diesel or electric buses until sufficient electric buses have been acquired.
- Explore creative financing options, such as leasing electric buses directly from the manufacturer, to lessen the upfront cost to the county.
- Incorporate EVs in the existing on-road fleet, including medium- and heavy-duty vehicles such trash haulers, shuttles, street sweepers, transit and school buses, and off-road equipment such as mowers, forklifts, and leaf blowers.
- Install EV charging at county facilities to encourage EV adoption among employees.
- Develop and enact local policies to streamline and clarify EV charging permitting and inspection processes.
- Leverage zoning and land use codes to incentivize or require the installation of EV-ready charging infrastructure in new buildings and in the right-of-way (on-street parking).
- Streamline existing permitting and inspection processes for EV infrastructure.
- Implement equity requirements for EV parking design, such as the Americans with Disabilities Act compliance.
- Work with key industry and policy partners to develop county-specific policies for integrating EV technologies in autonomous vehicles.

Financing

- Take advantage of two major federal programs offering grants and incentives for alternative fuel vehicles: Congestion Mitigation and Air Quality (CMAQ) Improvement Program and Volkswagen Mitigation Trust Fund.
- Take advantage of the Federal Transit Administration Low or No Emission Vehicle Program specifically designed to fund zero-emission transit buses and bus charging depots.

- Explore creative financing options, such as leasing zero-emission vehicles, to lessen the upfront cost to the county.
- Work with community-based organizations and local credit unions to create equitable opportunities for EV adoption through low-interest EV loans.

Incentive Programs

- Establish electric vehicle and charging infrastructure incentive programs that provide financial benefits through tax exemptions, permit fee reductions or other means for low- and moderate-income households and allocate program funds to make EV purchases more achievable for low- and moderate-income households.
- Incentivize integrating EVs across carsharing programs, ride hailing services provided by transportation network companies, and commercial delivery services (e.g., through electric vans and cargo bikes).

Recommended Activities for Implementation for the County Requiring State-Enabled Legislation

County Programs, Rules, and Regulations

- Authorize local jurisdictions to provide monetary incentives for electric vehicles and charging infrastructue.

Recommended Activities for Implementation for State and Federal Governments

State and Federal Legislation and Programs

- Establish a state green bank to support vehicle electrification implementation measures.
- Work with the state and with utilities to encourage the deployment of electric transit buses and the roll out of electric school buses (e.g., ensure that adequate funding of two newly enacted state programs—EV Rebate Program (HB 1979) and Electric Vehicle Grant Fund and Program (HB 2118)—will support the deployment of electric school buses).
- Adopt clean car standards. As of the writing of this report, the State of Virginia signed a bill to adopt the California Advanced Clean Cars standards, which work in combination with complementary policies to advance low- and zero-emission vehicles.
- Continue to commit to reduced emissions from transportation. As a co-signatory of the Transportation and Climate Initiative Program (TCI-P), the state has committed to reduce emissions from transportation. The state could further its commitment by signing onto the multi-state memorandum of understanding, which would allow it to participate in the TCI-P cap-and-invest program to lower GHG emissions and generate funds for the states.

Did You Know?

Fairfax County is testing an autonomous electric vehicle called Relay. Relay is a public transportation shuttle service that circulates between the Mosaic District and the Dunn Loring Metrorail Station. A ride on Relay is free of charge, and passenger safety is assured by an onboard Safety Steward.

Strategy 8: Support Sustainable Land Use, Active Transportation, Public Transportation, and Transportation Demand Management (TDM) to Reduce Vehicle-Miles Traveled

This strategy promotes sustainable mobility through three primary pathways:

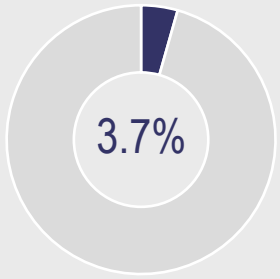
- Action 8a: Support the Use and Improvement of Bicycle and Pedestrian Infrastructure
- Action 8b: Support the Use and Improvement of Public Transportation and Commuter Services
- Action 8c: Support Smart-Growth and Transportation Demand Management (TDM) Strategies

These actions aim to reduce emissions from private vehicles, as well as traffic congestion, by expanding public and private mobility options that can decrease private vehicle use. The strategy relies on significant improvements in biking, walking, and transit infrastructure that makes a non-car dependent lifestyle a viable, convenient, and safe alternative to driving. This strategy aligns with the Transportation Sector Goal to increase transit and non-motorized commuting to 30% (including teleworking) by 2030. See Greenhouse Gas Reduction Goals.

GHG Emissions Reduced in 2050

392,000 MT CO_2e

Percent Contribution to Emissions Reductions Needed in 2050



GHG Reductions

This strategy results in GHG reductions of 392,000 MT CO_2e in 2050. This strategy is anticipated to account for 4% of the emissions reduction needed to achieve the long-term carbon neutrality goal by 2050.

This strategy makes the following assumptions on the various transportation modes. Biking is projected to increase from the current share of 0.2% to 1.5% in 2030 and 3% in 2050. Carpooling and vanpooling are assumed to increase at a rate of 1% per year, going from the current share of 10% to 15% in 2030 and 25% in 2050. Public transit utilization is assumed to reach 15% by 2030 and 20% by 2050. Finally, the strategy models teleworking to account for 10% in 2030 and 15% by 2050.

Cost Considerations

There are some low/no cost options available to reduce VMT, including certain TDM strategies and changes to local land use; however, large reductions will require investments by state and local governments. Increasing the use of active and public

transportation will requires significant new infrastructure. New bicycle and pedestrian pathways, new transit stops, and expansion of services all require collaborative funding and financing that goes beyond county investment.

Working Group Priorities

The Working Group strongly emphasized the need to improve mobility options for the residents of Fairfax County and further reduce car-centric behaviors. Pedestrian and biking safety are current concerns, along with health and social justice inequities caused by insufficient mobility options. Among the ideas brought forward, the members of the Working Group suggested the creation of safe routes for seniors and school children, increasing bike-friendly infrastructure, and incentivizing businesses to reward patrons who walk or bike to their stores. A Bus Network redesign was proposed to improve bus service coverage and efficiency to essential services.

Action 8a: Support the Use and Improvement of Bicycle and Pedestrian Infrastructure

This action supports the expansion and improvement of bicycle and pedestrian infrastructure and the use of bicycles by members of the community. This action also seeks to improve the safety of existing bicycle and pedestrian infrastructure through activities such as adding more lighting for trail users and designated bike lanes.

Timeframe: Immediate. Community members can immediately start gathering information about the critical areas in need of biking and pedestrian infrastructure improvement, and work with the county government on strategizing solutions to address urgent needs.

Technology considerations: This action includes the integration of electric micro-mobility, such as e-bikes and e-scooters, in mobility plans. The increase of electric micro-mobility vehicles may pose a challenge to planners as these vehicles can reach a much higher speed than their traditional counterparts, requiring the establishment of guidelines and regulations for the use of shared spaces with pedestrians and bicyclists.

Public Health	++
Environmental Resources	++
Economic Opportunity	+
One Fairfax	++
Payback	1–3 years
Cost to Community Members	$
Timeframe	Immediate

Impacts

- **Public health:** This action has a positive impact on public health as it supports mobility choices that promote exercise and wellness.
- **Environmental resources:** This action has a significant positive impact on environmental resources, as a mode switch reduces the physical footprint of personal mobility choices. Still, as pedestrian and bike infrastructure expands, care should be taken to minimize incursions into Resource Protection Areas (RPAs),[56] as well as minimize the loss of native tree canopy, contiguous forested areas, permeable carbon-sequestering soil, and other arable green spaces.
- **Economic opportunity:** This action has a positive impact on economic opportunity through improved and easier access to shopping areas.
- **One Fairfax:** This action elevates the One Fairfax policy if the county will prioritize building this infrastructure in low-income and vulnerable neighborhoods.

Economic Benefits and Costs

- **Payback:** Quick payback (1–3 years). There are immediate economic benefits from switching to biking from other modes of transportation.
- **Cost to community members:** Low cost ($). Community members who purchase a bicycle or e-bicycle will face relatively low costs that can be recovered through decreased costs by other modes of transportation (e.g., decreased spending on fuel for private vehicles).

Other considerations: This action may have a long implementation timeline, depending on the role of the county and state in funding and implementing measures. Individual behaviors and public education will be key for the success of this action.

Action 8b: Support the Use and Improvement of Public Transportation and Commuter Services

This action encourages expanded and improved public transportation and commuter services through activities, such as optimizing bus frequency and network coverage to connect large transit centers and close last-mile gaps, and investing in Bus Rapid Transit (BRT), such as is currently under consideration for the Richmond Highway corridor,[57] among other activities.

[56] Resource Protection Areas, or RPAs, are regulated waterbodies and associated corridors of environmentally sensitive land that lie alongside or near the shorelines of streams, rivers and other waterways which drain into the Potomac River and eventually into the Chesapeake Bay. See https://www.fairfaxcounty.gov/landdevelopment/faqs-resource-protection-areas.
[57] The county is already considering BRT for Richmond Highway. See https://www.fairfaxcounty.gov/transportation/richmond-hwy-brt.

Timeframe: Immediate. Community members can immediately start working with county planners and other key actors to evaluate solutions to improve public and private transportation options for all purposes, including commuting services.

Technology considerations: One technology that this action will introduce is BRT. Although BRT technology is not new, there are many different aspects that need to be considered. County planners and other regional planning organizations can work together to identify the appropriate and effective BRT elements at different locations throughout the county. In addition, the surrounding infrastructure, such as bus stops and safer crossings to bus stop access, should also be implemented or improved.

Public Health	++
Environmental Resources	+
Economic Opportunity	+
One Fairfax	++
Payback	1–3 years
Cost to Community Members	$
Timeframe	Immediate

Impacts

- **Public health:** This action has a positive impact on public health as it aims to decrease the overall number of gasoline vehicles on the road, thereby fewer pollutants will be released into the atmosphere.
- **Environmental resources:** This action has a positive impact on environmental resources as it will reduce the transportation footprint of individuals. Still, as transit networks expand, care should be taken to minimize incursions into RPAs, as well as minimize the loss of native tree canopy, contiguous forested areas, permeable carbon-sequestering soil, and other arable green spaces.
- **Economic opportunity:** This action has a positive economic effect as public transit is a recognized enabler of job opportunities for riders and business growth opportunities around transit hubs.
- **One Fairfax:** This action has a positive impact on eliminating inequities, as transit enables social and economic mobility by giving people a means to reach job opportunities. Furthermore, public transit is often the only mobility option for elderly, disabled individuals, and other disadvantaged communities. The equity impact of this action can increase further by implementing means-tested, low-fare programs or free bus services.

Economic Benefits and Costs

- **Payback:** Quick payback (1–3 years). There is an immediate benefit from switching to public and private forms of transit, especially for commuting purposes.
- **Cost to community members:** Low cost ($). Some community members might face higher than expected costs when utilizing public transportation or commuter services; however, these costs are expected to be moderate, on average, on an annual basis

(< $300), and depend on the fare policies established by transit agencies or private providers. Some transit agencies are piloting low- or zero-fare systems to advance equity and encourage ridership.

Other considerations: This action might have a long implementation timeline, depending on the role of the state in funding and implementing some of the discussed measures. Individual behaviors toward using public transit and commuter services will be key for the success of this action.

Action 8c: Support Smart-Growth and Transportation Demand Management (TDM) Strategies

This action encompasses a variety of approaches to reduce emissions from transportation while enhancing our connection with the places we live, work, and play. Transportation demand management (TDM) is the application of strategies and policies to reduce travel demand. Smart growth is an approach to development that encourages density, mixed-use development, housing and transportation options, development within existing neighborhoods, and community engagement.[58] For example, smart-growth development might increase housing density in or near "activity hubs," transit-oriented, dense, and mixed-use developments, thereby decreasing the need for people to use their cars in their day-to-day lives. Carpooling/vanpooling and teleworking options for public and private employees also are included in this action.

Public Health	+
Environmental Resources	+
Economic Opportunity	+
One Fairfax	+
Payback	N/A
Cost to Community Members	$
Timeframe	Soon

Timeframe: This action can be implemented within a medium timeframe (before 2030), as many of the recommended activities for implementation (below) require zoning and policy changes at the county level. Within this action, teleworking options can be implemented sooner.

Technology considerations: The increase in teleworking might require upgrades of the broadband infrastructure and the adoption of more modern communication technologies. In addition, smart growth and urbanization should be carefully planned to avoid urban sprawl from occurring.

Impacts

- **Public health:** This action has a positive impact on public health as an increase in housing density and the creation of activity hubs build and foster a sense of community, which can improve overall mental and physical health.

[58] Smart Growth America. See https://smartgrowthamerica.org/our-vision/what-is-smart-growth/.

- **Environmental resources:** This action has a positive impact on environmental resources due to increased housing density and reduced land use through, for example, the reduced footprint of private vehicles.
- **Economic opportunity:** This action increases economic opportunity through the creation of activity hubs. Promoting local living also will spur the development of grocery stores, restaurants, and other everyday stores, creating jobs for the community. However, increased teleworking can have a negative economic impact on areas such as central business districts and can lower tax revenue from sources such as tolls, sales taxes, and parking meters.
- **One Fairfax:** This action has a positive impact on eliminating social inequities by investing in affordable housing near public transit hubs, thus creating opportunities to access more mobility options. Broadband expansion to underserved communities also increases social and economic equality as it enables access to education and job opportunities.

Economic Benefits and Costs

- **Payback:** Not applicable. This action will not involve a payback period since the costs are borne by a variety of different entities depending on the specific measure.
- **Cost to community members:** Low cost ($). Some community members might face higher than expected costs when utilizing public transportation or commuter services; however, these costs are expected to be moderate, on average, on an annual basis (< $300) and depend on the fare policies established by transit agencies or private providers.

Other considerations: This action is more effective with proactive coordination with land use and housing policies, and with robust education and outreach to community members and elected officials.

Working Group-Recommended Activities for Implementation for Strategy 8

The actions in this strategy can be achieved by implementing a suite of local planning and policy actions combined with a strong educational component. The private sector and state agencies also are needed to unlock financing and programmatic opportunities.

The actions under this strategy have an inherent equity component as they promote public infrastructure and public transit over private transportation resources and therefore increase mobility choices for everyone. Additional elements of equity can be incorporated by pairing affordable housing and transit-oriented, mixed-use developments with integrated green and open spaces. Other examples of equitable city planning include the provision of last-mile mobility solutions to increase access to public transit in underserved areas.

Recommended activities for implementation for this strategy were developed by the Working Group and include the following:

Recommended Activities for Implementation for All Actors

Education

- Education and outreach carried out at various levels can help achieve implementation of this strategy as increasing the use of public transit and commuter services as well as biking, walking, and micromobility requires changes in personal behaviors.

Recommended Activities for Implementation for Individuals and Organizations

Individual Action

- Walk, bike, and use public transit for commuting and in everyday life.

Partnerships with Businesses, NGOs, and Government

- Leverage the existing community of car-free families and local biking/walking advocates and ambassadors to create opportunities to promote walking and biking activities.
- Educate employees about existing biking trails and provide discounts for public transit.
- Create alternative commuting options, such as shuttle, bus services, and carpooling.
- Implement internal policies to allow teleworking options for employees whenever possible.

Recommended Activities for Implementation for the County

County Programs, Rules, and Regulations

- Work with state and regional partners to expand walkable paths and existing bike lane networks to connect bike and pedestrian trails.

- Work with state and regional partners to improve the maintenance and safety of pedestrian and biking trails by keeping them clear from ice and snow, and adding protected bike lanes to separate bikers from motor traffic.
- Work with state and regional partners to provide adequate lighting and signaling for all pedestrian and bike infrastructure to ensure safety and usability.
- Work with state and regional partners to invest in public transit improvements to increase access through the expansion of current and the creation of new public transit routes.
- Leverage the existing County Comprehensive Plan, which includes the Capital Trails Network and Bicycle Master Plan, to improve and expand walking and biking infrastructure while minimizing incursions into RPAs as well as minimizing the loss of native tree canopy, contiguous forested areas, permeable carbon-sequestering soil, and other arable green spaces (in alignment with Strategy 12).
- Leverage the existing County Comprehensive Plan and zoning to ensure that protected zones, such as the Occoquan Watershed, remain intact.
- Plant trees along trails and sidewalks to provide shade while expanding natural resources (in alignment with Strategy 12).
- Install more bike racks in commercial areas and transit stations.
- Use zoning and land use codes as planning tools to create higher density neighborhoods, and mixed-use and transportation-oriented developments that also include affordable housing options for middle- and low-income residents.
- Explore higher pricing schemes for parking at county-owned facilities, modifying parking minimums and applying other measures in zoning and land use planning, such as the creation of local congestion fees, zero/low emission delivery zones, and pedestrian-only zones in densely populated areas.

Did You Know?

Fairfax County has long promoted bike and pedestrian travel throughout the county and region. Over 130 miles of bike lanes and 500 miles of bikeable trail are available to residents and visitors. The Fairfax County Department of Transportation oversees a growing network of 35 Capital Bikeshare stations, and hosts several events throughout the year, such as Bike to Work or Bike to School Days.

Fairfax County is developing an ActiveFairfax Transportation Plan to establish a vision and roadmap for implementation of safe, convenient and enjoyable streets and trails. The plan, which will update and reconcile the existing Bicycle Master Plan, Countywide Trails Plan and Area Plans, is focused on improving transportation and recreational options for pedestrians, bikers and other self-propelled travelers in the county.

- Implement internal policies to allow teleworking options for county employees whenever possible.
- Upgrade broadband infrastructure to allow for increased teleworking.

Partnerships with Businesses, NGOs, and Government

- Work with private companies to promote the creation of a robust network of rental bikes and other micro-mobility solutions that can cost-effectively fill the last-mile gap.
- Support carpooling and vanpooling by providing the adequate infrastructure and educational support by, for example, advertising Fairfax County park & ride existing infrastructure.

Recommended Activities for Implementation for the County Requiring State-Enabled Legislation

Financing

- Seek state funding opportunities to implement Complete Streets policies and to improve the safety and interconnectivity of its walking and biking infrastructure networks. (TCI-P could be a source of funding so that the county can ensure that funds are devoted to such purposes.)
- Work with Metro and Fairfax Connector to create reduced or no-fare programs for disadvantaged categories (low-income, seniors, and students), as well as 3-, 6-, or 12-month transit passes at discounted prices to incentivize public transit ridership.

Recommended Activities for Implementation for State and Federal Governments

State and Federal Legislation and Programs

- Support the creation or strengthening of programs to reduce VMT by implementing a mileage-based user fee program and/or reward individuals using public transit through tax breaks or deductions.
- Work with state and federal governments to evaluate expanding light rail and other transit services into Fairfax County.

Strategy 9: Increase Fuel Economy and Use of Low-Carbon Fuels for Transportation

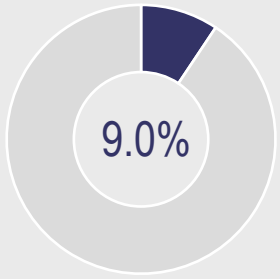
This strategy models the reduction of GHG emissions from the Transportation sector, including aviation, by implementing three primary actions:

- Action 9a: Support Low-Carbon Fuels for Transportation
- Action 9b: Support Improvements to Fuel Efficiency
- Action 9c: Support Low-Carbon Fuels for Aviation

GHG Emissions Reduced in 2050

946,000 MT CO_2e

Percent Contribution to Emissions Reductions Needed in 2050



Examples of low-carbon fuels include alternative fuels, such as biodiesel, propane, refuse-derived fuels, non-fossil (or renewable) methane from anaerobic digestion, vegetable oil, and zero-emission technologies, such as battery electric and fuel cell vehicles. While commercially available in some U.S. states, many of the renewable biofuels have limited applications and supply chain constraints. However, low-carbon fuels are expected to represent an increasing share of the total fuel use, especially for vehicles that cannot be readily or cost-effectively fully electrified. Likewise, more stringent policies to increase the fuel economy of combustion engines are expected to be released in the coming years as a complementary strategy for vehicle electrification.

GHG Reductions

The GHG reductions resulting from this strategy are 946,000 MT CO_2e in 2050. This strategy is anticipated to account for 9% of the emissions reduction needed to achieve the long-term carbon neutrality goal by 2050.

Cost Considerations

All actions that lower fuel consumption and emissions by increasing vehicle efficiency and/or reduce the carbon footprint of fuel are expected to generate costs saving over time, especially if fuels are priced through carbon pricing schemes. However, it is not clear if this strategy would create a cost for community members as much of costs passed onto consumers (e.g., cost to purchase a new vehicle) would depend on policy design and implementation at the federal and state levels.

Working Group Priorities

The Working Group emphasized the importance of reducing transportation emissions by fuel substitution and underscored the relative cost-effectiveness of fuel efficiency and the various health benefits from these measures. However, members of the Working Group also cautioned that low-carbon fuels still emit carbon pollution. Furthermore, the Working Group noted the downsides of this strategy, including the fact that continued reliance on vehicles encourages additional road infrastructure and vehicle-focused land development, the production of biofuels may interfere with more sustainable land use applications, and many of the levers for change for this strategy are at the state and federal levels.

Action 9a: Support Low-Carbon Fuels for Transportation

Low-carbon fuels have a reduced carbon intensity when compared with traditional transportation fuels. Low-carbon fuels can be purchased on the market, or they can be more broadly implemented through a Low Carbon Fuel Standard (LCFS) adopted through state legislation. An LCFS establishes a market where lower carbon fuels are incentivized through a system of credits which can then be sold to regulated entities that are required to reduce the carbon intensity of the transportation fuels they sell in-state. While the LCFS is fuel neutral, EVs generate the highest LCFS credits by achieving the highest carbon reduction compared with conventional and alternative fuels. This action includes transitioning to alternative transportation fuels at the individual level while supporting an LCFS at the state level.

Public Health	+
Environmental Resources	=
Economic Opportunity	=
One Fairfax	+
Payback	3–7 years
Cost to Community Members	$$$
Timeframe	Immediate

Timeframe: Immediate. The community can start gathering information about commercially available low-carbon fuels and scope cost-effective applications.

Technology considerations: There are many alternative fuels and alternative fuel vehicle options available on the market today, such as biodiesel, biogas, propane, renewable diesel and gas, and ethanol vehicles, as well as hybrid and electric vehicles. Some of these fuels, such as propane and biodiesel, are mostly used in heavy-duty and off-road vehicles. For passenger cars, hybrid, plug-in hybrid, and electric vehicles are the most common alternative fuels, and are rapidly becoming available on the market at cost-competitive prices with conventional new vehicles, especially after incentives are factored in. Hydrogen fuels also are a longer term focus for

heavy-duty vehicles. An important technology consideration is that the substitution of conventional with alternative fuels often requires vehicle replacement or engine retrofits.

Impacts

- **Public health:** This action has a positive impact on public health as fewer fossil fuels are used and replaced with alternative fuels. The greatest public health benefits will be generated by the targeted elimination of diesel fuel through substitution with an alternative low- or zero-emission fuel.
- **Environmental resources:** This action has a mixed impact on environmental resources with variations depending on the fuel type. The reduced use of fossil fuels for transportation has significant environmental benefits, but some alternatives, such as biofuel, may have adverse impacts on the environment, such as through land use change.
- **Economic opportunity:** The action has a mixed impact on economic opportunity as individuals will face different (both higher and lower) fuel costs. Since the sources for alternative fuels is not known, it is unclear whether this action will result in increased local jobs.
- **One Fairfax:** Alternative fuels that generate less pollution decrease the impact on social or racial inequities due to the reduced emissions that typically affect disadvantaged communities that live nearby high-traffic corridors or areas affected by heavy-duty vehicle traffic. Support for low- and moderate-income populations should be considered during implementation to help offset upfront costs of new vehicle purchases.

Economic Benefits and Costs

- **Payback:** Medium payback (3–7 years). This action is anticipated to have a payback period from 3–7 years, depending on the type of alternative fuel and needed vehicle retrofits or infrastructure adjustments. For some fuels, there is less infrastructure and/or vehicles available presently to support the increased use of alternative fuel vehicles (e.g., biofuel fueling stations).
- **Cost to community members:** High cost ($$$). Community members could face high upfront costs as vehicles that run on alternative fuels might have a higher sticker price, with costs varying based on fuel type. However, vehicles running on "cleaner" fuels than, for example, diesel, have less maintenance costs and become cost-effective over time. If this action focuses on replacing vehicles at the end of their useful life and financing, the incremental costs can be relatively affordable.

Other considerations: Increased biofuel use has land use change implications for the increased production of biofuel feedstock crops.

Action 9b: Support Improvements to Fuel Efficiency

This action supports the improvement of fuel economy through the adoption of the most fuel-efficient vehicles. As vehicle turnover occurs in the Fairfax County community, immediate carbon reduction benefits can be generated as more fuel-efficient vehicles are introduced in the vehicle fleet.

Timeframe: Immediate. Fuel-efficient vehicles are available today, allowing for the action to be implemented immediately.

Technology considerations: This strategy is connected to federal legislation. As of the writing of this report, the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule governs federal fuel economy through 2026, even though there are efforts underway to reconsider the SAFE program and to continue the original Corporate Average Fuel Economy (CAFE) standards. Possible technology challenges in implementing this strategy pertain to the need to purchase new fuel-efficient vehicles.

Public Health	++
Environmental Resources	=
Economic Opportunity	=
One Fairfax	+
Payback	3–7 years
Cost to Community Members	$$$
Timeframe	Immediate

Impacts

- **Public health:** This action has a positive impact on public health as fewer gallons of fuel are used in fuel-efficient vehicles and thereby fewer pollutants will be released into the atmosphere. These changes bring economic benefits directly stemming from reduced fuel consumption and improvements in public health.
- **Environmental resources:** This action has a neutral impact on environmental resources.
- **Economic opportunity:** The action has a neutral impact on economic opportunity.
- **One Fairfax:** Improved vehicle fuel economy has a positive impact on social or racial inequities due to the reduced emissions that typically affect disadvantaged communities that live nearby high-traffic corridors. Support for low- and moderate-income populations should be considered in implementation to help offset the upfront costs of new vehicle purchases.

Economic Benefits and Costs

- **Payback:** Medium payback (3–7 years). This action is anticipated to have a payback period of 3–7 years. The action will result in fuel savings as fewer gallons will be used in more fuel-efficient vehicles, although it is expected that the transition to more fuel-efficient vehicles will occur gradually as personal vehicles age or incentives are provided for replacement.

- **Cost to community members:** High cost ($$$). Community members may face high upfront costs as new fuel-efficient vehicles that comply with the most stringent fuel economy standards might have a higher sticker price. If this action focuses on replacing vehicles at the end of their useful life and financing, the incremental costs can be relatively affordable.

Other considerations: No other considerations were identified for this action.

Action 9c: Support Low-Carbon Fuels for Aviation

Liquid fuels are used throughout the Aviation sector as they have a high density of energy for their weight. While battery or hydrogen fuel cell technologies may provide a way to decarbonize other transportation modes and short flights, the aviation industry will likely continue to rely on liquid fuels for medium- and long-haul flights. A variety of low- and no-carbon alternatives are being researched to support the aviation industry. While low-carbon aviation fuel technologies are still emerging, the Sustainable Aviation Fuel Act was introduced in Congress in 2021 and, if passed, would establish a national goal to achieve a net 35% reduction in GHG emissions from flights by 2035 and net zero emissions by 2050. The Act would require EPA to establish a low-carbon fuel standard for aviation fuels under which it must set annual targets to reduce certain GHG emissions associated with aviation fuel by at least 20% by 2030 and 50% by 2050.[59] The passing of this legislation and/or other industry efforts to pursue research in low-carbon fuels for aviation will provide more alternatives for aviation in the future.

Public Health	++
Environmental Resources	=
Economic Opportunity	=
One Fairfax	+
Payback	NA
Cost to Community Members	NA
Timeframe	Future

Timeframe: Future (available after 2030). This action has a long implementation timeframe in the future as it relies on technology that is still at the pilot stage.

Technology considerations: This action will need to be supported by legislation, research, and development. While alternative fuels such as biofuel blends have been used in some pilot and demonstration projects, the timeline for broad adoption of low-carbon aviation fuels is heavily dependent on federal government legislation and their cooperation with industry.

[59] U.S. Congress. 2021. H.R. 741 – Sustainable Aviation Fuel Act. Available at https://www.congress.gov/bill/117th-congress/house-bill/741.

Impacts

- **Public health:** This action has a positive impact on public health as low-carbon biofuels emit significantly fewer air pollutants into the atmosphere than jet kerosene.
- **Environmental resources:** This action has a neutral impact on local environmental resources.
- **Economic opportunity:** This action has a neutral impact on local economic opportunity.
- **One Fairfax:** Changes to low-carbon aviation fuels have a positive impact on social or racial inequities, given the negative air quality and noise pollution experienced by communities located in the proximity of airports. These are often low- and moderate-income or minority populations.

Economic Benefits and Costs

- **Payback:** Not applicable. This action will not involve a payback period since the costs are not borne by community members.
- **Cost to community members:** Not applicable. The actual cost of scaled low-carbon fuels on air travel prices is largely uncertain at this time since cleaner aviation fuel technologies are still emerging and are under development.

Other considerations: There are opportunities to reduce GHG emissions from airport operations in the on-road vehicles and off-road equipment used onsite, as well by switching to lower carbon fuels and/or electrifying vehicles and equipment.

Working Group-Recommended Activities for Implementation for Strategy 9

The outcomes of this strategy are tied to federal and state regulations over which Fairfax County has little or no control (at the time of this report, Virginia is in the process of adopting the California Air Resources Board (CARB) Advanced Clean Cars standards, which work in combination with other complementary policies to advance low- and zero-emission vehicles). In the meantime, there are actions that can be taken at the county level to ensure that the most fuel-efficient vehicles and the lowest carbon-emitting fuels are used whenever possible.

Recommended activities for implementation for this strategy were developed by the Working Group and include the following:

Recommended Activities for Implementation for All Actors

Education

- Education campaigns might inform the community about vehicles with the highest fuel economy, how to increase the fuel efficiency of their vehicles, and ways to promote good practices, such as anti-idling.

Recommended Activities for Implementation for Individuals and Organizations

Individual Action

- Start or participate in programs to collect and reuse waste cooking oil for fuels as they could be viable for some applications.

Recommended Activities for Implementation for the County

County Programs, Rules, and Regulations

- Encourage the use of low-carbon fuels or the conversion to hybrid-electric retrofits of county-owned diesel-powered medium- and heavy-duty vehicles that are not yet commercially available as zero-emission options.

Financing

- Create financing programs for low/no-carbon fuel technologies.

Incentives

- Enact personal property tax credits for consumers purchasing higher fuel economy vehicles.

Recommended Activities for Implementation for the County Requiring State-Enabled Legislation

- No recommended activities specifically requiring state-enabled legislation were identified for this strategy.

Recommended Activities for Implementation for State and Federal Governments

State and Federal Legislation and Programs

- Continue to pursue opportunities for better fuel economy. As of the writing of this report, the State of Virginia recently signed a bill for the state to adopt CARB's Clean Cars standards.
- Increase fuel economy for all vehicles, including aviation, through federal regulations.
- Support the implementation of an LCFS.
- Support complementary policies and incentives, such as rebates and tax credits for businesses, and non-monetary initiatives, such as preferred access to parking for alternative fuel vehicles.
- Support federal fuel policies for low-carbon fuel markets in the coming years.

Did You Know?

Cooking oil collection is available through the county's Household Hazardous Waste Program.

See Public Works and Environmental Services – Household Hazardous Waste for more information.

WASTE

Strategy 10: Reduce the Amount of Waste Generated and Divert Waste from Waste-to-Energy Facilities and Landfills

Under this strategy, community members can reduce GHG emissions from waste activities by doing the following:

- Action 10a: Reduce Overall Waste Generation
- Action 10b: Increase Waste Diversion from Landfills and Waste-to-Energy Facilities Through Recycling and Composting

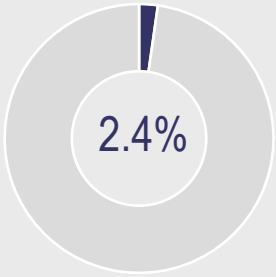
The U.S. Environmental Protection Agency's (EPA) waste management hierarchy prioritizes source reduction and reuse, followed by recycling and composting. Energy recovery through waste-to-energy facilities and disposal through landfill are the least preferred waste management practices in EPA's hierarchy.

Currently, waste in Fairfax County is sent to a waste-to-energy facility. Diversion of waste from landfills also is included under this strategy since waste management in Fairfax County may change in the time period through 2050.

GHG Emissions Reduced in 2050

251,000 MT CO_2e

Percent Contribution to Emissions Reductions Needed in 2050



Did You Know?

The products that we use every day contribute to GHG emissions throughout their entire life cycle, from raw material extraction to manufacturing, transportation, product use, and disposal. The Waste sector emissions in Fairfax County's GHG inventory account for emissions from the disposal phase. For many products, the majority of their life cycle emissions comes from raw material acquisition and manufacturing, which are activities outside of Fairfax County. As a result, reducing consumption and recycling materials not only reduce emissions from waste disposal but also reduce emissions generated outside of Fairfax County during the rest of the product's life cycle. See U.S. EPA's Sustainable Material Management Life-Cycle Perspective to learn more about material life cycles.

This strategy aligns with the Waste Sector Goal to achieve zero waste by 2040, defined as 90% waste diverted from landfill/incineration, in alignment with the definition by the Zero Waste International Alliance. See Greenhouse Gas Reduction Goals.

GHG Reductions

This strategy results in GHG reductions of 251,000 MT CO_2e in 2050. This strategy is anticipated to account for 2% of the emissions reduction needed to achieve the long-term carbon neutrality goal by 2050.

Cost Considerations

Source reduction and reuse are likely to result in no additional costs or cost savings through reduced and avoided purchases of material goods. Increased waste diversion will require financial investment in recycling and composting infrastructure.

Working Group Priorities

Working Group members identified the importance of reducing waste and the many co-benefits associated with the strategy, such as cost savings, reduced pollution, and the use of fewer natural resources. However, Working Group members noted that the waste strategies will not result in significant GHG emissions reduction within Fairfax County. (Although efforts to reduce waste do result in life cycle GHG emissions reduction outside of Fairfax County.) Additionally, Working Group members noted that the challenge of changing people's behavior would be a barrier that will need to be overcome in implementing this strategy.

Action 10a: Reduce Overall Waste Generation

This action supports the reduction of overall waste generated within Fairfax County. Reducing waste generation means minimizing the amount of waste produced at the source by limiting consumption, using products for a longer period of time, participating in peer-to-peer sharing, purchasing more durable products, and reusing materials when possible.

Timeframe: Immediate. Reducing waste can be achieved in the immediate term as many best practices for reducing waste are focused on the individual level. Consumers and businesses can make conscious decisions to begin reducing waste by changing their behavior and purchasing patterns.

Technology considerations: Individual behavior change and policy change are main drivers for reducing waste. Technology advancements for this action may include advancements in packaging design to minimize packaging and reduce waste. This action also will require convenient, cost-effective options for reusable products.

Impacts

- **Public health:** This action has a positive impact on public health by reducing the amount of waste sent to waste-to-energy facilities and landfills. Reduced waste in these locations will result in fewer air pollutants and an improvement in residents' quality of life. Reduced waste also results in fewer heavy-duty waste trucks on the roads, which reduces local air pollution.
- **Environmental resources:** This action has a positive impact on environmental resources by reducing the demand for raw materials.
- **Economic opportunity:** This action has a positive impact on economic opportunities by creating jobs at businesses, such as repair shops, and for recycling and salvaging activities, such as building deconstruction.
- **One Fairfax:** This action has a positive impact on equity since facilities that manage waste are often located in disadvantaged communities, so reducing waste in the long-term will reduce the need for additional waste facilities.

Public Health	+
Environmental Resources	+
Economic Opportunity	+
One Fairfax	+
Payback	1–3 years
Cost to Community Members	No Cost
Timeframe	Immediate

Economic Benefits and Costs

- **Payback:** Quick payback (1–3 years). This action will result in consumer and business savings through reduced consumption of purchased goods. Additionally, this strategy will result in savings for individuals and businesses that pay to dispose of their waste.
- **Cost to community members:** No cost. This action does not result in costs for the community member, however new services such as composting could include cost to the County.

Other considerations: Encouraging community members to reduce their waste generation will require a combination of education and infrastructure upgrades. While reducing waste generation is mainly an individual choice, providing access to reusable products and sharing information about how to reduce waste must be part of the action's implementation. Education and outreach should be conducted in a range of communities and in multiple languages to ensure that the benefits of reducing waste are shared widely.

Action 10b: Increase Waste Diversion from Landfills and Waste-to-Energy Facilities Through Recycling and Composting

This action will divert waste from waste-to-energy facilities and landfills through recycling and composting. (Waste reduction is discussed under Action 10a.) Currently, waste generated in Fairfax County is sent to a waste-to-energy facility. However, landfills are included in this

action because waste management in Fairfax County may change in the time period through 2050. Increasing the amount of waste recycled and composted requires a combination of individual effort and system changes, such as the availability of recycling and composting infrastructure.

Timeframe: Immediate. This action can be implemented immediately since most of the infrastructure required is already in place. Recycling centers and composting programs already exist in Fairfax County, including two composting drop-off sites at the I-95 Landfill Complex and the I-66 Transfer Station, which currently accept food scraps (but not all organic matter).[60] Efforts at the individual level, such as backyard composting, can begin immediately.

Technology considerations: There are few technology changes needed to implement this action. Most of the considerations are centered around individual behavior and access to recycling and composting infrastructure. It is important to ensure sure that recycling bins are widely available and that educational resources on what to recycle are available, such as Fairfax County's Public Works and Environmental Services Department's Recycle or Trash? website. Additionally, because recycling markets can be volatile, recycling programs should be carefully designed to reduce contamination and maximize the value of recycled materials.

Public Health	+
Environmental Resources	+
Economic Opportunity	+
One Fairfax	=
Payback	1–3 years
Cost to Community Members	$
Timeframe	Immediate

Impacts

- **Public health:** This action has a positive impact on public health by reducing the amount of waste sent to waste-to-energy facilities and landfills, which will result in fewer air pollutants and an improvement in residents' quality of life.
- **Environmental resources:** This action has a positive impact on environmental resources by reusing recycled materials, such as paper, cardboard, plastic, and glass, and avoiding the need to extract raw materials. Additionally, composting helps support agriculture and home gardening by supplying nutrient-rich soil that stores carbon and can replace synthetic fertilizer.
- **Economic opportunity:** This action has a positive impact on economic opportunity by providing jobs at recycling and composting facilities, as well as at businesses such as thrift stores, used book stores, repair shops, auto salvage yards, building deconstruction companies, and more.

[60] Fairfax County Department of Public Works and Environmental Services. Food Scraps Composting Drop Off. Available at https://www.fairfaxcounty.gov/publicworks/recycling-trash/food-scraps-composting-drop.

- **One Fairfax:** The impact of this action on equity is uncertain and will depend on implementation. It is important to ensure that recycling and composting facilities are distributed equitably throughout Fairfax County. Additionally, recovering food through donation may be able to alleviate food insecurity.

Economic Benefits and Costs

- **Payback:** Quick payback (1–3 years). Costs can be recovered through the reduced costs associated with waste disposal and transport to waste-to-energy facilities. Composting is a cost-effective alternative that can be done at home with little to no investment required.
- **Cost to community members:** Low cost ($). The cost to community members is relatively small for this action. Costs associated with this action include purchasing recycling and compost bins for the appropriate waste type and the contracting costs required for using the services of recycling and compost management companies.

Other considerations: As waste is reduced through reduction (Action 10a) and diversion practices (Action 10b), the energy recovered from a waste-to-energy facility will decrease. Balancing energy needs with responsible waste management practices is an important consideration. Additionally, composting can store carbon and reduce GHG emissions associated with waste disposal. Ensuring that composting infrastructure is widely available and easy to understand is a necessary component of this action's success.

Working Group-Recommended Activities for Implementation for Strategy 10

Recommended activities for implementation for this strategy were developed by the Working Group and include the following:

Recommended Activities for Implementation for All Actors

Education

- Educate the community through awareness and outreach campaigns to emphasize the 5Rs—Refuse, Reduce, Reuse, Repurpose, and Recycle.

Recommended Activities for Implementation for Individuals and Organizations

Education and Individual Action

- Implement the 5Rs in your daily life and promote initiatives that encourage the 5Rs in the community.
- Visit Fairfax County's Public Works and Environmental Services' Recycle or Trash? website to see what can be recycled in Fairfax County.
- Reduce your food waste through meal planning and participating in educational challenges such as EPA's Food Recovery Challenge.
- Divert food waste by composting in your backyard, in a community garden, or by contracting with a business that picks up compost from your door.
- Donate unwanted, usable items instead of throwing them away.
- Donate uneaten food to organizations that provide food to food insecure populations.
- Participate in the "sharing economy" by sharing resources with your neighbors.
- Shop at businesses, or even start a business or provide business and incubation support for businesses and organizations that help to reduce waste, such as reuse centers, repair shops, and donation centers.
- Recycle your business or project's construction/demolition debris.
- Develop a zero waste plan, goals, or framework for your community and advocate for a plan at the county level.

Recommended Activities for Implementation for the County

County Programs, Rules, and Regulations

- Expand education and outreach on source reduction, recycling, and composting (i.e., the dos and don'ts).
- Improve accessibility to waste reduction and diversion actions through education materials in alternate languages.
- Expansion of composting operations to manage organic waste, such as drop-off sites or curbside pick-up.
- Expand the county's current glass recycling program to include more drop-off locations.
- Provide for stricter enforcement of recycling through monetary penalties.
- Ensure that commercial and residential entities have the same access to recycling opportunities.
- Implement a pay-as-you-throw program, a pricing model based on generation, in which community members pay based on the amount of waste generated. Impacts on low- and moderate-income communities should be considered in the implementation of a pay-as-you-throw program.

Incentives

- Incentivize or require businesses to recycle.
- Provide financial benefits, such as grants and incentives, for businesses that reduce waste, such as reuse centers, thrift shops, donation centers, and repair shops.
- Incentivize building deconstruction, rather than demolition, to salvage and reuse building materials.

Did You Know?

Fairfax County collects and processes recycled glass through the region's **Purple Can Club** (named after the large, purple drop-off containers used to collect glass waste). There are currently **36 purple glass-only drop-off containers** located across these jurisdictions that serve to collect glass waste, which is then brought to Fairfax County's "Big Blue" processing plant. Much of the glass can be reused by glass product manufacturers, while crushed glass is used for paving, construction, and landscaping, as well as stormwater control applications. This glass recovery program diverted 162 tons of glass waste in 2018 and continues to grow. This program illustrates how diversion and reuse of material reduces GHG emissions upstream.

Recommended Activities for Implementation for the County Requiring State-Enabled Legislation

County Programs, Rules, and Regulations

- Authorize local jurisdictions to provide monetary incentives for individuals or businesses who recycle or compost certain waste types.
- Authorize local jurisdictions to allow the passage of local regulations, fees, and bans on commonly wasted items that also contribute to pollution, such as plastic bags, straws, polystyrene, and single-use containers.

Recommended Activities for Implementation for State and Federal Actors

State and Federal Legislation and Programs

- Support state and federal policies that reduce waste generation, such as single-use plastic reduction measures, chemical additive regulations, and taxes on certain waste types.
- Support state and federal policies to better manage construction demolition debris waste, as well as encouraging building deconstruction, rather than demolition, to salvage and reuse building materials.
- Create statewide incentive programs for recycling, such as bottle return fees.
- Implement a state-mandated recycling rate.
- Pass right to repair legislation, which allow consumers and businesses to repair and modify products such as electronics and automobiles, rather than requiring the use of the manufacturer's repair services.
- Enact state and federal legislation on Extended Producer Responsibility, also known as product stewardship, which requires producers to take responsibility of the end-of-life of the products they produce.

Strategy 11: Responsibly Manage Waste Generated

While Strategy 10 targets waste reduction and diversion, this strategy supports the responsible management of waste, once waste is generated and set out for disposal, through:

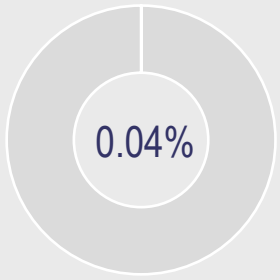
- Action 11a: Capture and Use Energy Generated at Waste-to-Energy Facilities and Landfills
- Action 11b: Explore Alternative Options for Long-Term Waste Management
- Action 11c: Capture and Use Energy Generated by Wastewater Treatment Processes

This strategy applies to both existing and new waste management facilities. Currently, waste in Fairfax County is sent to a waste-to-energy facility. Capture and use of energy from landfills also are included under this strategy since waste management in Fairfax County may change in the time period through 2050. The U.S. Environmental Protection Agency's (EPA) waste management hierarchy prioritizes energy recovery through waste-to-energy facilities over disposal through landfills.

GHG Emissions Reduced in 2050

4,000 MT CO_2e

Percent Contribution to Emissions Reductions Needed in 2050



GHG Reductions

This strategy results in GHG reductions of 4,000 MT CO_2e in 2050. This strategy is anticipated to account for 0.04% of the emissions reduction needed to achieve the long-term carbon neutrality goal by 2050.

Cost Considerations

The technology for alternative waste management, including newer models of waste-to-energy and biosolid processing facilities, will require financial investments; it will likely be another 5 to 10 years before large-scale deployment of newer models is cost-effective in the U.S. Furthermore, the efficiency gains from energy capture at waste facilities may make these actions cost-effective in the shorter term. Energy capture technology is well developed and relatively low cost.[61]

[61] U.S. EPA. 2021. Basic Information about Landfill Gas. https://www.epa.gov/lmop/basic-information-about-landfill-gas.

Working Group Priorities

The Working Group de-emphasized Strategy 11 because the strategy has a smaller GHG impact than other strategies presented in CECAP. Still, Working Group members did highlight the need to reduce local air pollution from waste management facilities and to improve local recycling programs. In addition, there were Working Group members both in support of and against the use of waste-to-energy facilities for waste management. Among the members, there were those who recommended that the county assess the feasibility and impacts of retiring Fairfax County's existing waste-to-energy facility.

Action 11a: Capture and Use Energy Generated at Waste-to-Energy Facilities and Landfills

This action includes the capture and use of energy from waste-to-energy (WTE) facilities and landfills. Currently, Fairfax County's only active waste disposal site is a waste-to-energy facility that generates energy; however, this action could consider other waste management options and application to closed landfills.

Public Health	–
Environmental Resources	=
Economic Opportunity	+
One Fairfax	=
Payback	1–3 years
Cost to Community Members	NA
Timeframe	Immediate

Timeframe: Immediate. This action can be implemented immediately by ensuring that waste contracts are aligned with best practices for reducing GHGs and air pollution from WTE facilities and landfills.

Technology considerations: WTE facilities produce both GHGs and air pollutants during the incineration process; this action should therefore explore emerging technologies that both improve air quality and reduce GHG emissions. WTE facilities within the U.S. and internationally may be considered as case studies for best practices in reducing GHGs and air pollution. Research has shown that there is a significant range in CO_2 emissions associated with waste incineration (260–780 kg CO_2 per ton of incinerated waste[62]), indicating that there is room for improvement in current waste-to-energy practices in Fairfax County. Technologies that improve air quality and reduce GHG emissions may have additional co-benefits, such as increased efficiency and cost savings for facility operators. Furthermore, carbon capture

[62] Obermoser, M., Fellner, J., and Rechberger, H. 2009. Determination of reliable CO_2 emission factors for waste-to-energy plants. *Waste Management & Research*, *27*(9), 907–913.

technology is developing and may be an important tool when combined with WTE, resulting in a WTE facility potentially being a negative GHG producer.

Impacts

- **Public health:** This action has an overall negative impact on public health. Although the energy generated from waste facilities helps to meet energy demand, the process of converting waste to energy produces harmful pollutants such as carbon monoxide, dioxins, and heavy metals such as lead and mercury. Policies that support WTE and landfill gas capture will result in continued emissions and negative impacts on public health.
- **Environmental resources:** This action has a neutral impact on environmental resources, as a waste-to-energy facility already operates in Fairfax County and will not require construction or land use change.
- **Economic opportunity:** This action has a positive impact on economic opportunity by continuing to provide a reliable source of energy within Fairfax County. Additionally, the research and development around best practices to reduce GHGs and air pollutant emissions from waste facilities may result in new job opportunities.
- **One Fairfax:** The impact of this action on One Fairfax is uncertain and will depend on specific implementation activities. It is important to consider the location of landfills or waste-to-energy facilities and their proximity to disadvantaged communities.

Economic Benefits and Costs

- **Payback:** Quick payback (1–3 years). This action will result in savings for waste-to-energy and landfill facilities through process improvements and increased efficiency. Research and development on best practices will help uncover new technologies that improve the efficiency of the waste management process.
- **Cost to community members:** Not applicable. This action will not result in any relevant costs for the community member as the management practices at waste-to-energy facilities are beyond the purview of community members.

Other considerations: Research into new technologies that reduce emissions from waste-to-energy facilities and landfills is an important part of responsible waste management. According to the U.S. EPA's waste management hierarchy, this action is lower down in the hierarchy when compared with actions that reduce the amount of waste generated in Fairfax County (Action 10a) and divert that waste away from landfills or waste-to-energy facilities when possible (Action 10b). Waste reduction and diversion should be prioritized since the potential GHG reductions from implementing this strategy are relatively low compared with reductions from Strategy 10.

Action 11b: Explore Alternative Options for Long-Term Waste Management

This action focuses on identifying alternative options for long-term waste management, such as landfill with energy capture and cleaner types of waste-to-energy facilities, such as biosolid combustion. These new forms of long-term waste management would effectively manage waste that cannot be reduced or recycled, while reducing GHG emissions and air pollutants. This action also can be applied to long-term stormwater management, as new strategies for wastewater and stormwater capture and treatment will have to be developed and implemented in order to mitigate the effects of climate change.

Public Health	+
Environmental Resources	+
Economic Opportunity	=
One Fairfax	=
Payback	3–7 years
Cost to Community Members	No Cost
Timeframe	Soon

Timeframe: Soon (available before 2030). While the technology for alternative waste management is currently available, it will likely be another 5 to 10 years before large-scale deployment is cost-effective in the U.S. Research into specific types of waste management practices and subsequent installation projects will require a few years to get off the ground. Similarly, the technology to better manage wastewater and stormwater already exists, but takes time to implement at scale. However, researchers and decision makers in Fairfax County can get started on this action immediately by conducting assessments and reviewing case studies of possible technologies.

Technology considerations: The technology considerations for this action depend largely on the type of waste management practices that are selected. As there is not currently an operational landfill within the borders of Fairfax County, it may be necessary in the future to identify and construct sites for future landfills. Waste management options, such as new technologies for waste-to-energy facilities and biosolid processing facilities, require their own unique infrastructure and investments. The technological requirements for certain practices may significantly alter the timeline of this action.

Impacts

- **Public health:** This action has a positive impact on public health by implementing alternative waste management options with fewer negative environmental and health effects. Waste management practices that limit air and water pollution and reduce GHG emissions should be prioritized and actively pursued.
- **Environmental resources:** This action has a positive impact on environmental resources by implementing alternative waste management practices with reduced

environmental impact on air and water. Additionally, instituting a more thorough system for wastewater and stormwater management will reduce runoff of pollutants into waterways.

- **Economic opportunity:** The impact of this action on economic opportunity is uncertain and will depend on specific implementation activities.
- **One Fairfax:** The impact of this action on One Fairfax is uncertain and will depend on specific implementation activities. Equity implications of constructing new waste management facilities must be part of the discussion. Additionally, if waste is moved outside of Fairfax County, the socioeconomic impacts on other communities should be evaluated.

Economic Benefits and Costs

- **Payback:** Moderate payback (3–7 years). This action will result in moderate savings from reduced costs associated with waste management, including transportation, processing, and storage costs, which will help recoup implementation costs over 3–7 years. Alternative management practices that save money and reduce GHG emissions should be prioritized for implementation.
- **Cost to community members:** No cost. This action will not result in any relevant costs for the community member as they are not responsible for making decisions about county-wide waste management practices.

Other considerations: Decisions related to siting any new waste management infrastructure should consider equity as well as climate-related risks. For example, an assessment of climate-related risks would avoid siting facilities in potential flood zones. For stormwater management, areas at the highest risk from stormwater impacts should be prioritized.

Action 11c: Capture and Use Energy Generated by Wastewater Treatment Processes

This action is targeted toward developing the capacity of wastewater treatment facilities to capture and use energy generated onsite. This action includes applying new and emerging technologies to wastewater treatment in order to capture energy that can be used onsite or sold back to the grid.

Timeframe: Immediate. This technology is currently available and is being commercially deployed on a significant scale.

Technology considerations: Technologies tend to improve more than one aspect of processing at a time, so it is important to consider the full suite of benefits of a technological improvement. For example, if a new technology more efficiently captures fumes from a treatment plant and uses them to produce energy or heat, those fumes also are being diverted from the atmosphere, improving air quality and reducing emissions.

Impacts

- **Public health:** This action has a negligible impact on public health, as the primary focus is on energy capture, and the positive externalities are not easily quantifiable.
- **Environmental resources:** This action has a negligible impact on environmental resources. Even once a potential new technology that allows treatment facilities to capture energy is implemented, the amount of energy that can be gained will most likely represent a very small portion of overall energy needs. Still, every action to reduce emissions helps alleviate climate change even if its impact on emissions is relatively small.
- **Economic opportunity:** This action creates economic opportunity as more jobs related to technological innovations, installation, and operations and management will be required in order to carry out improvements to wastewater treatment processes.
- **One Fairfax:** This action has a relatively small impact on One Fairfax. However, if wastewater treatment plants are sited in the proximity of disadvantaged communities, technology improvements that increase efficiency and reduce air pollution may have a positive impact on nearby communities, and subsequently on One Fairfax.

Public Health	=
Environmental Resources	=
Economic Opportunity	+
One Fairfax	=
Payback	1–3 years
Cost to Community Members	NA
Timeframe	Immediate

Economic Benefits and Costs

- **Payback:** Quick payback (1–3 years). Payback is expected to be short, as the primary focus is identifying technologies to implement and encouraging their implementation, rather than an immediate overhaul of the wastewater treatment system.
- **Cost to community members:** Not applicable. This action likely will not result in costs to the community member.

Other considerations: No other considerations were identified for this action.

Working Group-Recommended Activities for Implementation for Strategy 11

Recommended activities for implementation for this strategy were developed by the Working Group and include the following:

Recommended Activities for Implementation for All Actors

Education

- Encourage the use of electric trash and recycling trucks to reduce GHG emissions and local air pollution.

Recommended Activities for Implementation for Individuals and Organizations

Individual Actions

- Explore ways to ensure that private waste contracts align with best practices and best available technology for reducing emissions.
- Optimize trash pickup frequency to reduce emissions from the transportation of waste in trucks.
- Develop plans to reduce litter and illegal dumping.

Recommended Activities for Implementation for the County

County Programs, Rules, and Regulations

- Explore ways to ensure that waste contracts align with best practices and best available technology for reducing emissions.
- Understand and clearly disclose the impacts of existing waste-to-energy facilities, such as air quality analyses.
- Reclaim treated wastewater and sewage sludge to reduce emissions from wastewater treatment, such as by using reclaimed wastewater for process cooling and irrigation, and using sewage sludge for fertilizer application and fertilizer sales.
- Optimize trash pickup frequency to reduce emissions from the transportation of waste in trucks.
- Develop plans to reduce litter and illegal dumping.

Did You Know?

The Water Reuse Project uses clean wastewater from the Noman M. Cole, Jr., Pollution Control Plant for irrigation and industrial purposes. See Public Works and Environmental Services – Water Reuse for more information.

The county also won EPA's Landfill Methane Outreach Program Community Partner of the Year in 2005 for its landfill gas capture and reuse program.

- Promote solar PV projects on closed landfills to optimize the use of closed landfills and increase renewable energy in alignment with Strategy 5: Increase Production of Onsite Renewable Energy.

Recommended Activities for Implementation for the County Requiring State-Enabled Legislation

- No recommended activities for implementation were identified for this category.

Recommended Activities for Implementation for State and Federal Actors

State and Federal Legislation and Programs

- Support state and federal policies that reduce emissions from landfills, including converting captured landfill gas into natural gas and electricity for county use or sale, and capturing gas generated by closed landfills.
- Support state and federal policies that promote energy recovery from waste, such as energy production using biosolids combustion.

NATURAL RESOURCES

Strategy 12: Support Preservation, Restoration, and Expansion of Natural Systems, Green Spaces, and Soil Quality

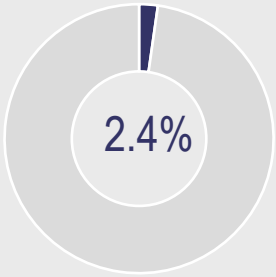
This strategy includes the preservation, restoration, and expansion of natural systems, green spaces, and soil quality in Fairfax County through:

- Action 12a: Conserve Existing Tree Canopy, Green Spaces, and Soil Quality
- Action 12b: Expand Tree Canopy and Green Spaces, and Improve Soil Management
- Action 12c: Create a Cross-Disciplinary County Staff Team to Strengthen Climate Change and Natural Resource Policies and Programs

GHG Emissions Reduced in 2050

251,000 MT CO_2e

Percent Contribution to Emissions Reductions Needed in 2050



Improved and ubiquitous green spaces have trees that increase carbon sequestration for the region, encourage wildlife to settle, strengthen ecosystem diversity, and lessen the costs associated with stormwater issues. Additionally, green spaces increase property values, tend to decrease the heat island effect, and provide social and public health benefits. Together, these impacts have a strong positive effect on climate change mitigation and risk reduction.

This strategy aligns with the Natural Resources Sector Goal to expand the tree canopy to 60% with a minimum of 40% tree canopy coverage in every census block by 2030 and a minimum of 50% tree canopy coverage in every census block by 2050, prioritizing areas of highest socioeconomic need first. See Greenhouse Gas Reduction Goals.

Heat Island Effect Explained

Heat islands are areas that, due to urban infrastructure such as densely packed buildings and roads, experience higher temperatures than outlying areas. These structures absorb and re-emit heat from the sun more readily than natural landscapes. Therefore, the heat island effect can be reduced if the area is interspersed with green spaces and shaded areas, and if roads and rooftops are painted light colors to reflect sunlight instead of absorbing it.

GHG Reductions

This strategy results in GHG reductions of 251,000 MT CO_2e in 2050. This strategy is anticipated to account for 2% of the emissions reduction needed to achieve the long-term carbon neutrality goal by 2050.

Cost Considerations

Actions under this strategy are likely to be low cost to implement and quick to return on investments, while passing on little, if any, costs to the community. The benefits of protecting and expanding green spaces reduce costs related to extreme weather events while also having a positive impact on mental health, thereby reducing costs related to the treatment of health problems. Green spaces also increase the property value of nearby properties.

Working Group Priorities

The Working Group emphasized Strategy 12 as one of the more important strategies in CECAP because of the many strong benefits trees and green spaces can provide. Working Group members highlighted that green spaces are in high demand and that they support other important sustainability issues, such as climate resiliency, equity, and public health. They also emphasized prioritizing the preservation of mature trees due to their carbon sequestration benefits.

Action 12a: Conserve Existing Tree Canopy, Green Spaces, and Soil Quality

This action includes assessing the current condition of tree canopies, green spaces, and soil quality around the county and determining how to improve their condition, on both site-specific and county-wide levels. This process could include improving soil quality and nutrient availability; addressing sources of pollution; and replacing non-native, high-upkeep species with native hardy species that are lower maintenance but still beautiful. Green spaces and tree-covered areas that are healthy and actively maintained provide significant social and health benefits for the surrounding area while also sequestering carbon, filtering groundwater, and reducing soil erosion.

Timeframe: Immediate. This action is currently available for implementation.

Technology considerations: This strategy will require research and recommendations based on scientific analysis of existing tree canopy, green spaces, and soil quality. The public's support will be needed in keeping green spaces clean and for cooperation during periods of research and assessment.

Impacts

Public Health	++
Environmental Resources	++
Economic Opportunity	=
One Fairfax	=
Payback	NA
Cost to Community Members	No Cost
Timeframe	Immediate

- **Public health:** This action has a very positive impact on public health. Trees filter pollutants, such as particulate matter, out of the air and water, reducing the concentration of airborne irritants that can lead to asthma. Tree cover and green spaces also reduce the heat island effect, which helps to lower the frequency and severity of heat-related illnesses. Green spaces also are known to improve mental and physical health as residents will have more options for getting outside and enjoying nature. Lastly, green spaces reduce noise pollution in cities.
- **Environmental resources:** This action strongly benefits environmental resources use. Mature trees sequester carbon from the atmosphere, helping to reduce net emissions for the county and work toward the county's goal of reducing overall emissions. Additionally, mature green spaces appeal to wildlife who may have left the area when their habitat was damaged. Ecosystems with native species and high diversity (i.e., many types of plants and animals) are more stable than artificially supported ecosystems. Trees and green spaces also protect groundwater from pollutants, reduce soil erosion, and reduce flooding during storms.
- **Economic opportunity:** This action does not have a significant impact on economic opportunity overall. However, this action may provide job opportunities to study and support existing trees, green spaces, and soil quality. Additionally, green spaces raise property values for the surrounding region, enabling nearby homeowners to sell their properties at a higher value.
- **One Fairfax:** As this action focuses on existing tree canopy, green spaces, and soil quality, this action does not directly impact One Fairfax. However, special consideration of site selection and support must be given throughout implementation to ensure that it does not exacerbate existing racial and social inequities.

Economic Benefits and Costs

- **Payback:** Not applicable. The payback from this action is not applicable to the community member in terms of monetary costs.
- **Cost to community members:** No cost. The cost to community members from this action is negligible as the county will specifically be supporting existing green spaces.

Other considerations: Care should be taken while implementing this action to ensure that existing green spaces are conserved with community buy-in and that mature trees are prioritized for conservation. Under this action, existing green spaces that are removed or

reduced due to development can be relocated or replaced in order to maintain the public health and carbon sequestration benefits of green spaces within the county.

Action 12b: Expand Tree Canopy and Green Spaces, and Improve Soil Management

This action aims to increase tree canopy and green spaces throughout the county with a focus on planting and supporting native and resilient species. The preparation for this process will include identifying new locations for green spaces and trees, and preparing them to be green spaces through construction and landscaping projects. Green spaces will need to be designed to be maximally climate resilient and improve ecosystem health. Methods to achieve this could include landscaping techniques, such as contour planting, where vegetation is planted in a way that follows the slope of the land, and planting a wide variety of trees, shrubs, and grasses that are native to the area and hardy with regard to severe weather.

Timeframe: Immediate. This action could be implemented right away; however, it takes time to select, prepare, and develop areas that have the potential to be new green spaces.

Technology considerations: This strategy will require research, recommendations, and community support in order to find ideal areas to convert to green spaces.

Public Health	++
Environmental Resources	++
Economic Opportunity	+
One Fairfax	+
Payback	NA
Cost to Community Members	$
Timeframe	Immediate

Impacts

- **Public health:** Developing new green spaces and planting more urban trees has a positive impact on public health. Trees filter pollutants, such as particulate matter, out of the air and water, reducing the concentration of airborne irritants that can lead to asthma. Tree cover and green spaces also reduce the heat island effect, which helps to lower the frequency and severity of heat-related illnesses. Green spaces also are known to improve mental and physical health, as residents will have more options for getting outside and enjoying nature.
- **Environmental resources:** This action strongly benefits environmental resources use. Although young trees do not sequester carbon from the atmosphere as quickly as mature trees, planting young trees provides a long-term strategy for emissions reduction as the trees mature. Additionally, new green spaces can attract wildlife who may have left the area when their habitat was damaged. Ecosystems with native species and high diversity (i.e., many types of plants and animals) are more stable than artificially supported ecosystems. Trees and green spaces also protect groundwater

from pollutants, reduce soil erosion, and reduce flooding during storms. Additionally, green spaces increase soil organic matter through decomposition of leaf litter and other vegetation. Organic materials fertilize the soil, as well as increase the water retention ability of the soil, which further decreases the need for irrigation and the risk of runoff and flooding during storms while improving soil carbon sequestration.

- **Economic opportunity:** Overall, this action has a significant impact on economic opportunity. Green spaces raise property values for the surrounding region, enabling nearby homeowners to sell their properties at a higher value. This impact on the community will need to be carefully monitored to ensure that it does not lead to low-income communities being pushed out by large-scale development looking to take advantage of proximity to a green space.
- **One Fairfax:** This action has a positive effect on equity in Fairfax County. If the new green spaces are sited and developed with equity in mind, they have significant positive social impacts for a community. The positive impact of green spaces will be most pronounced when areas of higher socioeconomic need are prioritized for new green space development.

Economic Benefits and Costs

- **Payback:** Not applicable. The payback from this action is not applicable to the community member in terms of monetary costs. In terms of reducing GHGs, it will take time to build entirely new green spaces. As the trees mature and the green spaces are completed, the numerous benefits on health, carbon sequestration, and societal health will be realized.
- **Cost to community members:** Low cost ($). This action is low cost for community members. Although there may be initial costs as the green spaces are built, they have very few ongoing costs once they are fully operational. This effect would be even more pronounced for green spaces and trees planted as part of this action, which will prioritize hardiness and be native to the region, reducing the inputs each space would require.

Other considerations: Consider planting additional vegetation and trees that are native to the region, work with the county's emissions reduction strategies, and do not cause harm to public health. For example, many cities and housing authorities limit trees that are allowed to be planted to male trees, as the fruit of female trees is considered a nuisance. This phenomenon has led to the overwhelming quantity of pollen that cities experience today, which has increased the prevalence of allergies and asthma among the residents of that area.[63] Natural resource expansion also could encompass the creation or protection of wildlife corridors, the connection of isolated habitats (e.g., connecting two or more small meadows to create a larger, less fragmented habitat), and the connection of urban forests. Finally, the contribution of green spaces toward efforts to adapt to climate change impacts

[63] Cariñanos, P., and M. Casares-Porcel. 2011, June 15. Urban green zones and related pollen allergy: A review. Some guidelines for designing spaces with low allergy impact. *Landscape and Urban Planning, 101*(3), pp. 205–214. https://www.sciencedirect.com/science/article/abs/pii/S016920461100137X.

and reduce the risk of extreme weather events, such as heat waves and flooding, should be counted when considering the development and placement of new green spaces.

Action 12c: Cross-Disciplinary County Staff Team to Evaluate Climate Change and Natural Resources Policies and Programs

This action involves the creation of a cross-disciplinary county staff team to analyze existing programs and policies across the county to evaluate where climate change and natural resources intersect, and what can be added or strengthened to create a comprehensive climate (mitigation plus adaptation/resiliency) approach.

Timeframe: Immediate. County staff can begin immediately by identifying the appropriate staff to participate in the cross-disciplinary county team and reviewing the input from CECAP Working Group members.

Technology considerations: There are no technology considerations for this action.

Public Health	++
Environmental Resources	++
Economic Opportunity	=
One Fairfax	=
Payback	NA
Cost to Community Members	NA
Timeframe	Immediate

Impacts

- **Public health:** Efforts to adapt to climate change impacts and support natural resources have a positive impact on public health.
- **Environmental resources:** This action has a positive impact on environmental resources as policies and programs that result from this action will support the health of natural resources.
- **Economic opportunity:** The impact of this action on economic opportunity is uncertain and will depend on the specific policies and programs developed by the cross-disciplinary county staff team.
- **One Fairfax:** The impact of this action on One Fairfax is uncertain and will depend on the specific policies and programs developed by the cross-disciplinary county staff team and whether those policies and programs prioritize areas of higher socioeconomic need.

Economic Benefits and Costs

- **Payback:** Not applicable. There is no payback to the community member for this action.
- **Cost to community members:** Not applicable. There is no cost to the community member for this action.

Other considerations: This action will be crucial to achieving the Natural Resource Sector-Based Goal: Expand the tree canopy to 60% with a minimum of 40% tree canopy coverage in every census block by 2030 and a minimum of 50% tree canopy coverage in every census block by 2050, prioritizing areas of highest socioeconomic need first. See Greenhouse Gas Reduction Goals.

Working Group-Recommended Activities for Implementation for Strategy 12

As natural systems provide numerous benefits to the surrounding area, their expansion presents an opportunity for development and partnerships among private owners, developers, companies, and different forms of government. When conducted in an equitable manner, movements to improve or expand green spaces in a community are usually well received. There are a variety of options that can be taken to implement this strategy. Recommended activities for implementation for this strategy were developed by the Working Group and include the following:

Recommended Activities for Implementation for All Actors

Education

Wide-reaching educational programs would help to ensure a lasting impact for this strategy. Education is especially key for green spaces, as the significant benefits of green spaces and trees can be overlooked in favor of management strategies that rely on exciting new technologies. To help green spaces capture the public's attention and interest, potential educational opportunities could include the following:

- Broad educational programs on the importance and value of natural resources and trees.
- Institute a measurement tool for tracking the land's climate impact value.
- Regularly report tree canopy data to the public.
- Monitor tree cover changes using satellite imagery urban tree canopy analyses to assess current conditions and determine how forests and urban tree ecosystems are changing over time.
- Competitions related to preserving green spaces, ideas for new green spaces, etc.
- Plant trees in clusters with understory plant species and groundcover.
- County-wide and site-specific inventories of trees in advance of proposed development can minimize impacts to and loss of high-quality trees and natural vegetative communities.
- Ensure that environmental planning and the importance of green spaces to communities is a central part of any development project—from redesigning a yard to building a new apartment complex.
- As green spaces provide numerous benefits to the surrounding area, their expansion presents an opportunity for development and partnerships among private owners, developers, companies, and different forms of government.
- Increase public awareness of the principles of biophilic design and encourage incorporating green spaces into new biophilic development projects and renovations.

Implementation of this action may include linking green spaces within the county to one another with a system of trails, which would give residents a wider network of trails along which they could walk, run, or bike (in alignment with Action 8a).

Recommended Activities for Implementation for Individuals and Organizations

County Programs, Rules, and Regulations

- Use the Fairfax County Tree Preservation and Planting Fund to help cover the costs of planting and preserving trees on public properties and common open spaces.

Individual Action

- Coordinate community tree planting events.
- Promote additional trees in existing spaces and native vegetation.

Recommended Activities for Implementation for the County

County Programs, Rules, and Regulations

- Create a cross-disciplinary county staff team to analyze existing programs and policies across the county to evaluate where climate change and natural resources intersect, and what can be added or strengthen to create a comprehensive climate (mitigation plus adaptation/resiliency) approach (Action 12c).
- Strengthen existing county voluntary programs that conserve and expand green spaces and trees. The Fairfax County Tree Action Plan provides a guiding structure through which the county can develop programs that conserve existing young and mature trees to help improve soils, filter groundwater, and remove air pollutants. Look at already available programs, such as TreeVitalize Pittsburgh or Biophilic City programs as models.
- Pursue the expansion of financial tools, such as the Tree Preservation and Planting Fund, to include tree planting in private spaces.
- Use research and inventory data to conduct land use reviews that inform local policies to prioritize open space, and better value and preserve natural areas. The county could also use this information to reform how land is sold, and coordinate new and expanded green areas with new or existing trails to create a network of green spaces.
- Continue research and status checks to ensure that county programs are having their intended effect on the community.

Did You Know?

Fairfax County already has numerous tools and programs designed to help county residents protect and expand green spaces, including the Fairfax County Tree Action Plan, the Tree Preservation and Planting Fund, and the Friends of the Trees Award Program.

- Require a higher density tree canopy replacement in development projects.
- Partner with homeowners' associations to promote additional trees in existing spaces and native vegetation since native species restore natural soil processes and biodiversity.

Incentives

- Incentivize more infill development to conserve existing tree canopies and green spaces, and reevaluate the existing Infill Development Review Process to incorporate best practices for preserving mature tree canopy. Specific actions include, but are not limited to:
  - Require a tree preservation plan first, before the stormwater, utility, and building plan or before any accessory project, such as a deck, shed, etc.
  - Stop all deviations or waivers from tree canopy replacement requirements.
  - Change setback requirements, particularly on smaller lots.
  - Establish stiff penalties for unpermitted removal of trees and/or damaging preserved trees in any building process.
  - Reduce the allowed amount of impermeability on any size of lot.
  - Ban the removal of mature trees in resource protection areas, buffers, or flood plains.
  - Require that more trees be planted in parking lots, as well as green roofs for every parking garage.
  - Incentivize rooftop gardens for offices, condos, and other flattop buildings.
- Incentivize developers and homeowners to reduce clearing, grading, or otherwise disturbing soils for development because soils provide important carbon sequestration.
- Incentivize or require conservation of tree canopies or green spaces in development projects, such as a regulation that restricts the removal of mature trees, and building designs and construction strategies that incorporate green space protection.

Recommended Activities for Implementation for the County Requiring State-Enabled Legislation

County Programs, Rules, and Regulations

- Authorize the local jurisdiction to further create new regulations and mandates that support progress on green spaces. Policies could include strengthened regulations on the removal of mature trees, reform of eminent domain to allow for walking and biking paths, and broadening Fairfax County's ability to manage land.

Recommended Activities for Implementation for State and Federal Governments

State and Federal Legislation and Programs

- State and federal government action is not required for implementation for this strategy; however, both entities can provide funding, research and development, and political support for the preservation, restoration, and expansion of natural systems, green spaces, and soil quality in Fairfax County.

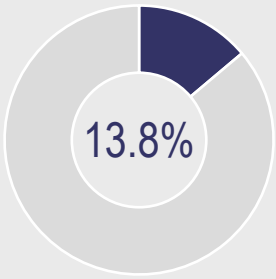
EMERGING TECHNOLOGIES

There are many established technologies that can support the GHG emissions reduction strategies described above. However, through research and development efforts and innovative business practices, technologies continue to improve over time, and novel technologies emerge that can reduce GHG emissions further. Emerging technologies can help shift the current emissions-intensive energy paradigm to a green growth paradigm and can help "future-proof" long-term plans by overcoming existing economic and technological barriers and minimizing future systemic shocks or stresses. Some emerging technologies include advanced fuel cells and refrigerants, next generation heat pumps, microgrids, and electric cars, among others, and they will become more widespread and effective over time.

GHG Emissions Reduced in 2050

1,456,000 MT CO_2e

Percent Contribution to Emissions Reductions Needed in 2050



The technologies discussed in this section are not comprehensive but are the most promising and likely to play an important role in GHG emissions reduction. Other emerging technologies proposed by the Working Group include microturbines, thin film solar, and LED lighting for agriculture, among others.

Advanced refrigerants: Today's standard refrigerants are synthetic gases that are extremely potent GHGs (as outlined in Action 2c); many have a GWP in the thousands (the most common refrigerant, R-22, has a GWP of 1,810). There is a current movement to transition to natural, advanced refrigerants, such as ammonia and CO_2, that have much lower GWPs (ammonia has a GWP of 0), and to improve refrigeration system designs. Advanced refrigerants and systems have yet to overcome obstacles, such as higher costs; safety implications; and restrictive codes, regulations, and procedures.[64] Once these obstacles are overcome, advanced refrigerants can help significantly reduce GHG emissions and improve energy efficiency in buildings (Strategy 1), especially supermarkets, hospitals, schools, and office buildings.

Next generation heat pumps: New heat pumps are being designed to enable flexibility in variable capacity, which optimizes energy use and provides greater comfort. This new technology allows for cold climate use and can be applied in traditionally fossil-heated locations, particularly the northeastern U.S. The next generation of heat pumps also

[64] National Renewable Energy Laboratory. 2015. *Refrigeration Playbook: Natural Refrigerants*. Available at https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/refrigeration-playbook-natural-refrigerants.pdf.

include a communications mechanism to optimize energy use and temperature control.[65] This technology can significantly reduce peak loads in summer and winter, and will help accelerate the electrification of buildings (Strategy 2).

Battery storage: Excess energy generation can be stored in batteries to provide energy later when there is high demand or low supply. This is especially valuable for intermittent renewable energy sources, such as solar, which cannot provide power when the sun is not shining, and also for meeting peak energy demand. Costs for battery storage have dropped in recent years (50% between 2018 and 2020)[66] and are expected to continue to drop an additional 40% to 80% by 2050 as technologies advance and scale up.[67] Lithium-ion technologies are the leading energy storage solutions, but other technologies are emerging for grid-scale applications, including vehicle-to-grid technologies (see below), lead-acid, redox flow, and molten salt.[68] Batteries can be coupled with renewable energy systems (Strategies 4 and 5) and/or microgrids (Strategies 1 and 5) to create more resilient energy systems.

Microgrids: A microgrid is a local energy grid that supplies energy independent from the centralized energy grid. Microgrids provide a self-sufficient energy system for small areas, such as college campuses, hospitals, or business centers. Microgrids offer resilient energy systems when paired with clean energy sources and energy storage. As the cost of batteries continues to fall and the deployment of clean energy generation grows, microgrids are becoming an increasingly attractive option to accelerate GHG emissions reduction, increase energy resiliency, and expedite renewable energy deployment (Strategy 5).

Fuel cells: Fuel cells use the chemical energy of hydrogen (or other fuels) to produce electricity that can be used in many applications, including transportation, buildings, and devices. Fuel cells generate electricity more efficiently than combustion engines and do not produce GHG emissions when powered by hydrogen. Fuel cells also are quieter and have fewer moving parts than combustion engines. Current research and development are focused on reducing the cost, improving the performance, and increasing the durability of fuel cells.[69] As fuel cells become less expensive and better, they can help expedite building energy efficiency and conservation (Strategy 1) and improve vehicle fuel economy (Strategy 9).

Façade controls: Building exterior design systems, such as dynamic smart windows and sunshades, can adapt to environmental conditions to reduce energy use and improve the comfort of occupants. Adaptable design features, such as sunshades, are connected to smart control systems that assess interior and exterior conditions to optimize HVAC and energy

[65] Domitrovic, R., Hunt, W., and Amarnath, A. 2017. *Next Generation Heat Pump Systems with Enhanced Smart Grid Response Capability for the United States Market*. Available at https://hpc2017.org/wp-content/uploads/2017/08/K.2.3.1-Next-Generation-Heat-Pump-Systems-with-Enhanced-Smart-Grid-Response-Capability-for-the-United-States.pdf.
[66] Energy Storage News. 2020. BloombergNEF: "Already cheaper to install new-build battery storage than peaking plants." Available at https://www.energy-storage.news/news/bloombergnef-lcoe-of-battery-storage-has-fallen-faster-than-solar-or-wind-i.
[67] Cole, W., and Frazier, A. 2020. Cost Projections for Utility-Scale Battery Storage: 2020 Update. NREL/TP-6A20-75385. Golden, CO: National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy20osti/75385.pdf.
[68] National Renewable Energy Laboratory. 2019. Grid-Scale Battery Storage: Frequently Asked Questions. Available at https://www.nrel.gov/docs/fy19osti/74426.pdf.
[69] U.S. DOE. n.d. Fuel Cells. Available at https://www.energy.gov/eere/fuelcells/fuel-cells.

usage. In addition to improving temperature control, these systems improve the comfort of occupants by reducing glare, increasing natural ventilation, and increasing natural light.[70] These benefits help reduce energy use and increase energy efficiency (Strategy 1).

Autonomous vehicles: There are varying levels of autonomous or automated vehicles, from driver assistance features such as lane-departure warning systems and adaptive lighting systems to self-parking cars to self-driving cars. Fully autonomous "hands-off" cars have yet to hit the streets, and may not for a decade, but the technology is advancing as many companies test different systems and scenarios. When autonomous vehicles have been determined to be safe and effective, and transportation systems have been adapted to accommodate them, they have the potential to provide a wide array of benefits, including increased safety, improved mobility, increased fuel efficiency, and improved quality of life.[71] As the auto industry transitions to EVs, making them autonomous vehicles can help increase the appeal and adoption of EVs (Strategy 7).

Vehicle grid integration (VGI): VGI is the connection of EV charging infrastructure with the electric grid to allow the optimization of charging time, level, and location of EV charging/discharging. VGI can provide net benefits by increasing grid utilization, integrating renewable energy resources, reducing supply costs, and increasing reliability.[72] VGI is already being developed today, and is expected to grow rapidly. VGI will help to decarbonize the Transportation sector, improve grid resiliency and security, and increase EV adoption (Strategy 7).

EV carshare/rideshare: Carsharing and ridesharing provide increased mobility options and have grown considerably in recent years with the advent of smartphones and dedicated apps, such as Lyft and Uber. Privately owned vehicles are often underutilized, mostly used to transport a single person for less than an hour a day. Carshare and rideshare services can significantly improve vehicle utilization and help reduce parking and traffic congestion.[73] Many sharing services have made pledges to increase the proportion of EVs in their fleets, and this may spur increased EV adoption (Strategy 7).

Electric mobility options: Beyond EVs, a number of new electric mobility (e-mobility) options, such as scooters and bikes, have recently become popular in cities across the U.S. Whether docked (e.g., city bikeshares) or dockless (e.g., privately owned scooters), these technologies offer new and highly accessible options for transportation over short distances, especially for reaching a final destination after public transit, known as "last-mile transport." By one report, 30% of electric scooter riders stated that they use e-scooters in

[70] Berkeley Lab. 2020. Dynamic Facades with Smart Controls: The Future of Building Control. Available at https://eta.lbl.gov/news/article/dynamic-facades-smart-controls-future.
[71] U.S. Department of Transportation. 2020. *Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles 4.0.* Available at https://www.transportation.gov/sites/dot.gov/files/2020-02/EnsuringAmericanLeadershipAVTech4.pdf.
[72] California Public Utilities Commission. 2020. *Final Report of the California Joint Agencies Vehicle-Grid Integration Working Group*. Available at https://gridworks.org/wp-content/uploads/2020/07/VGI-Working-Group-Final-Report-6.30.20.pdf.
[73] Mounce, R., and Nelson, J. 2019, February. On the potential for one-way electric vehicle car-sharing in future mobility systems. *Transportation Research Part A: Policy and Practice, 120*, pp. 17–30. https://doi.org/10.1016/j.tra.2018.12.003.

place of cars, signaling that e-mobility options can reduce car trips and therefore traffic congestion and transportation emissions.[74] While there are concerns over safety and parking infrastructure, cities have begun to devise policies and measures to address these concerns. As the technology advances and users increase, e-mobility options can play a role in developing bike and pedestrian infrastructure (Strategy 8).

Advanced waste-to-energy: In addition to reducing GHG emissions, two of society's greatest challenges are providing enough energy and managing and reducing the amount of waste generated. While the Working Group expressed concerns about this technology, advanced waste-to-energy technologies can help overcome all three challenges. Greater amounts of waste are generated each year, and waste emits GHGs, such as methane, when it breaks down. There are a variety of processes that transform waste into energy, including incineration, anaerobic digestion, pyrolysis, and others that provide direct energy, such as the heat from combustion that drives turbines to generate electricity, or fuel, such as biofuel or syngas. Advanced and emerging waste-to-energy technologies include hydrothermal carbonization, which can rapidly convert wet waste to dry to speed up the anaerobic digestion process,[75] and Dendro Liquid Energy, which results in nearly zero waste, is low cost, and is four times as fast and efficient as other processes.[76] Implementing advanced waste-to-energy technologies can help better manage waste (Strategy 11), provide energy, and reduce the amount of land used to landfill waste.

Carbon capture utilization and storage (CCUS): CCUS includes a broad set of technologies that generally capture CO_2 emissions from fossil fuel combustion source points (e.g., coal-fired power plants, industrial flue stacks) to prevent CO_2 emissions from entering the atmosphere. Capturing emissions at source points is most efficient because that is where they are most highly concentrated, and more than 90% of emissions can be captured this way.[77] Captured CO_2 can be utilized in other products, such as carbonated beverages, or sequestered (i.e., stored permanently) underground. There are a variety of technologies for capturing CO_2, including absorption, adsorption, and membranes. While these technologies are effective, there are not many commercial-scale CCUS facilities due to high system costs. However, as the technology continues to develop, costs decline, and demand grows, CCUS is poised to grow significantly in the future.

Carbon taxes and fees: A carbon tax (also called a "carbon fee") is a price that emitters must pay for each metric ton of CO_2 emitted. By putting a price on CO_2, emitters have a direct financial incentive to reduce their emissions to avoid the cost, making a carbon tax a very effective and efficient policy to reduce emissions. Virginia participates in the RGGI cap-

[74] Forbes. 2019. Electric Scooters and Micro-Mobility: Here's Everything You Need To Know. Available at https://www.forbes.com/sites/adeyemiajao/2019/02/01/everything-you-want-to-know-about-scooters-and-micro-mobility/?sh=55a7588b5de6.
[75] PreScouter. 2017. What are some of the latest waste-to-energy technologies available?" Available at https://www.prescouter.com/2017/10/waste-to-energy-technologies-available/.
[76] Cuita, S., Tsiamis, D., and Castaldi, M. 2018. Technologies for Generating Energy, Gas, and Chemicals from Municipal Solid Waste, Biomass, Nonrecycled Plastics, Sludges, and Wet Solid Wastes. *Gasification of Waste Materials*. Available at https://www.sciencedirect.com/topics/engineering/thermal-treatment-system.
[77] C2ES. n.d. Carbon Capture. Available at https://www.c2es.org/content/carbon-capture/.

and-trade scheme, which, in part, works as a carbon fee for electricity generation. The revenues generated by the tax can be used for various purposes, including reinvestment in emissions reduction technologies or programs. More than 20 countries have adopted some form of a carbon tax that has been adopted to a wide range of national policy goals and contexts. However, a carbon tax has the potential to inequitably affect lower income individuals. Part of the implementation of such a tax should involve an analysis of equity and potential solutions to address disparate impacts.

COMMUNITY ENGAGEMENT

Since January 2019 when CECAP development began in earnest, the public has been engaged in the process in two distinct ways. First, the members of the CECAP Working Group are, essentially, public representatives. Several members represent their magisterial districts as individuals. All of them serve voluntarily on this public body to advise the Board of Supervisors. They represent the first tier of public engagement in CECAP, and their very invested and high level of engagement has made the creation of this report and all the substantive recommendations it contains possible.

Second, throughout the CECAP development process, county staff have created opportunities for widespread public outreach, education, and engagement. Occurring in three phases over the course of 10 months, these engagement periods were designed to provide timely and relevant information to county residents and stakeholders about CECAP, and to invite their input on the goals, strategies, and actions likely to appear in this final plan. This portion of the report summarizes the public engagement tactics used to gather feedback and to raise county residents' awareness of the climate planning effort.

August/September 2020 Public Engagement

In the late summer and early fall of 2020, the CECAP team began an initial round of public engagement. Between August 27 and September 2, three virtual public meetings were held via WebEx. These meetings included presentations from the OEEC and subject matter experts from ICF were moderated by a trained facilitator. Each meeting provided an overview of the CECAP process and goals, and included structured opportunities for attendees to respond to questions about their willingness to make personal changes to reduce GHG emissions. The meetings were well attended as more than 150 participants in total attended. Recordings of the public meetings, along with presentation slide decks and meeting summaries, can be found online.

Simultaneously, the OEEC launched an online public survey that was available from August 27 through September 13, 2020. The survey asked respondents to evaluate the likelihood that they would choose to take specific actions to help reduce community GHG emissions. The survey was offered in English, Spanish, Korean, and Vietnamese.

More than 2,000 individuals responded to the survey, 850 of which submitted free-form comments and feedback. The responses from this survey provided an initial baseline evaluation of community interest in possible emissions reduction strategies and actions. On the whole, respondents expressed an interest in GHG reduction activities at the local level, but also hesitancy to take dramatic or even significant personal action to realize reductions. A full summary of the survey responses is available online. This summary is accompanied by a report on the individual survey comments.

The public meetings and public survey were widely advertised and promoted using the county's digital channels and platforms. The OEEC conducted outreach to other county departments and agencies, sharing promotional materials in multiple languages (English, Spanish, Korean, and Vietnamese), including sample social media language and graphics.

February/March 2021 Public Engagement

On February 1, 2021, the OEEC launched a six-week CECAP public education and engagement campaign. The first three weeks of this campaign were dedicated to activities designed to raise public awareness of CECAP and the need for climate action at the local level. The latter three weeks resembled the August/September public engagement period, with two virtual public meetings and an online public survey.

As with the August/September 2020 public engagement campaign, the February/March campaign was largely driven by grassroots digital marketing and outreach. During the winter campaign, the OEEC cast a wider net, establishing a network of approximately 80 community promotional partners in addition to existing promotional relationships with fellow county departments and agencies. These community partners included homeowners' associations, civic associations, environmental advocacy groups, and nonprofits. Information sessions were held for promotional partners in late January 2021 to prime them to help distribute messaging to their audiences. These contacts were then provided with plug-and-play promotional materials, such as sample social media language, graphics, and videos to share widely.

Public Education

The public education campaign was digital in nature, with article and video content distributed on county and partner promotional channels. The goal of the campaign was to build a case for CECAP in the public sphere. The campaign focused on sharing basic climate facts and figures, highlighting the potential impacts of climate change on Fairfax County, and calling out the need for local action This initial public education effort, in connection with CECAP, provides a foundation for future efforts. The OEEC anticipates rolling out a robust public education effort as CECAP moves from its planning phase to implementation in late 2021.

Sector-Specific Public Meetings

In a departure from the model deployed in August and September 2020, the public meetings held in February 2021 were sector-specific. The first meeting, held on February 23, was devoted to energy issues, while the second meeting, held on February 25, was focused on transportation, development, and waste issues. The division of subject matter mirrored the structure of the CECAP Working Group subgroups. These meetings were lightly attended compared with those held in August and September 2020, with approximately 75 individuals attending over the course of the two meetings. Meeting information and materials, including recordings, slide decks, and meeting summaries, are available online.

Once again, the public meetings were formatted to provide information to attendees about the CECAP planning effort, and to gather their feedback in a structured manner. In February, attendees were given technical information about various emissions reduction strategies, such as using renewable energy sources to power a home or driving an electric vehicle, and were asked to share what would motivate them to make such a change and what would stop them from doing so.

Public Surveys

Similar questions were asked in two online public surveys, open from February 22 through March 14, 2021. These surveys also were divided by topic, with one focused on energy issues and the other on transportation, development, and waste. Designed to help evaluate the gap between interest and action, the surveys asked questions about barriers to entry and what would make it easier for a respondent to take elective action to reduce their personal carbon footprint. Notably, many respondents indicated that financial incentives or rebates would make a difference in their ability or desire to take action to reduce emissions. The call for financial support was followed closely by an interest in more information from the county and other reputable sources on how to make changes in a cost-effective, safe, and efficient manner.

A third survey with open-ended questions provided county residents and stakeholders a chance to share their thoughts on CECAP and climate planning in general. Collectively, more than 2,600 individuals responded to the three surveys. A comprehensive summary of the survey results is available online.

Targeted Business Engagement

In addition to hosting two public meetings and issuing three public surveys in the February/March 2021 timeframe, the OEEC also hosted two roundtable meetings with representatives of the business community. These meetings were meant to provide county staff with insight into the sustainability goals and objectives of some of the county's largest employers, and to spark a discussion of how the county and these companies can best support one another's climate action initiatives in the future. See this link for further information.

May 2021 Public Engagement

In May 2021, a third round of virtual public meetings was held to inform the public about the likely contents of this report, and to solicit feedback on the CECAP goals, strategies, and actions in their near-final form. The meetings, which took place on May 18 and May 20, resembled those held in August and September 2020. These meetings were not sector specific; the same points were addressed at both. As with the previous public outreach opportunities, the participants asked clarifying questions about the material presented and had a substantially positive reception regarding the material.

Ongoing Public Engagement Efforts

In addition to the three rounds of public engagement just described, the OEEC has maintained an open-door policy for members of the public with regard to CECAP. For the entirety of 2020, while much of the substantive planning work was underway, the OEEC issued monthly updates on CECAP in the form of articles. An e-newsletter distribution list specific to CECAP was developed to share information with interested individuals on a regular basis. A public inbox is available at all times to invite and encourage county residents and stakeholders to share their thoughts, questions, and concerns about CECAP.

All meeting materials, including recordings of virtual meetings, slide decks, meeting minutes or notes, and transcripts of WebEx chats, are available to view online. As CECAP progresses into its implementation phase, the county will maintain this level of transparency and public engagement, with the CECAP website serving as the central information source.

CURRENT POLICIES AND PROGRAMS/ IMPLEMENTATION

Turning words into action is no small feat. This report outlines 12 strategies to reduce local GHG emissions. As the planning phase of CECAP concludes and the implementation phase begins, it will take consolidated action across the entire Fairfax County community to meet the aggressive goals set by the Working Group. Throughout the implementation phase, Fairfax County has a unique role to play in tracking progress; identifying the needs of the community; developing and promoting partnerships to address those needs; and ensuring that policies, programs, and tools are in place to support CECAP implementation.

Due to a number of barriers, including economic and legislative obstacles, implementing the CECAP strategies will be challenging. However, the county has a number of policies, programs, and tools already in place across the Building, Energy, Transportation, Waste, and Natural Resources sectors that can be leveraged and expanded to help residents and businesses enact GHG reduction measures. Together with programs offered by federal, state, and other local actors, existing initiatives provide a starting point for many of the strategies included in this report. The Fairfax County community, including government, residents, businesses, and organizations, can continue to develop and support additional programs and policies at the local level, while advocating for state and federal assistance to help make the goals of CECAP a reality.

This section of the report identifies the existing programs, policies, and tools that can help community members begin to adopt the CECAP strategies across all the included sectors. Where appropriate, remaining challenges and potential implementation methods also are summarized for future consideration and action.

Strategies Related to Building Energy Use

CECAP has three strategies related to building energy use:

1. Increasing energy efficiency and conservation in existing buildings.
2. Electrify existing buildings.
3. Implementing green building standards for new buildings.

Because residential and commercial buildings account for the majority of community-wide Building sector GHG emissions in Fairfax County, implementing these strategies will be crucial to meeting the goals set by the Working Group. As highlighted below, existing policies and programs can be used to encourage the adoption of energy efficiency measures and green building practices for residents, businesses, and organizations.

Energy Efficiency and Conservation Programs

Implementing energy efficiency and conservation measures in homes and businesses can help community members reduce their GHG emissions while lowering their energy costs. During the February/March 2021 public engagement round of CECAP, community members identified a need for public education and outreach on such GHG-reducing activities. Financial assistance for energy improvement projects also was cited as a potential driver for action. A variety of programs and services available to Fairfax County community members that promote energy efficiency and conservation are highlighted below, including programs that offer outreach and financial assistance for energy improvement projects. Moving into the implementation phase, the county can look at ways to expand its own offerings, and work to increase connections between community members and partner organizations working in the same sphere.

Current offerings from the county include two outreach programs for residents geared toward energy efficiency and conservation. The first, Energy Action Fairfax, provides residents with information, resources, and assistance to reduce at-home energy use. Specific initiatives include LED lightbulb exchange events; information on home energy audits; and, in partnership with the Fairfax County Public Library, a thermal camera loan program.

The second program, HomeWise, educates, empowers, and enables residents to make changes that reduce their energy use, water use, and associated in-home costs. HomeWise began in FY 2021. As the program continues to develop, trained volunteers will assist low- and moderate-income residents with physical improvements to their homes and provide support for behavior changes that are proven to conserve resources and money. Educational ambassadors will connect with Fairfax County students and residents to raise awareness of personal actions that can save energy, water, and money.

Similar to HomeWise, the U.S. Department of Energy (DOE) has a Weatherization Assistance Program to support weatherization improvement upgrades for low-income households to reduce energy use and energy bills. The program, which is administered in Virginia by the state's Department of Housing and Community Development, helps families

and individuals improve the energy efficiency of their homes, while also assessing and eliminating related health and safety issues.

Further assistance for residents who wish to make home energy improvements may be available from utility service providers in the form of rebates or incentive programs. For example, Dominion Electric, the primary electric service provider in Fairfax County, provides a variety of rebates for home energy audits and improvements. Federal and state tax credits also may be available for select residential energy efficiency projects. Additional information on federal incentive and rebate programs may be found through the Database of State Incentives for Renewables & Efficiency.

On the commercial side, Fairfax County has a financing option in place for businesses and organizations to make substantial sustainability and resiliency improvements to their buildings through the Commercial Property Assessed Clean Energy and Resiliency (C-PACE) program. C-PACE is a financing tool designed to provide long-term private funding to building owners for energy-saving, water-saving, and resiliency improvement projects within commercial properties. The private loans are repaid via a special assessment. This lending model enables building owners to undertake large-scale projects and improvements with minimal initial capital outlays, preserving cash flow and producing near-term operational savings.

Green Building Policies and Practices

Implementing green building practices in new and existing buildings can help reduce energy use, water use, and waste, while providing health and environmental benefits for building occupants and the greater community. Fairfax County promotes residential and commercial green building practices by expediting reviews for qualifying buildings. This expedited review may translate into cost savings for the overall project and provide the developer with more certainty regarding review timeframes.

In addition, to promote green building practices in the private sector, the county's Comprehensive Plan includes a green building policy, which encourages green building in areas of the county where it is most appropriate. The county cites its own Sustainable Development Policy in the Comprehensive Plan as the standard for public-private partnerships (Objective 13, Policy f, p. 22). In September 2020, this policy was updated, setting a goal for Fairfax County capital projects to achieve a minimum of LEED Gold certification for new construction and major renovations. The policy has a goal of improving energy performance by a minimum of 30% compared with a baseline building for projects beginning design in FY 2021, to 50% in FY 2027, and being net zero-ready by 2031.

Operating within a Dillon Rule state, the county is unable to require stricter green building practices in the private sector than the standards set by the state. However, through Fairfax Green Initiatives, a series of environmental and energy-related action items set by the Board of Supervisors between 2019 and 2020, the county is committed to identifying and pursuing options at the state level to adopt more aggressive building design and code

changes. Success in these efforts could inform future implementation programs and policies in this sector.

Energy Supply

CECAP includes three strategies in the Energy Supply sector:

1. Increasing the amount of renewable energy in the electrif grid.
2. Increasing the production of onsite renewable energy.
3. Increasing the energy supply from resource-recovered gas, hydrogen, and power-to-gas.

As previously noted, commercial and residential buildings account for the majority of community-wide GHG emissions. Transitioning to clean, renewable energy generation is a necessary step to achieve GHG reduction goals. Several programs to facilitate this transition are described below.

Renewable Energy on the Grid

The role individuals and businesses can play in "greening the grid" is limited. The Emissions Reduction Strategies and Actions section (specifically Strategy 4) touched on the VCEA of 2020, and the expectation that the electric grid will become cleaner in accordance with the VCEA. It will largely be up to utility providers to meet the VCEA mandates and timelines.

That said, some of the larger corporations and organizations operating in Fairfax County could participate in, or may already be participating in, utility-scale power purchase agreements—equal to or greater than 20 MW—for renewable energy, such as offsite wind or solar. Organizations such as Facebook, Amazon, the University of Virginia, and Naval Station Oceana in Virginia Beach have all entered into agreements for very large-scale renewable energy generation. Due to statutory restrictions, organizations are typically unable to directly use the energy generated by these utility-scale projects. However, the organizations can sell the electricity these projects generate to the utility grid yet retain the environmental benefits, essentially offsetting their operational GHG emissions.

Through public engagement with businesses and organizations during the CECAP planning phase, the need to expand and reboot existing partnerships to work together on climate goals and strategies became clear. The pursuit of large-scale power purchase agreements is an example of a renewable energy activity that could be coordinated through a regional or local framework or program. This coordination could involve providing educational materials, connecting interested parties, and helping potential partners identify and address challenges.

Renewable Energy Programs

Renewable energy generation has grown steadily over the past five years in Fairfax County, particularly solar energy. This growth must increase dramatically to meet the goals of CECAP. The cost of renewable energy technology, such as solar, has significantly decreased

in recent years. However, for many, adopting renewable energy may not be feasible without financial assistance. The county offers both outreach and financial incentives for those who wish to install renewable energy, such as solar panels, at their homes or businesses. These programs are highlighted below. Similar to efforts in the energy efficiency and conservation realm, the county can look at ways to expand its own programs and promote partners' efforts in this area throughout the CECAP implementation phase.

To help boost adoption of solar, Fairfax County participates in an annual Solarize campaign run by the Local Energy Alliance Program and the Northern Virginia Regional Commission. Solarize links home and business owners with pre-selected solar vendors, which provide free assessments to determine whether a building has solar installation potential. If so, owners may take advantage of bulk discounts on solar systems for their home or business, including panels and battery storage systems.

Solar tax incentives also are available for community members. In addition to zero cost permit fees for solar hot water or solar PV projects, the county offers a limited solar tax incentive in accordance with the Virginia Code, Section 58.1-3661. This is covered by the county ordinance in Article 18, Chapter 4 of the Fairfax County Code. Essentially, qualifying solar equipment, as approved by the Department of Public Works and Environmental Services, can result in a tax credit (not an exemption) against the amount of property taxes due. The credit is determined by applying the local tax rate to the value of the solar equipment (the value is typically the cost of the equipment). The tax credit is available the first tax year following the date of application. The credit is good for five years. Although the concept was generally aimed at homes, both commercial and multi-unit residential properties qualify. Federal and state tax credits for residential renewable energy systems also are available through December 31, 2021.

Another option for promoting renewable energy is the county's C-PACE program. C-PACE, or Commercial Property Assessed Clean Energy, is an innovative clean energy financing tool that provides 100% upfront capital to commercial property owners, contractors, and others to facilitate the financing of renewable energy, energy efficiency, and resiliency projects on both existing buildings and new developments.

As the county identifies additional avenues to promote renewable energy in the CECAP implementation phase, collaboration across sectors could boost solar deployment through creative transactions that yield mutual benefit. For example, residents or owners of low-rise, multi-unit housing may desire a solar rooftop installation but be unable to afford its installation. A commercial business may want to green its energy use yet not have suitable roof area or space for solar panels. The business could pay some of the cost of the solar installation on the residential housing, and in return, receive the solar renewable energy credits for the electricity generated. Residents would benefit from lower monthly electricity costs, and businesses would receive full credit for the environmental benefits of the clean power. In some ways, this is not unlike a locally generated carbon offset, with the dollars remaining in the community. While such an arrangement is not permissible under current Virginia law, in time, it may be.

Although regulatory restrictions can prevent the more widespread use of solar in Virginia, some restrictions have been removed in recent years. Additional legislative proposals taken up by the county and many of its community members continue to seek a broader, less-encumbered market for solar deployment.

Transportation

CECAP identifies three transportation strategies:

1. Increasing electric vehicle adoption.
2. Reducing VMT through various approaches.
3. Increasing fuel economy and use of low-carbon fuels.

Transportation is the second largest GHG emissions source in the county. As such, implementing these three strategies is vital to the success of CECAP. Discussed below are existing programs, policies, and tools related to the first two transportation strategies.

Electric Vehicle Deployment

Transitioning from internal combustion engines to EVs can reduce GHG emissions associated with the Transportation sector. EVs are three to four times more efficient than fossil-powered vehicles, and therefore use less fuel per mile driven. As the electricity generated to power EVs becomes cleaner, the climate impacts of EVs will decrease year after year. There are some tools in place at the federal and state levels to promote EV adoption. For example, as of March 2021, Virginia has joined the California-led ZEV program, which will enable more EV sales across the state. The legislature also passed a bill to implement a $2,500 rebate for EV purchases in the state and allows income-eligible drivers to receive an additional $2,000 for an EV purchase. However, as EV technology continues to advance and becomes more prevalent, there is an opportunity for the county and other local and regional actors to develop new programs, policies, and incentives around EVs.

In terms of current offerings, the county is installing EV charging stations at 20 of its major facilities. These stations will be available for county fleet vehicles, as well as private vehicles. The stations will facilitate EV usage for employees and neighboring jurisdictions alike, easing concerns about charging availability cited by community members in the latest CECAP public engagement round. These public charging stations will add to the county's existing charging network (which drivers can look up through third-party mapping applications). Additionally, the Solarize program has begun offering bulk discounts to individual home and business owners to help facilitate the installation of EV charging technology on private properties throughout the county.

Increasing accessibility to charging stations can promote EV deployment to some extent; however, members of the public also indicated a need for EV incentives or rebates through the February/March 2021 public engagement round. The county's ability to offer EV rebates or incentives is extremely limited. It can, however, share information on federal and private sector programs for community members. For example, the federal government has a tax

credit for new electric and plug-in hybrid vehicles. Dominion Energy has some incentives for Virginia non-residential customers who wish to install smart charging stations. The Virginia state EV incentives are not effective until January 1, 2022, and currently there have been no funds allocated yet in the state budget for these rebates.

Up-to-date information regarding Virginia state laws and incentives for alternative fuels is available in the DOE Alternative Fuels Data Center Database. The county can continue to track and provide information on state, federal, and private sector incentives as updates become available.

Reducing VMT

Adopting EVs is important to reaching CECAP's goals. A number of approaches for this strategy have been identified in this report. Sustainable land use, active transportation, public transportation, and transportation demand management are all ways to reduce VMT. The county has existing policies, plans, and programs related to each approach, which are highlighted below.

Land use planning in Fairfax County is guided by the Comprehensive Plan. The Plan contains a Policy Plan with an Environment section with guidance on all forms of environmental protections, as well as policies regarding transportation, housing, and other related sectors. The land use and transportation policies of the Comprehensive Plan emphasize locating mixed-use development, such as employment centers and multifamily housing, in activity centers (e.g., the Tysons Urban Center, suburban centers, community business centers, transit station areas) with transportation options, especially rail transit. Transportation-oriented development guidelines were incorporated into the Policy Plan in March 2007. Locating housing, retail, and service centers by public and active transportation options is intended to allow those who live or work in or around these areas to reduce their dependence on personal vehicles.

In terms of active transportation, Fairfax County is developing an ActiveFairfax Transportation Plan to encourage transportation options such as walking, biking, rolling (scooter/wheelchair/stroller), hiking, and running. As the plan is being developed, the county is working with residents to identify mobility concerns, needs, and desires. Previous active transportation efforts, such as the Bicycle Master Plan and Countywide Trails Plan, are being consolidated into one cohesive document that is easy to digest and track. Through the plan, the county intends to:

- Encourage livable street design through the development of tools and products which ensure that its transportation network connects people to where they live, work, play, learn, and take transit.
- Support access to safe, comfortable, and connected active transportation facilities (such as shared-use paths, bike lanes, sidewalks) for people of all ages, incomes, and abilities.
- Provide clear direction to improve safety for the most vulnerable transportation users.
- Begin the planning process to update the Comprehensive Plan.

The county works locally and regionally to provide public transportation options to residents, employees, and other community members. The county operates the Fairfax Connector bus systems, which connect riders to regional transit hubs and other prime locations. Certain riders, such as Fairfax County Public School students, may be eligible for free or reduced-cost rides.

The county's current Transportation Demand Management program falls under Fairfax County Commuter Services (FCCS). To further promote alternative transit modes and reduce the use of single-occupancy vehicles, FCCS provides outreach and marketing to employers, residential communities, and individual commuters on alternative commuting incentives and programs (e.g., carpooling and teleworking).

As strategies in CECAP and concurrent planning initiatives, such as ActiveFairfax, are implemented, it will be important to track progress and identify the remaining challenges to reduce VMT. For example, the February/March 2021 public engagement round identified several challenges individuals have in reducing their use of personal vehicles. Cost and access to public transportation was frequently cited as an impediment, as was the availability of safe, connected pedestrian and biking infrastructure. Tracking these planning initiatives may identify future needs for expanded or new programs, policies, and tools.

Waste

While solid waste only accounts for about 2% of Fairfax County's GHG emissions, reduction and sustainable management of waste can address climate and environmental impacts on a broader scale. The two waste management strategies identified in CECAP are:

1. Reducing the amount of waste generated and diverting waste from landfills and WTE facilities.
2. Managing all waste generated responsibly.

The county has a number of programs, policies, and tools in place to facilitate these strategies. The county may continue to offer new programs as it develops innovative ways to reduce and manage waste. Select programs are highlighted below.

Waste Reduction and Diversion

To divert solid waste from the county's WTE facility, the county has established programs such as the Purple Can Club and the Food Scraps Composting Drop Off. The Purple Can Club was established in 2019 to collect and recycle glass bottles from residents. Purple bins are distributed across the county and region where residents may drop off their glass bottles. The bottles are collected and crushed, and the resulting product is used in county infrastructure projects or sold for reuse in commercial manufacturing. Residents can find their nearest purple bin ay Northern Virginia's Glass Recovery Program – Google My Maps.

The Food Scraps Composting Drop Off is a pilot program developed in late 2020 that allows residents to drop off food scraps at the I-95 Landfill and I-66 Transfer Station. Food scraps

are collected by a third-party and composted, thus diverting waste that would otherwise be incinerated at the WTE facility. In connection with this pilot, the county has produced a number of educational and outreach materials about composting food scraps and yard waste at home and with the county. Residents can find more information about the county's composting initiatives at Composting Organic Waste | Public Works and Environmental Services (fairfaxcounty.gov).

Waste Management

The county's Solid Waste Management Plan, accepted by the Virginia Department of Environmental Quality in 2005 and revised in 2010 and 2015, is a 20-year strategy to ensure adequate capacity for the solid waste generated within Fairfax County. Staff designed the solid waste management system around the following strategic goals:

- Maintain a balanced solid waste management system that benefits the community while following regulatory requirements.
- Provide efficient and economical refuse collection, recycling, and disposal services.
- Reduce the volume of the solid waste stream through the implementation of waste reduction and recycling programs.
- Provide for the operation of sanitary waste disposal facilities, utilizing the most environmentally acceptable and economically viable methods available.

Fairfax County offers a variety of recycling options for household recyclables, as well as household hazardous waste. All Fairfax County citizens can drop off recycling at county facilities. Residential recycling is handled either by the county or a private waste hauler collection service. In February 2021, the Board of Supervisors approved an amendment to the Solid Waste Management ordinance to ban the use of plastic bags for yard waste.

Public engagement conducted throughout the CECAP planning process identified a number of pain points related to waste management. For example, residents frequently cited a need for increased education and outreach about what can and cannot be recycled. As the CECAP waste strategies are implemented, the county can do its part by addressing these points in new or existing programs.

Natural Resources

CECAP includes one Natural Resources sector strategy:

1. Supporting the preservation, restoration, and expansion of Fairfax County's natural systems, green spaces, and soil quality.

Natural systems can act as carbon sinks by capturing and storing CO_2 that would otherwise be released into the atmosphere. Protecting and enhancing green spaces can help reduce the impacts of climate change. The county has a number of policies in place that aim to protect and enhance its natural resources. As many of these plans are periodically

reassessed, future reviews may help further facilitate the CECAP goals and strategies. Such plans include the Comprehensive Plan, natural resource management policies and plans, and watershed management plans highlighted below. To actively protect natural resources, community members can participate in existing environmental stewardship programs, which also are briefly noted below.

Natural Resource Management Policies/Plans

Fairfax County has a variety of natural resource management plans, including the Park Authority Policy, the Park Authority's Natural Resource Management Plan, and the Tree Action Plan. The Fairfax County Park Authority Board approved new mission and vision statements for the Park Authority in 2018 that focus on both active and passive recreation, along with natural resource preservation. The Natural Resource Management Plan coordinates agency-wide efforts to achieve the natural resource preservation mission of the Fairfax County Park Authority. The Tree Action Plan, adopted in 2006 and updated in 2019, is a 20-year strategy to preserve and restore tree cover in the county.

Stormwater Management/Watersheds

Fairfax County has made significant investments in stormwater management and water pollution control mechanisms. The county is proactive in reducing the negative effects of stormwater runoff and preventing water pollution. The county has developed comprehensive watershed management plans for each of its 30 watersheds. The plans identify issues affecting the environment and provide guidance for protecting and restoring the county's stream corridors.

Virginia Conservation Assistance Program

Outside of county policies and plans, residents and organizations can take advantage of natural resource management programs offered by county partners such as the Northern Virginia Soil and Water Conservation District (NVSWCD). One such program the NVSWCD coordinates locally is the Virginia Conservation Assistance Program (VCAP), which assists individual private property owners, homeowner and community associations, and places of worship as they install watershed conservation projects.

Environmental Stewardship

The county is ripe with environmental stewardship opportunities through which community members can actively preserve and restore natural resources on public and private land. Many of these opportunities are highlighted in Section 3.8 of the Fairfax County Sustainability Initiatives report.

Next Steps

Fairfax County has a longstanding commitment to sustainability, as demonstrated through the numerous environmental and energy programs, policies, and tools highlighted in this section. These programs, policies, and tools are closely related to the strategies identified in CECAP. That said, CECAP includes aggressive GHG reduction goals that will be challenging to meet. It will take all community members acting together to meet these goals. The county's programs, policies, and tools can serve as a starting point for new or expanded initiatives.

External programs and outreach opportunities also will be vitally important to the success of CECAP. Successful strategy implementation will not be possible without collaborative partnerships among businesses, advocacy groups, educational and other institutions, and community organizations. Many of these potential partners were active participants during the planning process, with their representatives serving on the Task Force/Working Group. Now, even broader participation will be needed.

As CECAP moves to the implementation phase, continued dialogue with the community will be needed to further progress toward goals and to determine where additional action is needed. Meeting the goals implementing the strategies laid out in CECAP will be difficult, but the county embraces the opportunity to work with the community to meet these challenges head-on.

APPENDICES

Appendix A: Acronyms

ACEEE	American Council for an Energy-Efficient Economy
AD	Anaerobic digestion
ADA	Americans with Disabilities Act
AFLEET	Alternative Fuel Life-Cycle Environmental and Economic Transportation
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
AV	Autonomous vehicles
BAU	Business-as-usual
BEV	Battery electric vehicles
BOS	Board of Supervisors
BRT	Bus rapid transit
CAFE	Corporate Average Fuel Economy
CARB	California Air Resources Board
CCUS	Carbon capture utilization and storage
CECAP	Community-Wide Energy and Climate Action Plan
CEEPC	Climate, Energy and Environment Policy Committee
CHP	Combined heat and power
CMAQ	Congestion Mitigation and Air Quality
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
COG	Metropolitan Washington Council of Governments
DOE	Department of Energy
DSM	Demand-side management
EaaS	Energy-as-a-service
EPA	Environmental Protection Agency
ESCO	Energy service company
EUI	Energy use intensity
EV	Electric vehicle
FCCS	Fairfax County Commuter Services
FCPS	Fairfax County Public Schools
GHG	Greenhouse gas
GWP	Global warming potential
HFC	Hydrofluorocarbons
HVAC	Heating, ventilation, and air conditioning
ICLEI	Local Governments for Sustainability
IECC	International Energy Conservation Code
LCFS	Low Carbon Fuel Standard
LEED	Leadership in Energy and Environmental Design
LMI	Low and moderate income

MAH	Multifamily Affordable Housing
MSW	Municipal solid waste
MSWG	Multi-Sector Working Group
MT CO_2e	Metric tons of carbon dioxide equivalent
MMT CO_2e	Million metric tons of carbon dioxide equivalent
MW	Megawatt
NGBS	National Green Building Standard
NVSWCD	Northern Virginia Soil and Water Conservation District
OEEC	Office of Environmental and Energy Coordination
PACE	Property assessed clean energy
PFC	Perfluorocarbons
PHEV	Plug-in hybrid electric vehicles
PPA	Power purchase agreements
PV	Photovoltaic
REC	Renewable electricity certificates
RGGI	Regional Greenhouse Gas Initiative
R-PACE	Residential Property Assessed Clean Energy
RPA	Resource Protection Area
RTO	Regional transmission organization
SAFE	Safer Affordable Fuel-Efficient
SOMAH	Solar on Multifamily Affordable Housing
TDM	Transportation demand management
VCEA	Virginia Clean Economy Act
VGI	Vehicle-grid integration
VMT	Vehicle-miles traveled
WTE	Waste-to-energy
ZEV	Zero-emission vehicle

Appendix B: Glossary

Action: A project or specific technology that impacts greenhouse gas emissions within a strategy or sector.

Base year: The historical year against which the future reduction goal will be compared.

Carbon neutrality: Achieving net zero greenhouse gas emissions by balancing greenhouse gases released with an equivalent amount sequestered or offset through carbon credits, as defined during the CECAP Working Group's goal-setting process.

CO_2 equivalent (CO_2e): Basic unit of measure used to sum different GHGs by comparing their respective relative global warming effect to an index unit, namely the global warming effect of carbon dioxide.

Fugitive emissions: Leaks and irregular releases; refers to releases from various sources including leaks in natural gas distribution systems and releases of hydrofluorocarbons.

Goal boundary: A boundary of what emissions sources are included in the base and target years.

Goal type: Goal type can vary and may include long-term, interim-term, sector-based, and others.

Greenhouse gases (GHGs): Gases that trap heat in the atmosphere, contributing to global warming and climate change. Common GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_20), and fluorinated gases.

Greenhouse gas reductions: Decreases in the emissions of heat-trapping greenhouse gases into the atmosphere.

Impact: Effect of an action on a specific value or indicator.

Implementation: Programs or policies that support the realization of actions.

Power-to-gas: Refers to the process of converting renewable energy into a synthetic gas, usually by first creating renewable hydrogen and then combining it with biologically derived carbon, to create a methane molecule equivalent to natural gas.

Renewable energy: Energy generated from renewable, non-fossil fuel sources such as solar and wind.

Resource recovered gas: Commonly referred to as renewable natural gas, this term refers to biogas created from decomposed organic matter through anaerobic digestion, thermochemical processes, or gasification. Biogas may be sourced from landfills, livestock operations, or wastewater treatment plants.

Sector: An area of emissions focus or an economic sector that generates GHG emissions from its energy use or economic activity.

Strategy: A broader set of actions or set of subsector work that can be modeled to understand GHG emissions reductions.

Target year: The future year by which communities aim to achieve their goal.

Appendix C: Full GHG Inventory Report, Business-As-Usual Projections, and Emissions Reduction Scenarios

The materials developed by COG as part of the CECAP process, including the full GHG inventory, business-as-usual projections, and emissions reduction scenarios, can be found at the following links:

Fairfax County Greenhouse Gas Emissions Fact Sheet from COG

Draft Emissions Reduction Scenarios Overview

Draft Emissions Reduction Scenarios Excel Spreadsheet

Draft Business-as-Usual Projections

Draft Greenhouse Gas Inventory Methodology Report

Appendix D: GHG Modeling Methodology

Each GHG reduction strategy was quantitatively modeled to estimate the GHG reduction potential. Methodologies are provided below for each strategy and specify action-level methods. Key assumptions and data sources are included in each description.

Strategy 1: Increase Energy Efficiency and Conservation in Existing Buildings

The methodology to estimate GHG reductions from energy efficiency and conservation (Actions 1a and 1b) assumes that residential buildings have savings of 30% for electricity and 20% for gas, and commercial buildings have savings of 25% for electricity and 20% for gas compared with the business-as-usual scenario. All savings are achieved by 2050.

Modeling for this strategy focused on residential and commercial energy and GHG savings. Energy efficiency in existing local government buildings and streetlights (Action 1c), implementation of district energy and CHP systems (Action 1d), and gas and electricity demand programs (Action 1e) were not quantitatively modeled. It is expected that residential and commercial energy savings through energy efficiency will comprise the most GHG savings associated with this strategy. The needs of district energy and CHP systems (e.g., size) should be identified to estimate GHG reductions accurately.

Strategy 2: Electrify Existing Buildings

The methodology to estimate GHG reductions from residential electrification (Action 2a) assumes switching of the fuel source from natural gas to electricity for 75% of single-family homes, 50% of multifamily homes, and 20% of commercial buildings by 2050.

Electrification factors were used to represent the electricity used once natural gas systems were replaced. For residential buildings (both single and multifamily), a Heating Seasonal Performance Factor of 8.2 was used (the equivalent of an ENERGY STAR air source heat pump[78]). For commercial building electrification (Action 2b) GHG reductions, an overall electrification factor of 18% was used in alignment with an American Council for an Energy-Efficient Economy (ACEEE) study on commercial buildings.[79] For HFCs (Action 2c), the methodology assumes a reduction in total emissions from HFCs following the Kigali Amendment schedule (35% reduction by 2025, 70% in 2029, 80% in 2034, and 85% in 2035) and in line with the American Innovation and Manufacturing Act. The model also assumes a 20-year life of equipment.

Strategy 3: Implement Green Building Standards for New Buildings

The methodology to estimate GHG reductions from increased building code stringency (Action 3a) assumes that new construction will be above current code standards, with high energy efficiency and electrification by 2030 and 2040, respectively, for both residential

[78] ENERGY STAR. Available at https://www.energystar.gov/products/heating_cooling/heat_pumps_air_source/key_product_criteria.
[79] ACEEE. 2020. Electrifying Space Heating in Existing Commercial Buildings. p. 56. Available at https://www.aceee.org/sites/default/files/pdfs/b2004.pdf.

and commercial sectors (Action 3b). The modeling assumes baseline building codes of IECC 2015 for residential buildings and ASHRAE 2013 for commercial buildings, with building code upgrades every six years. A 90% compliance rate for each sector is also assumed to estimate energy savings and GHG reductions. Natural gas savings that would have occurred from increased building code stringency after 2030 and 2040 for the residential and commercial sectors, respectively, are assumed to be savings in electricity use. Green building principles and practices (Action 3c) and reuse of existing buildings (Action 3d) were not modeled quantitatively.

Strategy 4: Increase the Amount of Renewable Energy in the Electric Grid

For the methodology to estimate GHG reductions associated with this strategy (Actions 4a, 4b, and 4c), the model assumes the VCEA schedule of 100% renewable sources by 2045 and allowance of continued nuclear operations compared with baseline estimates developed using the Energy Information Administration's Annual Energy Outlook projections for the PJM/Dominion region. The model assumes that grid storage technologies will be deployed to support the renewable generation required by VCEA.

Strategy 5: Increase Production of Onsite Renewable Energy

The methodology to estimate GHG reductions from solar on existing and new buildings and from community solar projects (Action 5a, 5b, and 5c) was to calculate the maximum technical potential of rooftop solar energy in Fairfax County. The 2018 solar rooftop capacity was estimated using Google's Project Sunroof[80] and was then projected through 2050 using a population growth factor. Solar panels were assumed to be installed on 100% of available rooftop space by 2050, and on 37% of available rooftop space by 2030. Battery storage projects (Action 5d) are assumed to come online to support storage of onsite renewable generation. The model does not include quantitative modeling on battery storage projects.

Strategy 6: Increase Energy Supply from Resource-Recovered Gas, Hydrogen, and Power-to-Gas

The methodology to estimate GHG reductions from this strategy (Action 6a) considered the Greater Washington, D.C. region's technical potential for resource-recovered gas production through 2040 and scaled the potential to a Fairfax County technical potential using data on gas demand county- and region-wide. GHG reductions were estimated by assuming the technical potential of resource-recovered gas will replace conventional natural gas use in Fairfax County. Power-to-gas technologies were not modeled quantitatively.

Strategy 7: Increase EV Adoption

The methodology to estimate GHG reductions from increased electric vehicle use from county assets and throughout the community (Actions 7a and 7b) assumes that 42% of the vehicles in Fairfax County are electric by 2050. While a higher fraction of zero-emission vehicles by 2050 is possible, this choice represents a realistic scenario, recognizing that

[80] https://www.google.com/get/sunroof

policy and technology limitations might prevent reaching the goal of 100% EVs by 2050. Within the vehicle categories, passenger cars, passenger light trucks, and commercial trucks are assumed to have the highest penetration of EVs by 2050 (55%, 45%, and 9% EVs by 2050, respectively) based on currently available technology and projected market trends. These three vehicle categories are also responsible for the majority of VMT and, thus, for most of the GHG emissions from the Transportation sector in Fairfax County. The fuel economy values used for the GHG calculations were obtained by the Argonne National Laboratory Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) tool[81] and fuel economy data from the U.S. EPA.[82] Action 7c (Install EV Chargers in New Buildings) was not modeled quantitatively as it mostly pertained to adopting zoning policies to advance EV readiness in new constructions, and therefore EV adoption in the county. Finally, the GHG emissions reductions resulting from this strategy were layered with the GHG reductions in other strategies to avoid double counting.

Strategy 8: Support Sustainable Land Use, Active Transportation, Public Transportation, and TDM to Reduce Vehicle-Miles Traveled

The methodology to estimate GHG reductions associated with this strategy (Actions 8a, 8b, and 8c) uses existing trends adjusted to Fairfax County geography, commuting patterns, infrastructure plans, and the projected population increase. After accounting for all these factors, the percentage of commuting by biking was set to increase from the current share of ~0.2% to 1.5% by 2030 and 3% by 2050, while walking was held constant at 1.4%. Carpooling and vanpooling are assumed to increase at a rate of 1% per year, going from the current share of 10% to 15% in 2030 and 25% in 2050. Public transit utilization is assumed to reach 15% by 2030 and 20% by 2050. Finally, the strategy models telework to account for 10% in 2030 and 15% by 2050. When modeling the emissions reductions due to mode shift from private driving, only emissions from light-duty passenger cars and trucks were reduced. Additionally, only the portion of total VMT attributed to commuting (30%) is used to determine VMT reductions from increased use of public transit and teleworking. However, the increased availability of active and public transportation modes for non-commuting trips was incorporated, resulting in an additional 10% reduction of VMT during weekends. Similar to Strategy 7, the GHG emissions reductions resulting from this strategy were layered with the GHG reductions in other strategies to avoid double counting.

Strategy 9: Increase Fuel Economy and Use of Low-Carbon Fuels for Transportation

The methodology to estimate GHG reductions for this strategy included the following assumptions. First, the modeling excludes vehicles that have already transitioned to EVs. In modeling the adoption of low-carbon fuels (Action 9a), the average GHG reduction from using alternative fuels such as biofuels was set at 25%. This number is based on emission factors reported by the Argonne National Laboratory (the number only reflects emissions from fuel burning and does not include emissions from fuel production, which can be up to 80% lower than petroleum-based fuels in the case of soy-derived fuel).[83] A 25% GHG

[81] Argonne National Laboratory (anl.gov). AFLEET Tool.
[82] Fuel Economy.
[83] Alternative Fuels Data Center: Biodiesel Vehicle Emissions (energy.gov).

emissions reduction would also occur from gasoline and diesel vehicles converting to hybrid-electric, also an alternate fuel technology that is readily available today. Action 9a assumes that the percentage of new on-road vehicles using alternate fuels and technology is 100% for light-duty vehicles and 80% for medium- and heavy-duty vehicles by 2030. For off-road vehicles, it is assumed that the switch to low-carbon fuels yields a 2% GHG emissions reduction by 2025, 50% reduction by 2035, and 80% reduction by 2050. Finally, low-carbon fuel adoption was also modeled for aviation based on the Sustainable Aviation Fuel Act (Action 9c). In the case of aviation, it is assumed that the switch to low-carbon fuels yields a 2% GHG emissions reduction by 2025, 35% reduction by 2035, and 100% reduction by 2050.

To model the increased fuel economy (Action 9b), the current federal fuel economy standards (i.e., SAFE standards) are applied to new light-duty passenger vehicles and trucks through 2026, reaching 40 miles per gallon (mpg) in 2026. After that, the fuel economy is increased by ~1% every year and reaches 52 mpg through 2050.

Strategy 10: Reduce the Amount of Waste Generated and Divert Waste from Landfills and Waste-to-Energy Facilities

The methodology to estimate GHG reductions from waste reduction and diversion (Actions 10a and 10b) assumes a 50% reduction in waste generation by 2030 and an 80% reduction by 2050 (compared with a 2015 baseline). The modeling also assumes that waste will continue to be sent to a waste-to-energy facility throughout the projection period.

These modeling assumptions were set based on the reductions necessary to meet the long-term carbon neutrality goal by 2050, as well as the following national-level goals and guidance—the U.S. EPA national goal to increase the U.S. recycling rate to 50% by 2030; C40's Advancing Towards Zero Waste Declaration to reduce the amount of municipal solid waste disposed to landfill and waste-to-energy facilities by at least 50% by 2030 compared with 2015; and the United States Department of Agriculture and EPA first-ever domestic food waste goal, announced in 2015, to reduce food loss and waste by 50% by the year 2030.

Strategy 11: Responsibly Manage Waste Generated

The methodology to estimate GHG reductions from responsibly managed waste (Actions 11a and 11b) assumes an improvement in the emissions per ton from the waste-to-energy facility. Specifically, the model assumes a reduction in the CO_2 emissions factor for waste sent to a waste-to-energy facility from the baseline value of 0.33 MT CO_2 per short ton of waste to 0.26 MT CO_2 per short ton of waste, based on a study[84] on best practices at waste-to-energy facilities. The model also assumes reduced waste sent to waste-to-energy based on the waste generated in Strategy 10 modeling.

The methodology did not include quantitative GHG reductions from improvements to wastewater treatment processes (Action 11c) as reductions were assumed to be negligible.

[84] Obermoser, M., Fellner, J., and Rechberger, H. 2009. Determination of reliable CO2 emission factors for waste-to-energy plants. Waste Management & Research, 27(9), 907–913.

Strategy 12: Support Preservation, Restoration, and Expansion of Fairfax County's Natural Systems, Green Spaces, and Soil Quality

The GHG reductions from the expansion of natural systems, green spaces, and soil quality (Actions 12a and 12b) were modeled with the assumption that tree coverage by 2050 would align with the potential tree canopy area identified in the 2015 Fairfax Country Tree Canopy Report. In order to model these improvements, the current extent of the tree canopy was inventoried, and the sequestration factor for the projected coverage was determined based on current levels of sequestration. This was compared to multiple projections for future green space area, including business-as-usual, improvements that are possible within the county right now with existing restrictions, possible improvements and programs that are currently not allowed without state enabling legislation, and the impact of potential state and federal programs.

Key Differences between ICF and COG Business-as-Usual (BAU) Emissions Projections

The BAU projections developed by ICF for the GHG modeling in Step 3 of the CECAP planning process differ from the BAU projections developed by COG in Step 2. (See the CECAP Process and Methodology section for more on the steps of the process.)

These differences exist for several reasons, with the largest driver being the use of a different methodology for projecting electricity grid emission factors. Other reasons include differing methodologies to estimate source emissions in the transportation sector, use of different emission factors associated with fuel combustion in buildings, and the inclusion of aviation emissions in the BAU projections used for the GHG modeling in Step 3. This section compares the differences between the two methodologies. A link to the methodology for the BAU projections developed by COG is provided in Appendix C.

Electricity Emissions Factors

The key difference between ICF's and COG's BAU projections is emission factors developed to estimate emissions from electricity in each analysis. ICF's BAU estimates are based on eGRID's SRVC subregion emission factor for 2018. Years after 2018 are scaled using the Energy Information Administration's (EIA) Annual Energy Outlook (AEO) projections for electricity generation in the PJM/Dominion region. EIA's AEO accounts for planned policies that may impact electricity grid changes regionally, and the use of these estimates to adjust forecasted emission factors are useful indicator to project grid changes. COG's estimates also use eGRID's 2018 SRVC subregion emission factor, but keep this factor constant through the projection period.

Fuel Emissions Factors

The emission factors used to estimate emissions from LPG and fuel oil by COG in ClearPath are also different than the emission factors used by ICF to estimate emissions from combustion of those fuels in buildings. ICF's projections used emission factors from the EPA's Greenhouse Gas Emission Factor Hub.

Transportation Sector

Transportation sector emissions contain two key differences. First, ICF's BAU estimates include emissions from aviation in the transportation sector and COG's BAU estimates exclude this source of emissions. Second, off-road emissions in ICF's BAU are projected with population data, while they are held constant in COG's BAU.

Other Differences

Building energy growth: ICF calculated the growth of building sector energy use based on the previous year's value (i.e., existing plus new energy use in one year becomes the existing energy use value for the next year), whereas COG calculated growth based on a static year. As a result, ICF's BAU energy use estimates are slightly higher than COG's.

On-road transportation factors: COG derived an $MTCO_2e$ factor from the MOVES Model output for on-road transportation, whereas ICF derived factors for each greenhouse gas. This caused a small difference in BAU projections.

On-road transportation projections: ICF projected linear growth in on-road transportation emissions between 2045 and 2050, whereas COG used specific values for 2045 and 2050 and interpolated results for interim years.

Appendix E: Working Group Brainstorming Matrix

At the Working Group meetings in December 2020 and January 2021, members of the Working Group sector-based subgroups—the Energy Subgroup and the Transportation and Development Subgroup—brainstormed technologies and actions to be included under each of the 12 strategies in CECAP. Working Group members also brainstormed the impacts and implementation methods of those technologies and actions.

An Excel matrix was developed to organize the ideas generated at those meetings. The matrix can be found at https://www.fairfaxcounty.gov/environment-energy-coordination/sites/environment-energy-coordination/files/Assets/documents/Mural%20Brainstorming%20Matrix_2.24.2021.xlsx.

The online whiteboards for each of these meetings can be viewed in the December 2020 and January 2021 Working Group meeting materials at https://www.fairfaxcounty.gov/environment-energy-coordination/cecap-working-group.

Appendix F: Results of the Working Group Prioritization Exercise

At the Working Group meetings on March 24, 2021 and March 25, 2021, Working Group members participated in a prioritization exercise to emphasize and/or de-emphasize each of the 12 strategies in CECAP. ICF facilitators led the Working Group members through the exercise in Mural, an online whiteboarding tool.

Each participant was given six votes to indicate a preference for emphasizing strategies and a separate six votes to indicate a preference for de-emphasizing strategies. The Mural platform uses the term "vote"; however, this exercise was meant to indicate preferences rather than formal votes of the Working Group. The exercise resulted in a list of the strategies to emphasize in the report and those to de-emphasize. The prioritization exercise informed the Working Group Priorities textboxes in the strategy sections of the report.

Results from Energy Subgroup

The Energy Subgroup of the Working Group prioritized Strategies 1 through 6 as follows:

Ranking of votes to prioritize the strategy (in order of most votes to least)

- Strategy 1: Increase Energy Efficiency and Conservation in Existing Buildings
- Strategy 4: Increase the Amount of Renewable Energy in the Electric Grid
- Strategy 3: Implement Green Building Standards for New Buildings
- Strategy 2: Electrify Existing Buildings, Strategy 5: Increase Production of Onsite Renewable Energy, and Strategy 6: Increase Energy Supply from Resource-Recovered Gas, Hydrogen, and Power-to-Gas (each received the same number of votes)

Ranking of votes to de-prioritize the strategy (in order of most votes to least)

- Strategy 6: Increase Energy Supply from Resource-Recovered Gas, Hydrogen, and Power-to-Gas
- Strategy 5: Increase Production of Onsite Renewable Energy
- Strategy 3: Implement Green Building Standards for New Buildings
- Strategy 2: Electrify Existing Buildings
- Strategy 4: Increase the Amount of Renewable Energy in the Electric Grid
- Strategy 1: Increase Energy Efficiency and Conservation in Existing Buildings

Additional Resources

Recordings of the meeting and meeting materials, including the full WebEx chat transcript and Mural board.

Results from Transportation and Development Subgroup

The Transportation and Development Subgroup of the Working Group prioritized Strategies 7 through 12 as follows:

Ranking of votes to prioritize the strategy (in order of most votes to least)

- Strategy 8: Support Sustainable Land Use, Active and Public Transportation, and TDM to Reduce VMT
- Strategy 12: Support Preservation, Restoration, and Expansion of Natural Systems, Public Spaces, and Soil Quality
- Strategy 7: Increase EV Adoption and Strategy 9: Increase Fuel Economy and Use of Low-Carbon Fuels for Transportation (each received the same number of votes)
- Strategy 10: Reduce the Amount of Waste Generated and Divert Waste from Landfills and Waste-to-Energy Facilities
- Strategy 11: Responsibly Manage All Waste Generated

Ranking of votes to de-prioritize the strategy (in order of most votes to least)

- Strategy 11: Responsibly Manage All Waste Generated
- Strategy 10: Reduce the Amount of Waste Generated and Divert Waste from Landfills and Waste-to-Energy Facilities and Strategy 9: Increase Fuel Economy and Use of Low-Carbon Fuels for Transportation (each received the same number of votes)
- Strategy 8: Support Sustainable Land Use, Active and Public Transportation, and TDM to Reduce VMT
- Strategy 7: Increase EV Adoption
- Strategy 12: Support Preservation, Restoration, and Expansion of Natural Systems, Public Spaces, and Soil Quality

Additional Resources

Recordings of the meeting and meeting materials, including the full WebEx chat transcript and Mural board.

Appendix G: Summary of Public Feedback

The public had the opportunity to provide feedback at three points during the CECAP process. In August/September of 2020 there were three public feedback meetings and an online public survey. In February/March of 2021, there were two facilitated public meetings and an online public survey. Finally, in May of 2021, there were two facilitated public meetings.

Links to the meeting recording and materials and surveys can be found here: https://www.fairfaxcounty.gov/environment-energy-coordination/public-engagement-cecap

PAST CECAP PUBLIC MEETINGS

Development of the Community-wide Energy and Climate Action Plan (CECAP) included three rounds of public engagement. The first round was conducted in August and September 2020, the second round is being conducted in February and March 2021, and the third round will take place in May 2021. Below you will find links to past meeting pages where more detailed information is available.

- August 27, 2020 Meeting
- September 1, 2020 Meeting
- September 2, 2020 Meeting
- February 23, 2021 Meeting
- February 25, 2021 Meeting
- May 18, 2021 Meeting
- May 20, 2021 Meeting

PAST CECAP PUBLIC SURVEYS

In August and September of 2020, the Office of Environmental and Energy Coordination issued a public survey to gather an initial round of public input on the development of the Community-wide Energy and Action Plan (CECAP). A subsequent series of surveys were issued in February 2021 and remained open until mid-March.

The full results of the February/March 2021 survey can be found here (including Appendix A with demographics).

Appendix B with the raw data for the open-ended questions can be found here.

A summary of the responses to the multiple choice questions from August/September 2020 survey can be found here.

A summary of the comments made in response to the August/September survey can be found here.

Contact Information

Office of Environmental and Energy Coordination
12000 Government Center Pkwy, Suite 533
Fairfax, VA 22035
cecapoutreach@fairfaxcounty.gov
https://www.fairfaxcounty.gov/environment-energy-coordination

ADA Statement

The County of Fairfax is committed to a policy of nondiscrimination in all County programs, services and activities and will provide reasonable accommodations upon request.

Photo Credits

Figure 1: Flash flooding event in Fairfax County, Va. in July 2019 (Tysons Reporter/ First photo via @SteveML9022/Twitter). Retrieved from Tysons Reporter. 30 July 2019. “Flash Flooding Damage in Fairfax County Costing Millions for Repairs.” https://www.tysonsreporter.com/2019/07/30/flash-flooding-damage-in-fairfax-county-costing-millions-for-repairs/.