

DRAFT Community Energy and Sustainability Master Plan

Prince William County, Office of Sustainability

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Glossary

Term	Definition
Adaptation	The process of adjustment to actual or expected climate and its effects
Carbon offset	Carbon offsets represent the reduction or removal of greenhouse gas emissions that compensate for emissions emitted somewhere else
Climate action	An action that reduces greenhouse gas emissions or climate risk
Climate change	A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer
Climate mitigation	Reducing emissions of and stabilizing the levels of heat-trapping greenhouse gases in the atmosphere
Greenhouse gas reduction scenario	A greenhouse gas reduction scenario represents a group of high-level technological strategies that are needed to reach a greenhouse gas reduction goal
Greenhouse gas reduction strategy	Greenhouse gas reduction strategies are high-level technological strategies that help meet a greenhouse gas reduction goal. Examples of technological strategies include switching electricity generation sources from fossil fuels to renewables, travel mode shifting from single-occupancy vehicles toward active and public transportation, and electrifying buildings
Greenhouse gas	Gases in the earth's atmosphere that trap heat
Renewable energy	To meet the County's renewable electricity goals, renewable electricity is being defined as electricity coming from any non-fossil fuel energy source, such as solar, wind, hydro, geothermal, and nuclear
Resiliency	The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation
Sequestration	Process of capturing and storing atmospheric carbon dioxide
Vehicle Miles Traveled	The number of miles traveled by a vehicle
Vulnerability	The propensity or predisposition to be adversely affected

Acronyms

Acronym	Definition
ASAP	Action Selection and Prioritization
°C	degrees Celsius
CCA	community choice aggregation
CESMP	Community Energy and Sustainability Master Plan
CH ₄	methane
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide equivalent
CPA	comprehensive plan amendments
C-PACE	Commercial Property Assessed Clean Energy
DCSM	Design and Construction Standards Manual
DRPT	Department of Rail and Public Transportation
EEA	equity emphasis area
EV	electric vehicle
°F	degrees Fahrenheit
FEMA	Federal Emergency Management Agency
FY	fiscal year
GHG	greenhouse gas
GWP	global warming potential
HFC	hydrofluorocarbon
HOA	homeowners' association
HVAC	heating, ventilation, air conditioning
IJJA	Infrastructure Investment and Jobs Act
IPCC	Intergovernmental Panel on Climate Change
IRA	Inflation Reduction Act
JET	Joint Environmental Task Force
MTCO ₂ e	metric tons of carbon dioxide equivalent
MWCOG	Metropolitan Washington Council of Governments
N ₂ O	nitrous oxide
NOS	natural open space
NOVEC	Northern Virginia Electric Cooperative
PPA	Power Purchase Agreement
PRTC	Potomac and Rappahannock Transportation Commission
PWC	Prince William County
PWCS	Prince William County School
PWCSA	Prince William County Service Authority
RECs	renewable energy certificates
RPS	Renewable Portfolio Standard
SUP	special use permits
TOD	transit oriented development
ZEV	zero-emission vehicle
VDOT	Virginia Department of Transportation
VMT	vehicle miles traveled
VPPAs	Virtual Power Purchase Agreements
VRE	Virginia Railway Express

Letter from County Executive

The time for climate action is now. The Prince William Board of County Supervisors adopted the county's Climate Mitigation and Resiliency Goals in 2020. These aspirational goals are focused on reducing greenhouse gas emissions, incorporating renewable energy, and becoming more resilient to the effects of climate change. In adopting these goals, the County committed to doing our part locally, regionally, and globally in reducing our climate impact.

The Community Energy and Sustainability Master Plan (CESMP) provides actionable steps that the county can take in striving to meet our goals. The actions recommended in this plan are ambitious to meet the moment and the level of ambition set forth by the goals. Decreasing our county's emissions by 50% by 2030 from a 2005 baseline, for example, will require an intentional shift from business as usual. However, the strategies and frameworks that these actions have been built upon are not new for Prince William. They expand upon the smart growth measures and sustainability action strategies included in our Comprehensive Plan and Strategic Plan and take them to the next step of implementation.

This plan not only lays out how we could meet our climate goals, but also how we can be resilient and adaptable to the effects of climate change. Resiliency is important for the county as a whole, but particularly for low income and minority communities who often experience the burden of climate change impacts the most, including extreme heat, flooding, and poor air quality. Knowing that Prince William is Virginia's most diverse county, it was critically important that environmental justice and equity principles were foundational in its development. The plan's Vulnerability Assessment identified the climate hazards that would most affect the county's socially vulnerable populations, and climate adaptation actions have been recommended to mitigate them.

Developing the CESMP is step one in moving towards meeting our climate goals. We view this as a living document that will continually be updated as we take advantage of new technology and policies that lead to more efficient and cost-effective strategies. We understand that we must be both adaptable in our approach and urgent to meet the time sensitive challenges of climate change.

This plan is calling for an all-hands approach to tackling climate change in Prince William. Implementation will require participation and collaboration from our government agencies, the school division, businesses, and residents. We invite you to engage in this journey together as we strive for a cleaner and greener Prince William for generations to come.

Executive Summary

On November 17, 2020, the Prince William County (the County)¹ Board of County Supervisors (Board) adopted Climate Mitigation and Resiliency Goals. This plan, the Community Energy and Sustainability Master Plan (CESMP), presents recommendations on what actions the County government could take to contribute to the achievement of these goals. We recognize that climate change is not a distant problem, but one that impacts our citizens and resources directly. The increasing effects of our changing climate include, but are not limited to, more severe and persistent heat waves, poor air quality from wildfires, greater risk of power outages, more heat-related illnesses, and storm damage from flooding and high winds. This warming of our climate is caused primarily by the burning of fossil fuels to produce electricity, heat our homes and businesses, and power our vehicles. Our county's climate is changing, and it is directly related to human activities.

According to the Environmental Protection Agency, sea levels are expected to rise between one and four feet along the Virginia coast in the next century.² Climate change in Virginia manifests as erosion of its beaches and barrier islands, saltwater intrusion, intense tropical storms and hurricanes with more flooding and bigger storm surges throughout the state, increased rainfall with exacerbated coastal and inland flooding, loss of important coastal ecosystems, harmful effects on farming and fishing, and increased dangerously hot days. These effects are already being realized. Compared to 100 years ago, Virginia is experiencing 30 more evenings each year above 68 degrees Fahrenheit (°F) and Virginia's portion of the Chesapeake Bay has seen approximately 4.5 more inches of rain annually.³ Virginia was affected by 82 of the 290 U.S. billion-dollar disaster events that occurred between 1980 and 2020.⁴

We recognize the time for action is now. The goals that guide our recommended actions are:

1. **Cut Greenhouse Gas (GHG) Emissions County-Wide by 2030:** Reduce GHG emissions county-wide to 50% below 2005 levels by 2030
2. **Use 100% Renewable Electricity County-Wide by 2035:** Source 100% of county-wide electricity from renewable sources by 2035⁵
3. **Use 100% Renewable Electricity in County Government Operations by 2030:** Achieve 100% renewable electricity in the County government operations by 2030⁶
4. **Become Carbon Neutral for County Government Operations by 2050:** Achieve 100% carbon neutrality in the County government operations by 2050
5. **Prepare for Climate Change:** Become a Climate Ready Region and make significant progress to be a Climate Resilient Region by 2030

Achieving these goals would require unprecedented, aggressive action. This plan presents a list of actions recommended for the County government to take, with 25 actions that have been prioritized for immediate execution. In many cases, the actions will be initially driven by the County government but will also require strong participation by residents and businesses. Partnerships and advocacy at the regional, state, and federal levels will become crucial. The 25 High Priority Actions can be grouped into five topic areas in which significant action is needed: electricity, buildings, transportation, natural resources, and adaptation. These high priority actions and the goals they contribute to are listed in **Table 1** below. A longer list including medium and low priority actions is provided in **Appendix A. Complete List of CESMP Actions.**

¹ Capitalized "County" will be used when referring to the County government as an entity. Lowercase "county" will be used when referring to the geographic area that is Prince William County

² <https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-va.pdf>

³ <https://www.chesapeakebay.net/news/blog/a-new-report-gives-virginia-a-realistic-view-of-the-future>

⁴ <https://statesummaries.ncics.org/chapter/va/>

⁵ For renewable electricity goals, we define renewable electricity as electricity coming from any non-fossil fuel energy source, such as solar, wind, hydro, geothermal, and nuclear

⁶ The County does not consider the county's schools a part of County government operations

Table 1. CESMP High Priority Climate and Resiliency Actions

Topic Area	CESMP High Priority Actions	Related Goal #
Electricity	E.1: Acquire Clean Electricity Sources for the County	1, 2, 3, 4
	E.2: Promote Renewable Energy Incentive Programs and Develop Additional Solar Incentives	1, 2
	E.3: Incentivize Renewable Energy Use in Energy-Intensive Commercial Buildings	1, 2
	E.4: Promote Existing Green Power Products	1, 2
	E.5: Install Solar on County Government Facilities	1, 2, 3, 4
Buildings	B.1: Incentivize Energy Efficiency and Electrification Retrofits	1
	B.2: Propose Green Zoning Regulations	1
	B.3: Incentivize Energy Efficient and Electric New Construction	1
	B.4: Promote Energy Efficiency and Electrification Incentives	1
	B.5: Transition to Net Zero County Government Facilities	1, 2, 4, 5
Transportation	T.1: Improve Pedestrian and Bicycle Infrastructure and Enhance Connectivity	1
	T.2: Incentivize Transit-Oriented Development	1
	T.3: Expand Existing Programs that Reduce Single-Occupancy Vehicle Trips	1
	T.4: Upgrade Public Transit Infrastructure	1
	T.5: Incentivize Zero-Emission Vehicles and Charging	1
	T.6: Expand Public EV Charging Network	1
	T.7: Adopt Zero- or Low-Emissions County Fleet	1, 4
Natural Resources	N.1: Adopt Natural Open Space Requirements	1, 5
Adaptation	A.1: Develop Adaptation Plans for Critical Facilities	5
	A.2: Manage Stormwater Flooding in Areas Outside of the Floodplain	5
	A.3: Improve Power Resiliency for Critical Infrastructure	5
	A.4: Implement Shoreline Protection and Nature-Based Solutions	5
	A.5: Restore Streams to Reduce Flooding	5
	A.6: Incentivize Technology for Residents to Make Homes Adaptive	1, 5
	A.7: Plan Alternate Evacuation Routes for Flood-prone Areas	5

Action Implementation and Budgeting: Each action listed in [Table 1](#) is accompanied by 1) a more detail description of what the action entails ([Chapter 4 CESMP Actions](#)), and 2) expanded Implementation Plans. The implementations plans provided in [Appendix B. Implementation Plan](#) were developed by County departments leading the actions and include the first few steps needed to get the action off the ground. The high-level cost estimates listed in the plans ([Appendix B.1 Estimated Budget for CESMP High Priority Actions](#)) are not budget requests, but rather an estimate of what it may take to complete that action over their implementation time periods. Once approval for implementation is granted, the County lead departments would conduct further analysis and prepare detail budget requests including 1) a cost-benefit analysis and 2) a cost-saving analysis as many actions may end of saving the county and its residents money.

Alignment with County Plans: The recommended actions in the CESMP align with and contribute to meeting the goals and action strategies in our Comprehensive Plan and 2021-2024 Strategic Plan (see [Appendix C. CESMP Actions Mapped to Strategic Plan and Comprehensive Plan Action Strategies](#)). As part of CESMP development, county emissions were projected to 2050 utilizing the County’s growth projections that were provided in the Comprehensive Plan. This included projected population, household, and jobs growth. In working towards meeting the Climate Mitigation and Resiliency Goals, the CESMP is recommending implementation of many of the Smart Growth action strategies already included in the Comprehensive Plan and Strategic Plan.

Plan Structure: The CESMP reviews the county’s GHG emissions and climate vulnerability context, outlines what it will take for us to reach our goals, and establishes what we can do to meet these goals through local climate actions. The CESMP divides our climate actions into climate mitigation actions, which reduce GHG emissions, and climate adaptation and resiliency actions, which reduce community-wide climate risk. Climate mitigation actions are further divided into community-wide actions that address the broader community’s emissions and government actions that address County government emissions.

GHG Emissions: The county’s GHG inventories can be used to monitor progress toward the 2030 GHG reduction goal. These inventories are created every two years by the Metropolitan Washington Council of Governments (MWCOG). A pie chart of the county’s 2018 emissions inventory is shown in [Figure 1](#) below. A detailed explanation of why we utilized the 2018 inventory for our baseline instead of the 2020 inventory is provided in [Chapter 2 Prince William County Greenhouse Gas Emissions](#).

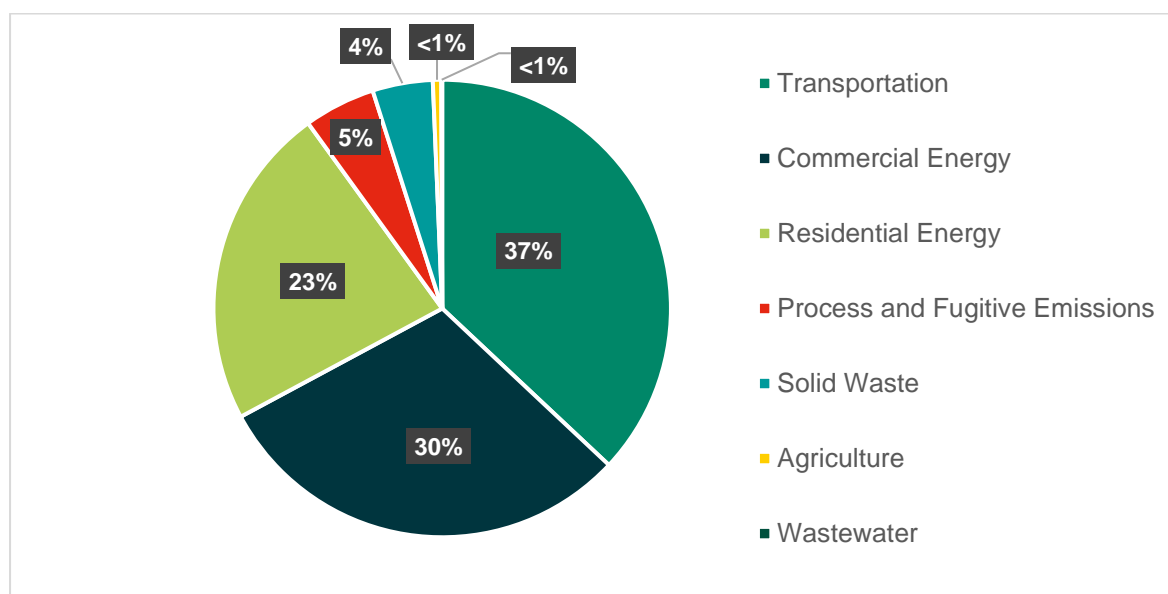


Figure 1. 2018 Community-wide Emissions by Sector

Climate Vulnerability Assessment: We assessed our county’s vulnerability to current climate hazards from extreme temperatures, precipitation, coastal flooding and sea level rise, drought, and high winds/tornadoes. The assessment looked at future climate hazards from extreme temperatures, precipitation, and sea level rise. County assets were divided into categories, and the vulnerability of each category was rated based on its exposure, sensitivity, and adaptive capacity.

The CESMP Actions: Climate actions describe what we can do to reduce emissions and adapt to climate change. The first step in the action development process was to identify current policies and programs that support the 2030 GHG reduction scenario strategies and address local climate hazards, recognize limitations in our ability to influence these sectors, and determine areas of opportunity for new action development. We then evaluated the new actions for their impact on specific evaluation criteria to provide a more holistic understanding of each action’s viability and value to the community. Evaluation criteria included GHG reduction potential; climate risk reduction potential; impact on organizational diversity, equity, and inclusion; resource conservation; cost to residents and businesses; local employment; funding source identification; cost to the County government; and cost savings to the County government. After gathering stakeholder feedback, we conducted an action prioritization exercise to organize actions into high, medium, and low priority categories.

During this process, many residents expressed their priorities for climate action development and implementation. An example of how some of these priorities were addressed through CESMP actions is included in [Figure 2](#) below.

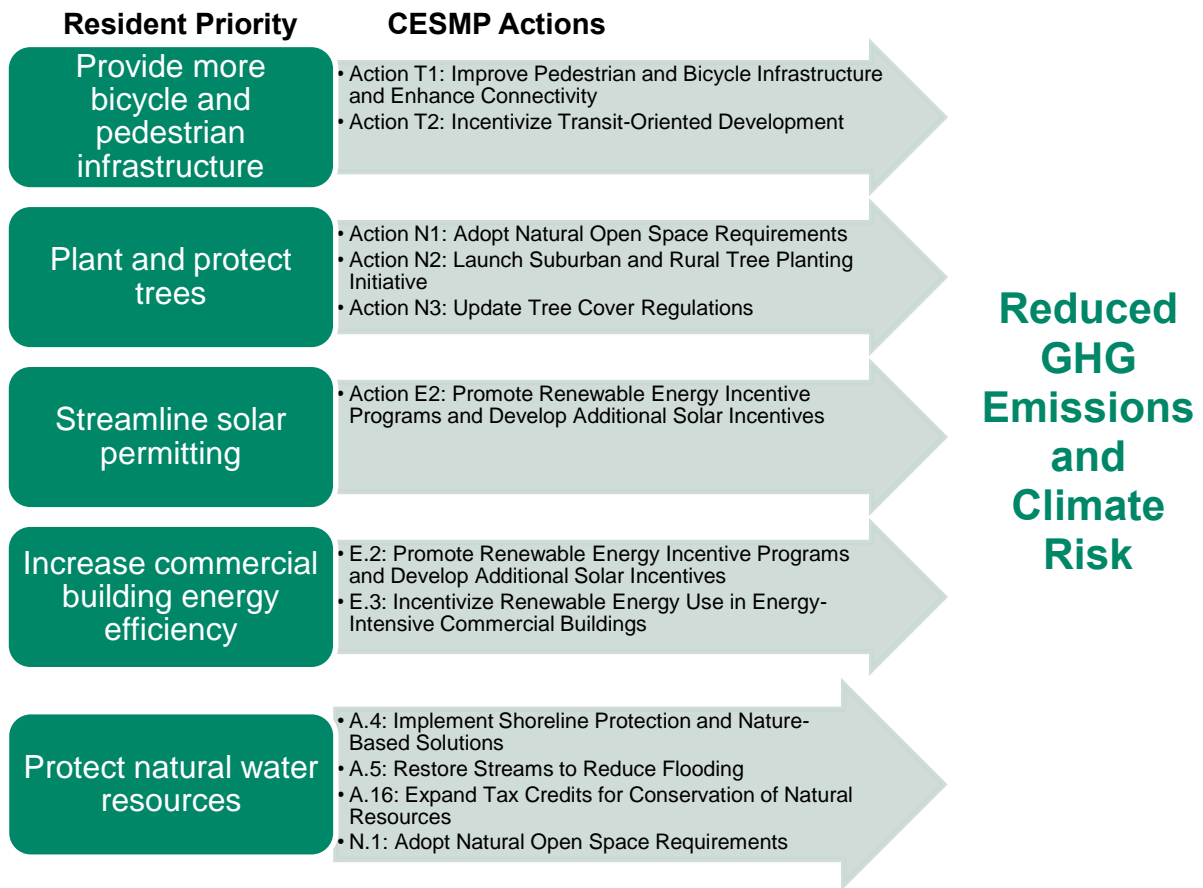


Figure 2. Resident Priorities and Related Climate Actions

Meeting the GHG Reduction Goal: To understand what it would take to achieve the 2030 GHG reduction goal, we selected a set of strategies that would need to be accomplished to achieve that goal. When developing this scenario, we first evaluated how external regulatory or market forces would impact emissions over time. These forces include factors like expected electric vehicle (EV) adoption or technology improvements that are projected to help reduce emissions without additional County action. These external factors result in nearly 32% of emissions reductions needed to meet the County's 2030 GHG reduction goal.

Building on these external regulatory and market forces, we selected a set of strategies the County would need to accomplish to show what it would take to reach the 2030 GHG goal. Two important strategies identified to meet the 2030 goal include ensuring over 90% of the electricity used in the county comes from clean energy sources (e.g., solar, wind, hydropower, nuclear, and geothermal) and that half of passenger and medium-duty vehicles traveling within the county are electric or produce zero-emissions. These two strategies are estimated to produce about 80% of the total GHG reductions needed to meet the 2030 goal. However, these strategies and their underlying implementation rates might be different than what is feasible for the County government to achieve.

With the County government's lack of control over county-wide emission sources, it will not be possible to meet all the strategies and goals through County government action alone. **Figure 3** shows the difference between the county's projected emissions levels, emissions levels after action implementation, and the emissions trajectory needed to meet the 2030 GHG reduction target. In **Figure 3**, the top line shows the county's business-as-usual emissions projections that were created using Comprehensive Plan growth factors such as population, households, and jobs (5,700,000 MTCO_{2e} in 2030). The black line shows emissions projections if external regulatory and market forces are considered (4,600,000 MTCO_{2e} in 2030). The bottom dotted red line shows the 2030 county-wide GHG reduction goal trajectory (2,100,000 MTCO_{2e} in 2030). To meet the 2030 county-wide GHG reduction goal, the county would need to reduce emissions by about 2,500,000 MTCO_{2e} in 2030.

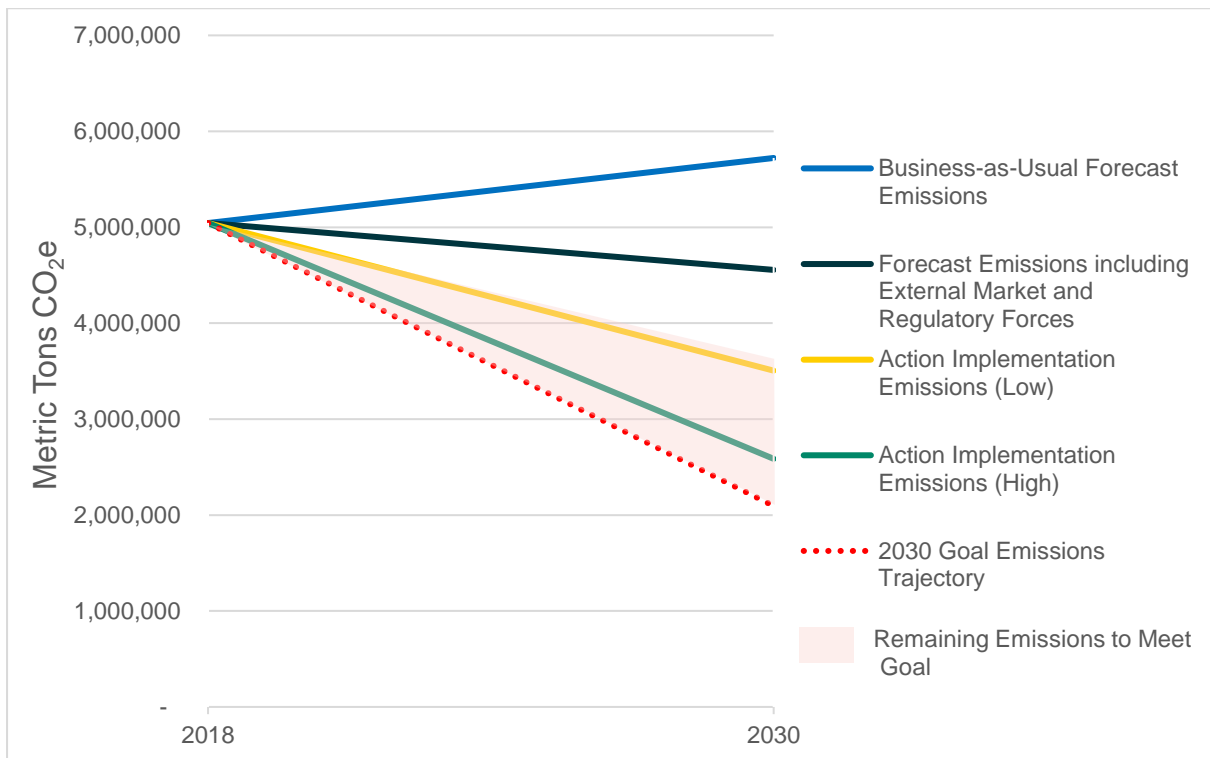


Figure 3. GHG Reduction Potential and Remaining Emissions

The middle yellow and green lines in **Figure 3** show the potential range of emissions reduction impact from implementing CESMP actions. For example, if there is high collective community participation for some actions, this may result in higher emissions reductions while less participation may result in lower emissions reductions. Looking at this range, if we implement all actions listed in the CESMP, we estimate a gap in reductions needed to meet the 2030 goal of about 500,000 – 1,400,000 MTCO₂e (shown as the shaded pink area). This is because the County has limited authority or influence over these emissions sources.

This gap could potentially be bridged with the help of significant external support, such as contributions from market factors, state- and national-level regulation, incorporating forest and tree carbon fluxes into our GHG inventories, or potentially through the purchase of high-quality carbon offsets. However, it is important to emphasize that the acquisition of carbon offsets would be our last resort as the first line of action should always be focusing on direct emissions reductions.

The intent of the CESMP is to build upon what we already have been doing in energy conservation, decarbonization, and adaptation to climate change. Our county is already making progress towards the Climate Mitigation and Resiliency Goals. Among many actions, our county currently captures landfill methane to generate electricity and we are building out a new renewable natural gas facility; we established a Residential Solar Task Force to streamline the permitting processes; we began procuring EVs and building out charging infrastructure; we built an automated flood warning system; and we coordinate community outreach and preparedness engagement through the Ready Prince William program. For a full list of actions the county has already taken, see **Appendix D. Existing County Government Actions**.

With timely implementation of the high priority actions in the CESMP, we can continue to build upon the County's successes and put ourselves in a position to strive towards meeting the Climate Mitigation and Resiliency Goals to the best of our ability.

Next Steps: In addition to the specific actions identified through the analysis described above, the CESMP includes three foundational program-wide sustainability initiatives designed to improve the County's ability to monitor and implement the plan:

1. **Implementation of an "Adaptive Management" approach** that improves our ability to make decisions in the face of uncertainty and complexity
2. **Assessments for climate mitigation and resiliency impacts** performed by the County to provide data on a project's impact on greenhouse gas emissions, renewable and fossil energy mix, and climate resiliency metrics

3. **Institutional capacity-building** to support sustainability, including staffing capacity to pursue federal grants for green programs and capacity for communication and outreach that will engage residents and businesses in the voluntary measures recommended in the CESMP

Adaptive Management: Implementation of the CESMP will be a dynamic effort that will require taking an Adaptive Management approach of continuous data collection, analysis, and reassessment. Adaptive Management is an intentional and iterative approach designed for decision making in situations characterized by volatility (rapid change), uncertainty, complexity, and ambiguity. The County intends to implement the CESMP through a process similar to the one employed by the Chesapeake Bay Program shown in **Figure 4** below, to making decisions and adjustments in response to rapidly evolving technologies, policies, strategies, and funding opportunities. Note that stakeholder input is a continuous element of the process.

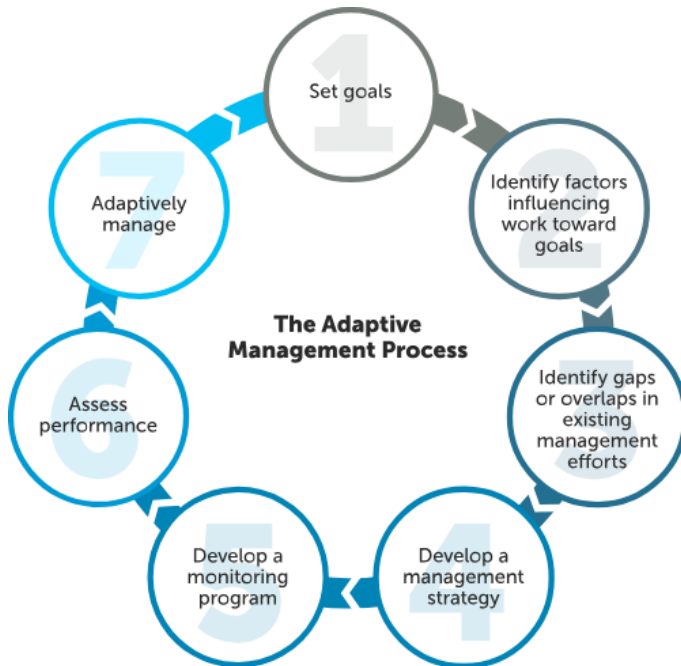


Figure 4. Adaptive Management Process⁷

As a next step, we will need to develop a system for annually assessing the impact of the proposed actions towards meeting the climate mitigation and climate resiliency goals. This work has already begun through the development of Implementation Roadmaps for the 25 high priority actions (see **Appendix B. Implementation Plan**). The roadmaps identify the County government departments that will lead implementation, supporting partners, implementation steps, action cost range, and high-level performance indicators (which will form the basis of the monitoring and performance assessment steps). **Appendix B. Implementation Plan** also includes a description of additional cost saving considerations for the actions. These are general descriptions of potential cost savings as many actions would require further analysis of feasibility studies to determine exact savings. When budget requests are made for the actions, more specific cost and savings information will be included.

The Implementation Roadmap actions are fluid and may change as the county's emission sources, funding sources, and department roles change. They are not a requirement for lead departments to complete each implementation step or a guarantee that all actions will be implemented. They are simply a recommended starting point to begin action. Given the complexity and magnitude of the systems we are managing, we need to act now with the best current information available. The Office of Sustainability will have an oversight role in guiding and tracking action implementation, but actual action implementation will be led by the respective departments.

As a part of the Adaptive Management approach, we expect that methodologies for analysis of the county's emissions will continue to evolve over time. In the future, we expect to incorporate the following into CESMP updates or as part of action implementation steps:

1. Validate and integrate forest carbon sequestration estimations into GHG inventories
2. Assess how commercial building owners and businesses may use renewable energy to reduce their carbon intensity
3. Forecast clean energy growth in the electric grid
4. Account for the effects of the Federal Inflation Reduction Act (IRA) and other legislation on the carbon intensity of the electric grid and on vehicle emissions reductions

⁷ Source: <https://www.chesapeakebay.net/what/what-guides-us/decisions>

5. Conduct a more detailed analysis of the effectiveness of smart growth measures on vehicle miles traveled and emissions reductions.

Additionally, we recommend incorporating the social cost of carbon in the methodology as a metric for quantifying action impact. The social cost of carbon is an estimation of the cost in dollars of either negative implications of adding a ton of carbon emissions to the atmosphere, or the benefit of reducing a ton of carbon emissions. For example, the EPA currently estimates the social cost of reducing a ton of carbon in 2030 to be around \$230.⁸ If the county were to meet the 2030 goal of reducing emissions by 50% from a 2005 baseline, the benefit to society would be valued at an estimated \$575M per year.

Assessments for Climate Mitigation and Resiliency Impacts: The County currently conducts environmental reviews for rezonings, comprehensive plan amendments (CPAs), special use permits (SUPs), and major road projects. These reviews rate projects in terms of their conformance to goals of the Comprehensive Plan, Strategic Plan, Schools Plan, and other County planning documents, as well as compliance with environmental regulations.

In the future, County staff recommends that the Board consider amending relevant County regulations and policies, consistent with applicable law, to assess greenhouse gas emissions, to assess renewable and fossil energy mix, and to assess climate resiliency metrics. This would provide additional information about the potential environmental impacts of specific rezoning and SUP applications, Capital Improvement Program (CIP) projects, and CPAs on the community based on the Board's adopted Climate Mitigation and Resiliency Goals.

The Office of Sustainability is requesting an Environmental Analyst position to assist with developing and/or reviewing these assessments.

Institutional Capacity: To implement the CESMP, one of the necessary first steps is to build up institutional capacity to execute the foundational elements of the plan. This includes key activities such as increasing staff capacity to pursue federal grants for green programs and the capacity for communication and outreach that will engage residents and businesses in the voluntary measures recommended in the CESMP.

To begin implementation, the Office of Sustainability is hiring a Climate and Energy Manager to provide the necessary support to begin to stand up projects and programs for the high priority actions in the CESMP. The County will also utilize the \$1.04M in CIP funding that has been allocated by the Board via Resolutions 21-663 and 22-573 for the CESMP to kick-start actions that are related to County infrastructure. Projects with CIP funding allocated are included below.

Projects with CIP Funding Allocated:

- Installing solar on County buildings identified in feasibility study that will be completed December 2023 (Action E.5)
- Conduct feasibility study for electrification of County buildings (Action B.5)
- Transition of high-pressure sodium streetlights to LED (estimated 200 streetlights) (Action B.7)

We recommend consideration of CIP funds for FY25 to implement the below projects.

FY25 CIP Fund Requests for \$10M:

- Begin to implement recommendations from feasibility study for electrification of County-owned buildings (Action B.5)
- Begin to implement recommendations from feasibility study to convert County fleet to low- or zero-emission vehicles that will be completed Spring 2024 (Action T.7)
- Development of greenhouse gas inventory for County government operations (Action B.5)
- Installing solar on buildings identified in feasibility study that will be completed December 2023 (Action E.5)

⁸ "Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review": EPA External Review Draft of Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances

In addition to the CIP funds that have already been allocated for CESMP implementation and FY25 CIP funds, the following general fund budget requests for FY25 would provide the institutional capacity needed for the first year of implementation:

- Sustainability Communications and Outreach Manager – Manage grant writing opportunities and communications with the public, including campaigns about available resources and incentives.
- Environmental Analyst – Stand up the Adaptive Management system for analyzing progress towards the Climate Mitigation and Resiliency goals. This would include development and review of assessments for impacts of major projects on Climate Mitigation and Resiliency goals and tracking CESMP implementation costs and savings.

Lastly, we recommend that the CESMP is incorporated into the Comprehensive Plan through an amendment to the Comprehensive Plan, and that the action strategies of the CESMP are incorporated into the County's next Strategic Plan. This step would help fulfill the mandate in Board Resolution 20-773 to "incorporate into the Comprehensive Plan goals of 100% of Prince William County's electricity to be from renewable sources by 2035, for Prince William County Government operations to achieve 100% renewable electricity by 2030, and for Prince William County Government to be 100% carbon neutral by 2050." This would also support implementation of the many sustainability strategies already established in the Comprehensive Plan and 2021-2024 Strategic Plan ([Appendix C. CESMP Actions Mapped to Strategic Plan and Comprehensive Plan Action Strategies](#)).

Chapter 1 Introduction

The Purpose of this Plan

In 2008, MWCOG set a series of ambitious goals to reduce emissions in the region by 2020. In 2020, MWCOG published its 2030 Climate and Energy Action Plan that set new 2030 goals for area governments. Motivated by this plan, the County’s Board of Supervisors adopted five climate and resiliency goals provided in **Table 2**. These goals demonstrate our continued commitment to protect and prepare our citizens and resources for climate change.⁹ The primary purpose of the CESMP is to develop a pathway toward addressing these goals.

Table 2. County Climate Goals

County-wide Goal	County Government Goal
<ul style="list-style-type: none"> Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 	<ul style="list-style-type: none"> Achieve 100% renewable electricity in County government operations by 2030*
<ul style="list-style-type: none"> Become a Climate Ready Region and make significant progress to be a Climate Resilient Region by 2030 	<ul style="list-style-type: none"> Achieve 100% carbon neutrality in County government operations by 2050
<ul style="list-style-type: none"> Source 100% of county-wide electricity from renewable sources by 2035* 	

* We define renewable electricity as electricity coming from any non-fossil fuel energy source such as solar, wind, hydro, geothermal, and nuclear.

How the CESMP was Developed

The County made it a point to have an inclusive stakeholder engagement process by striving to involve representatives for all groups who may be affected by the implementation of the CESMP in the decision-making process. This approach was taken to ensure that the steps we take to achieve our objectives consider the priorities of our community. Stakeholder engagement was embedded throughout the CESMP process as shown in **Figure 5**.

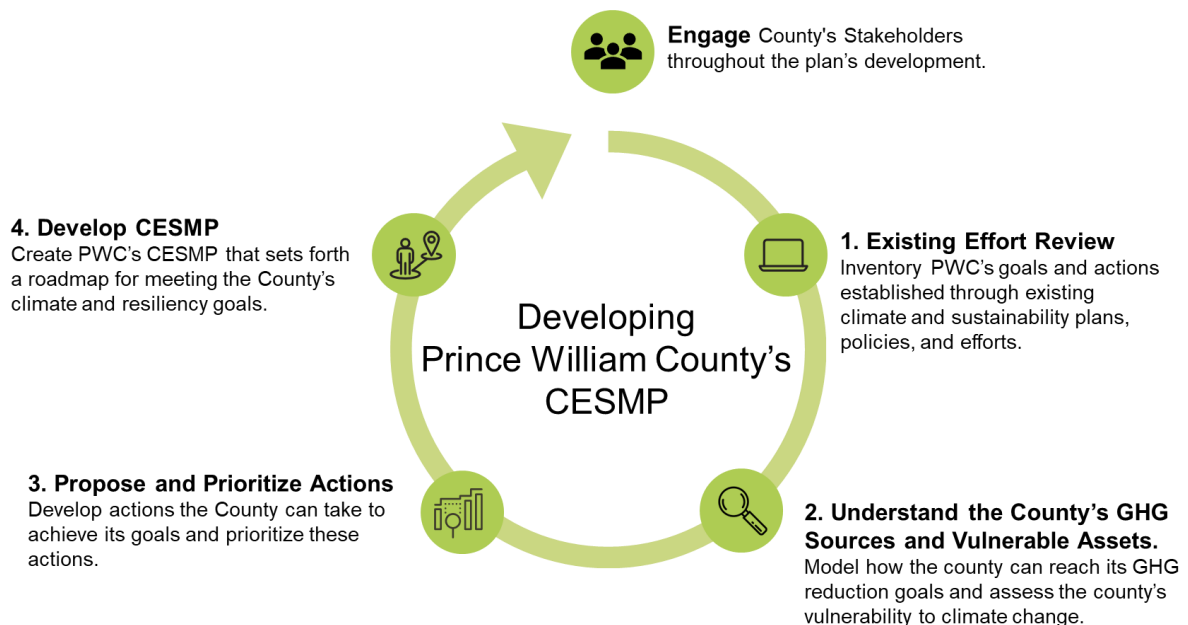


Figure 5. CESMP Development Process

⁹ <https://www.pwcva.gov/assets/2022-05/13-D.pdf>

We took into consideration things like the knowledge of our local experts, the voice of the public, and any unexpected side effects of our actions. A complete list of stakeholders that were engaged during the development of the CESMP is provided in [Appendix E. List of Stakeholder Groups Involved in CESMP Development](#).

The stakeholder engagement process was designed to approach stakeholder groups, introduce them to the plan development process, and provide their feedback to the County Government Core Team for consideration and incorporation at key milestones.

Importance of Climate Action and Resiliency Planning

Recognizing the importance of resiliency in a rapidly changing world, the CESMP underscores not only our commitment to mitigating climate impacts, but also our determination to adapt and thrive in the face of adversity. We firmly believe that understanding the dynamics of climate change and fostering resiliency are key pillars of sustainability and integral to the ongoing vitality and prosperity of the county.

As it relates to climate change, GHGs function like a warm blanket around our Earth, absorbing and re-emitting heat. This natural process, known as the greenhouse effect, is vital for our survival, keeping the planet at a habitable temperature. There are many different GHGs, each with a different ability to trap heat — we call this their "global warming potential." To make sense of all these gases, we convert their quantities into carbon dioxide equivalents (CO_{2e}) for easier comparison.

There are several major GHGs that result from human activity and are included in U.S. and international estimates of GHG emissions:

- Carbon Dioxide (CO₂)
- Methane (CH₄)
- Nitrous Oxide (N₂O)
- Nitrogen Trifluoride (NF₃)
- Sulfur Hexafluoride (SF₆)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)

While GHGs naturally occur at beneficial levels, maintaining the Earth's temperature, our actions have released more GHGs and have tipped the scale since the 1800s. This disruption in balance is "climate change," a long-term shift in average global or regional weather patterns. This imbalance ushers in a host of troubles like extreme droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, devastating storms, and declining biodiversity. Human activities, such as burning fossil fuels to power our buildings or vehicles, have been the main driver of climate change.

The United Nations Intergovernmental Panel on Climate Change (IPCC) — the leading international body for assessing climate science — noted that more severe climate impacts could be avoided if global warming is limited to 1.5 degrees Celsius (°C) (or 2.7 degrees °F) above pre-industrial levels. To do this, global emissions need to fall by at least 45% from 2010 levels by 2030 and reach carbon neutrality by 2050.

"Carbon neutrality" means maximizing GHG reduction efforts through strategies like energy efficiency, clean electricity, and zero-emission technologies. Any remaining emissions are then balanced out by removing them directly from the atmosphere through natural sequestration or direct air capture technologies, among other solutions.

To tackle this challenge, world leaders developed the Paris Agreement — a legally binding, international treaty with a goal of holding the global average temperature increase to well below 2°C (3.6°F) above pre-industrial levels and pursuing efforts to limit the temperature rise to 1.5°C. The United States re-joined the Paris Agreement in 2021 and developed a nationally determined contribution of reducing net GHG emissions by 50-52% below 2005 levels by 2030.

Relevance to Prince William County

In Prince William County, climate change is a pressing reality already impacting the community, not a distant issue for future generations to address. Our local impact mirrors a global trend where urban areas contribute

significantly to the problem by generating much of the world's energy related GHG emissions.¹⁰ Daily activities are part of this large puzzle. For instance, whenever we power our vehicles and buildings with fossil fuels, treat and dispose of solid waste and wastewater, leak refrigerants and natural gas, or carry out agricultural practices, we are contributing to the production of these emissions. Each action, seemingly small on its own, adds up to our collective footprint on the climate. These emissions have contributed to the dangerous levels of climate change our county experiences today.

Looking back over the 20th century, our county and Virginia have experienced increased average temperatures more than 0.83°C (1.5°F) and a small upward trend in annual total precipitation with multiyear values mostly above average since 1995 based on data compiled for the National Climate Assessment.¹¹ Virginia was affected by 82 of the 290 U.S. billion-dollar disaster events that occurred between 1980 and 2020. Analysis developed for our Vulnerability Assessment (**Chapter 3 Vulnerability Assessment**) confirm these trends and project increased sea level rise throughout the 21st century. Virginia is projected to experience an increased number and intensity of extreme precipitation events and increased intensity of droughts. This results in economic, ecologic, health, and social impacts including infrastructure damages, erosion, road closures, loss of power, saltwater intrusion, loss of important coastal ecosystems, increased dangerously hot days, and harmful effects on farming and fishing.

Climate Actions we are Currently Taking

This CESMP is not the first step we are taking to act on this growing concern. The roadmap in **Figure 6** lays out our journey, showcasing key milestones we have hit in confronting climate change.

¹⁰ World Resources Institute, C40 Cities Climate Leadership Group, & ICLEI - Local Governments for Sustainability. (2014) Global protocol for Community-Scale Greenhouse Gas Emission Inventories

¹¹ <https://statesummaries.ncics.org/chapter/va/>

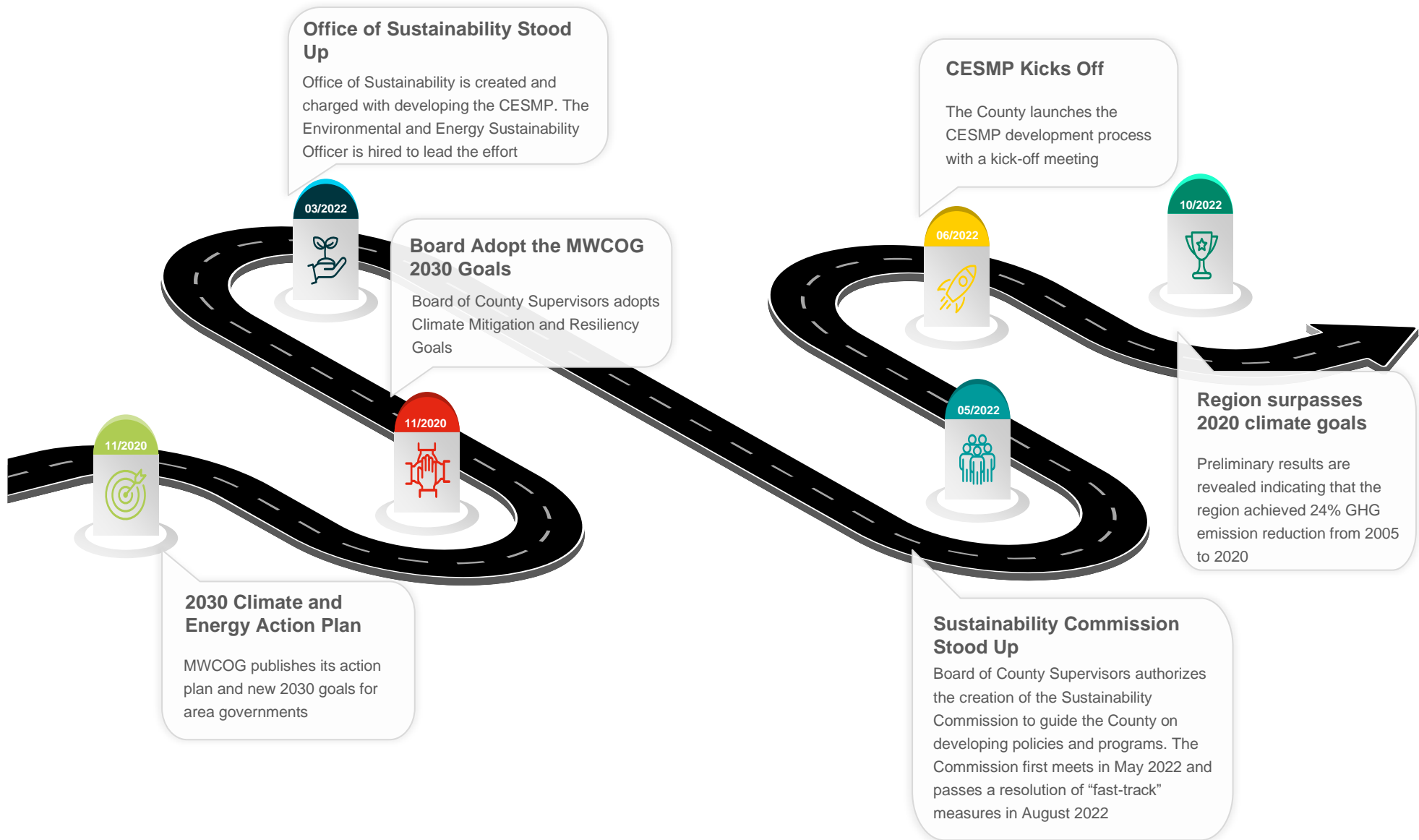


Figure 6. Timeline of CESMP Launch

Ongoing Progress on Climate Action

The County is already pursuing many programs, projects, and actions that benefit GHG reduction or climate adaptation. As a starting point, we reviewed established programs, policies, and actions that are already underway. We wanted to avoid developing new actions based on programs already funded and underway. We will continue to support, staff, advertise, bolster, and fund existing programs so they continue to have a positive effect toward the goals and reduction targets. However, the CESMP actions in **Chapter 4 CESMP Actions** largely focus on implementation and start-up of new efforts.

Examples of our ongoing GHG mitigation efforts, by area, are described in **Figure 7**. For a full list of our current efforts, please refer to **Appendix D. Existing County Government Actions**.

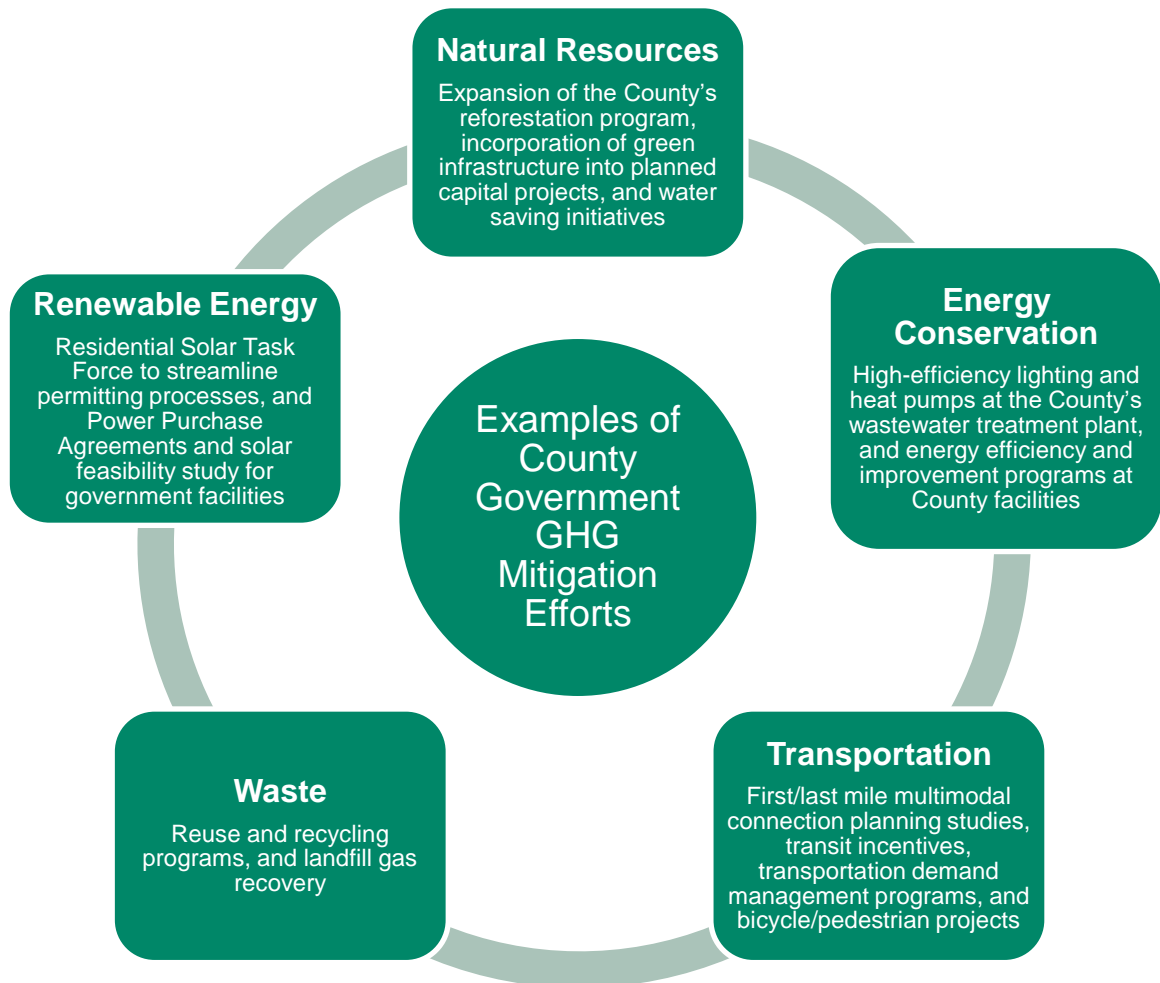


Figure 7. Ongoing GHG Mitigation Efforts

The Sustainability Commission is a public advisory body appointed by the Board of Supervisors tasked with advising on CESMP development. In addition to the County's ongoing efforts, the Sustainability Commission provided recommendations for "fast-track" climate mitigation and climate resiliency measures in September 2022.¹² The intent of the resolution was to get a head start on some actions prior to the delivery of the CESMP. This resolution resulted in the expansion of the County's reforestation program through the FY24 budget.

To address additional elements of the Sustainability Commission fast track recommendations, the Board also issued Directive 23-07 titled "Climate Mitigation and Resilience Fast-Track Measures: Clean Energy, Solar Freedom, Energy Efficiency" that directed County staff to research actions aimed at increasing the use of solar and other renewable energy sources throughout the County.

¹² <https://www.pwcva.gov/assets/2022-09/Res%202022-007%20Fast%20Track%20Sustainability%20Recommendations.pdf>

Among the ongoing programs that relate to climate resiliency, we currently maintain eligibility in the Northern Virginia Hazard Mitigation Plan for the Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Program and other post-disaster federal financial assistance. The County's Hazard Mitigation Workgroup was established in 2017 to implement the county-specific mitigation strategies outlined in the Northern Virginia Hazard Mitigation Plan. The County's Office of Emergency Management facilitates this Workgroup, and it includes representatives from the Departments of Public Works, Development Services, Transportation, Information Technology, Parks, Recreation, and Tourism, Public Safety Communications, Police, the Fire and Rescue System, and the Virginia Department of Transportation. Additional agencies and partners, such as utility or transportation providers, the School Division, town representatives and others are consulted on hazard-specific and project-specific strategies, as they are identified.

To date, the Workgroup has utilized a project management framework to coordinate efforts around specific grant programs and individual mitigation strategies. As flooding is one of the top hazards in the county, recent efforts have focused on collecting data on flood stage elevations in flood-prone areas, providing enhanced warning about imminent flooding conditions, and increasing participation in the National Flood Insurance Program.

In addition, the County's Office of Emergency Management coordinates our all-hazards emergency management program which includes mitigating against, preparing for, responding to, and recovering from all natural, technological, and human caused disasters. Key activities include coordination of our Hazard Mitigation Workgroup noted above, the development and maintenance of our Emergency Operations Plan and supporting operational plans, Continuity of Operations Planning, coordinating relevant training and exercises to ensure agency partner readiness for response and recovery tasks, and coordinates community outreach and preparedness activities through the Ready Prince William program.

Chapter 2 Prince William County Greenhouse Gas Emissions

Greenhouse Gas Inventory

One of the tools that is used to measure a community's impact on climate change is the GHG inventory. This chapter will discuss how we can use this tool to identify relevant climate actions, understand what our future GHG emissions may look like, and develop pathways to reaching GHG reduction goals.

A GHG inventory is a record of the emissions generated by a community in one year. It allows us to measure our progress, identify the largest sources of emissions, and find areas where we can make improvements. Understanding current emissions is important as we work toward achieving the climate goals.

MWCOG develops a new GHG inventory for our county every two years. **Figure 8** represents county emissions from 2018.

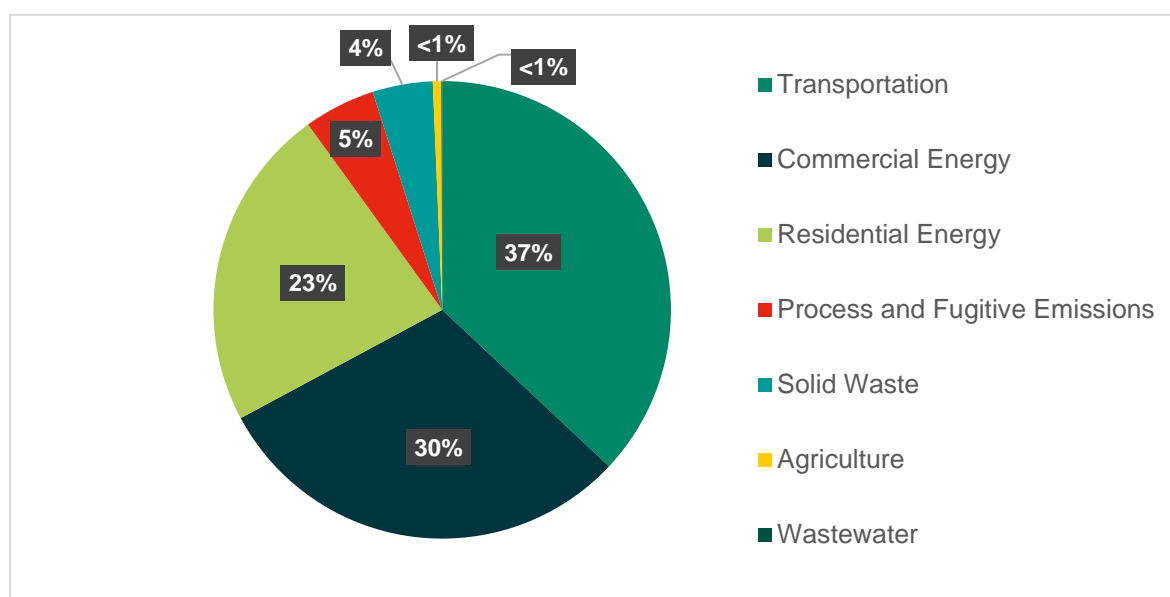


Figure 8. 2018 Community-wide Emissions by Sector

Impact of COVID-19 on GHG Emissions

While county emissions have been steadily increasing annually since 2005, emissions decreased by 9% between 2018 and 2020 (though emissions in 2020 were still 9% higher compared to the baseline year of 2005). The decline in emissions from 2018-2020 is most likely due to the impacts of COVID-19 restrictions, such as reduced on-road travel or non-residential building energy use, though the exact magnitude of emissions impact from these restrictions cannot be precisely measured. Additionally, studies have shown that US-wide GHG emissions are returning to pre-pandemic levels, demonstrating that COVID impacts on emissions are most likely not permanent.¹³

Therefore, while a 2020 county GHG inventory exists, the CESMP references the 2018 inventory year for forecasting and emissions reduction calculations. This represents the most recent pre-pandemic community activity levels and provides a more accurate baseline for local GHG emissions analyses. Future GHG inventories will better reflect any long-term impacts of the pandemic on county-wide emissions.

Of our county's 2018 emissions, 37% are from transportation and mobile sources, 30% are from commercial energy, 23% are from residential energy, and the remainder are from fugitive emission sources, solid waste management, agriculture, and wastewater treatment (see **Figure 8**). It's important to understand that more than half of total emissions are generated by electricity used in the commercial and residential sectors. This is largely a consequence of our region's reliance on fossil fuels such as natural gas and coal for electricity generation (see **Appendix F. Greenhouse Gas Inventory and Analysis** for the regional electric grid resource mix). Additionally,

¹³ <https://rhg.com/research/us-greenhouse-gas-emissions-2022/>

on-road transportation generated about a third of total emissions. **Given that the building energy and transportation sectors produce 90% of total emissions, the path to our ambitious 2030 emissions reduction goal necessitates a strategic focus on these sectors.** A more detailed summary of the 2018 GHG inventory is also provided in [Appendix F. Greenhouse Gas Inventory and Analysis](#).

Impact of Forests and Trees on the GHG Inventory

Historically, our county's GHG inventories have included emissions from buildings, transport, waste, and agriculture. These inventories did not consider emissions or removals of CO₂ from other land uses such as forests. Different land use types have different levels of carbon stocks, or stores of carbon in biomass, litter, dead wood, and soils. The net GHG effect of land use is estimated based on the change in these carbon stocks. In the United States, land use is a net sink where removals of CO₂ exceed emissions of CO₂, mostly due to forests and trees outside forests (collectively called forests and trees) that sequester carbon through photosynthesis.

Recent IPCC reports state that all mitigation pathways compatible with limiting global warming to 1.5°C also involve significant CO₂ removal from the atmosphere, highlighting the importance of maintaining and expanding the ability of forests and trees to capture and store carbon. These carbon sinks help to offset other sources of GHG emissions, including those produced by combusting fossil fuels.

To calculate the GHG impact of forests and trees on community GHG inventories, the average annual change (gain and loss) in forest and tree canopy as well as how much forest and tree canopy is unchanged over the GHG inventory cycle must be estimated. To enhance local GHG inventories, MWCOG calculated CO₂ emissions and removals due to forests and trees in our county from 2005 to 2020. The estimated CO₂ emissions are due to forest conversion and loss of trees while the CO₂ removals are due to CO₂ sequestration in existing forests and trees, and the addition of new forests. This data showed that including forest and tree emissions and removals in the county's GHG inventories would decrease total annual emissions through 2020 by approximately 7%, as local forest and tree CO₂ removals exceeded emissions.

However, MWCOG noted that there are significant uncertainties in the estimates for 2005-2020. Typical GHG inventories of forests using similar approaches, including the national GHG inventory, report uncertainties in the net GHG balance that can be as high as ±45% (with 95% confidence). While uncertainties can be high, the estimates still provide useful information on the relative magnitude and importance of such GHG fluxes. Forest and tree emissions data was not available until after the county-wide GHG analysis was complete. Due to the uncertainty of the data, the CESMP has not included forest and tree emissions or removals in the 2018 inventory, emissions forecasting, or primary GHG reduction scenario development. However, the plan does include actions to promote the preservation and expansion of forests and trees (see actions N.1, N.2, and N.3). Additionally, forest and tree emissions and removals were not included in the county's GHG emissions forecasts. Further discussion of forest and trees potential impact on the forecasts and meeting the 2030 GHG reduction goal is included in [Chapter 5 Meeting the County Goals](#).

Greenhouse Gas Forecasts

While the 2018 inventory provides a recent snapshot of our county's GHG emissions, it's important to understand how the GHG emissions may change in the future. Our forecast in [Figure 9](#) below paints a picture of a "business-as-usual" emissions scenario, illustrating how emissions could evolve if no additional climate actions are initiated at either local, state, or national levels. The forecast considers regional and local growth indicators, such as increases in households, population, building square footage, employees, and vehicle miles traveled. While accurately forecasting GHG emissions is challenging due to the multitude of influencing variables, we are committed to periodically updating these forecasts as more current information becomes available. This approach allows us to continuously reassess our strategies and actions in our mission to reduce emissions.

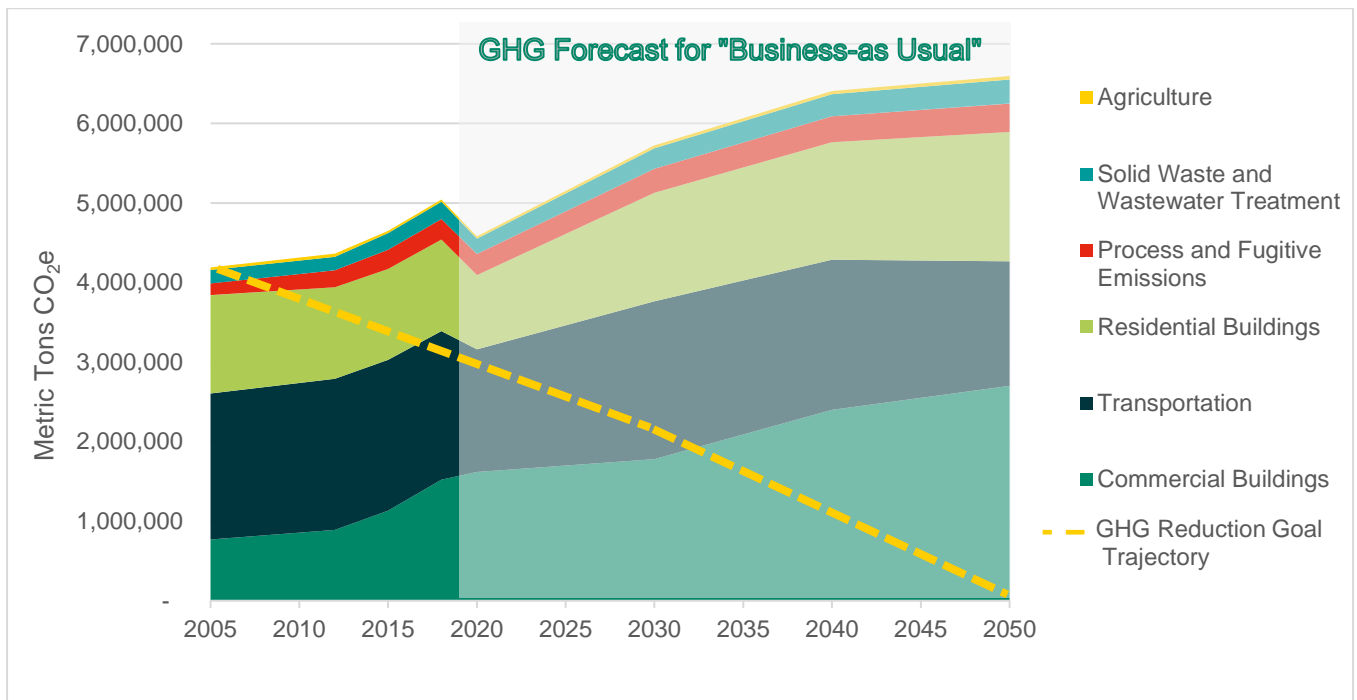


Figure 9. GHG Emissions Business-as-Usual Forecast and Target Trajectory

The forecast illustrated in **Figure 9** shows how emissions in each sector are estimated to change over time in a business-as-usual scenario from 2005 to 2050. Data from 2005-2020 was provided through the MWCOG greenhouse gas inventories. Data for 2021- 2050 was forecasted through projections using the County’s growth factors established in the Comprehensive Plan. The dotted line shows approximately where emissions levels should be to maintain a trajectory toward our goal of 50% GHG reductions compared to 2005 levels by 2030. The target trajectory line extends to carbon neutrality by 2050 for illustrative purposes only, as this is the target recommended by the IPCC. Though the Board has adopted a carbon neutrality target for County government operations by 2050, it has not adopted this target for the entire county.

The forecast shows that emissions are projected to increase by 37% from 2005 to 2030 and 57% from 2005 to 2050. The difference between the top forecast line (i.e., top of the colored chart) and dotted goal line demonstrates that ambitious climate action will be needed to meet our 2030 reduction goal and potential future 2050 reduction goal.

Impact of Data Centers

The GHG emissions forecast includes projections from our Comprehensive Plan to estimate emissions from new data centers being built in our county through the year 2050. Data centers are typically much more energy intensive than other commercial buildings as they require substantial electricity to maintain and cool their servers. However, many data centers in our county have set corporate energy and emissions reduction goals. For example, some existing data centers in the county are already procuring 100% clean electricity for their operations. Many actions in the CESMP address new data center emissions and could help data centers meet their energy and emissions goals. The actions provided in **Appendix A. Complete List of CESMP Actions**, including action E.1: Acquire Clean Electricity Sources for the County, action E.2: Promote Renewable Energy Incentive Programs and Develop Additional Solar Incentives, action E.3: Incentivize Renewable Energy Use in Energy-Intensive Commercial Buildings, action E.4: Promote Existing Green Power Products, action B.1: Incentivize Energy Efficiency and Electrification Retrofits, action B.2: Propose Green Zoning Regulations, action B.3: Incentivize Energy Efficient and Electric New Construction, action B.4: Promote Energy Efficiency and Electrification Incentives, and action B.8: Implement Building Energy Benchmarking.

Through a directive by the Board of County Supervisors in January 2023, County government staff have established a Data Center Ordinance Advisory Group, comprised of residents, industry representatives and other stakeholders, to advise the County government on the development of Regulatory Ordinance changes that will address data center development impacts.

2030 GHG Emissions Reduction Scenario

To understand what it will take to achieve the 2030 GHG reduction goal, we developed a preferred GHG reduction scenario. A GHG reduction scenario represents a group of high-level technological strategies that are needed to reach the 2030 reduction goal. Examples of technological strategies include switching electricity generation sources from fossil fuels to renewables, travel mode shifting from single-occupancy vehicles toward active and public transportation, and electrifying buildings. However, these strategies and their underlying implementation rates might be different than what is politically or financially feasible. The purpose of these scenarios and strategies is to show **what it will take** for us to reach our 2030 reduction goal, demonstrate where climate action is needed, and guide action development. The climate actions then show **what the County government can do** to meet the reduction strategies and ultimately the 2030 goal. The relationship between reduction scenario, strategies, and actions is further illustrated in an example in **Figure 10** (this graphic is an example and does not list all our strategies or actions).

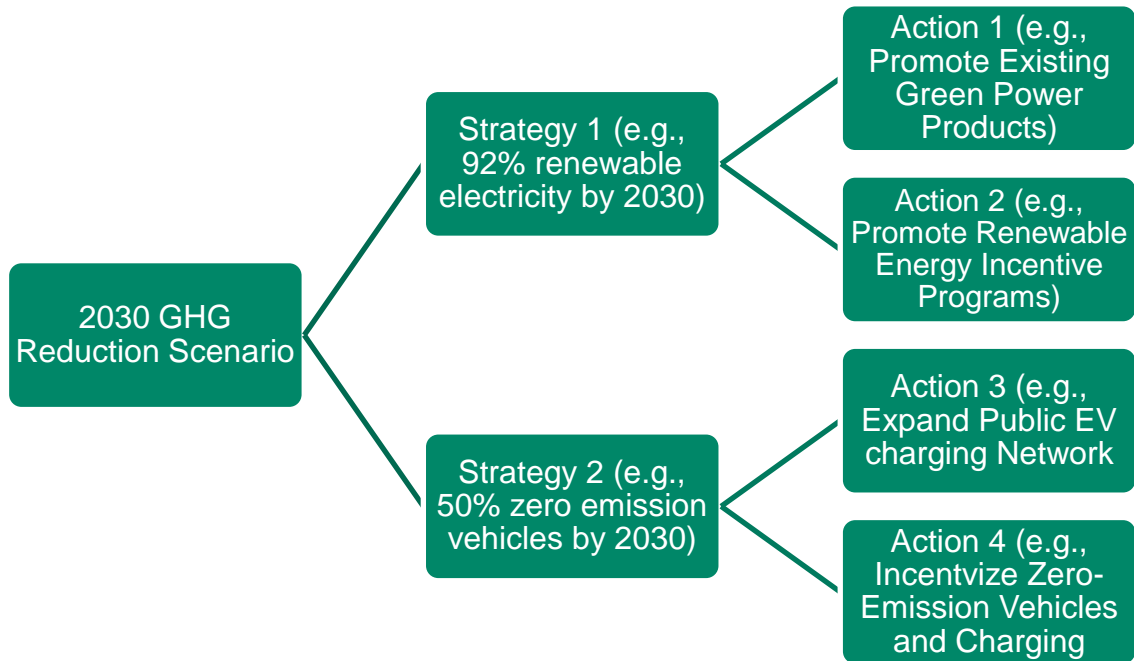


Figure 10. Example of County Strategies and Actions to Reach 2030 Goal

GHG reduction scenarios can be represented by “wedge charts” as illustrated in **Figure 11**. The top line represents the emissions forecast and the bottom line shows the GHG goal trajectory. The colored wedges in between those two lines illustrate the magnitude of GHG reductions from each high-level technological strategy shown in the legend. Each wedge represents the emissions reduced through that strategy, with larger wedges representing greater emissions reductions. Any remaining emissions not addressed by GHG reduction strategies are shown in the hatched area at the bottom of the chart.

The top three strategies that provide nearly 90% of the reductions needed to achieve the 2030 goal include:

- **Decarbonize Electric Grid:** 92% of the electricity used in the county is from clean energy sources (e.g., solar, wind, hydro, nuclear)
- **Vehicle Fuel Switch:** 50% of passenger and medium-duty vehicles traveling within the county are electric or zero-emission vehicles
- **Building Efficiency and Fuel Switch:** 40% of fossil fuel building systems (e.g., space or water heaters) are transitioned to highly efficient electric options (e.g., heat pumps) and 100% of lighting and appliances are highly efficient (e.g., LED lights, Energy Star appliances)

Because all other sectors and strategies contribute a relatively small amount to total emissions, there is no path to 2030 goal achievement without incredibly aggressive progress in the three areas mentioned above: clean electricity, transportation and vehicle fuels, and building energy. The methodology for developing these strategies and why certain external regulatory or market forces (e.g., the Inflation Reduction Act or the Infrastructure Investment and Jobs Act) were not integrated into the GHG reduction scenario are included in **Appendix F. Greenhouse Gas Inventory and Analysis.**

After establishing the preferred 2030 reduction scenario, we developed a list of feasible actions we could pursue to meet these strategies (see **Chapter 4 CESMP Actions**). While the GHG reduction scenario and strategies shows **what it will take** to achieve the 2030 goal, the GHG actions shows **what we can do** to achieve the strategies and ultimately the 2030 goal. However, because many of these emissions sources are out of the County government's direct control, County government action alone will not necessarily achieve the GHG strategies or the overall GHG reduction scenario to meet the 2030 goal. The ability to achieve these strategies relies on significant external support from market factors and state- and national-level regulation. We have identified where external assistance is needed to meet the GHG reduction strategies and our role in promoting these external forces through advocacy or partnerships in **Chapter 5 Meeting the County Goals**. Further discussion of how we could consider forest and tree CO₂ removals and carbon offsets to meet the 2030 GHG reduction goal is also included in **Chapter 5 Meeting the County Goals**.

Addressing Goals Related to GHG Emissions

The CESMP is meant to address how we could meet the community-wide goal of 50% emissions reduction from 2005 levels by 2030 through local climate action. The Board also established three other emissions-related goals,¹⁴ including:

- Sourcing 100% of county-wide electricity from renewable sources by 2035
- Achieving 100% renewable electricity in County government operations by 2030
- Achieving 100% carbon neutrality in County government operations by 2050

We define renewable electricity as electricity coming from any non-fossil fuel energy source, such as solar, wind, hydro, geothermal, and nuclear. Because the definition of renewable electricity can differ among communities, the CESMP uses the term "clean electricity" instead to mean any non-fossil fuel energy source.

Though achievement of these additional goals was not specifically analyzed in the CESMP, the climate actions developed in the plan can contribute to achievement of these goals. A qualitative discussion of how the plan actions can contribute to these goals is provided in **Chapter 5 Meeting the County Goals**.

¹⁴ <https://www.pwcva.gov/assets/2022-05/13-D.pdf>

Chapter 3 Vulnerability Assessment

The County has committed to preparing for the impacts of climate change through our goal of becoming a Climate Ready Region by 2030. In line with this commitment, we have concentrated our efforts on understanding the susceptibility of our county's people and infrastructure to local climate hazards, paving the way for resilient action plans that meet the community's most pressing needs. The fruits of this undertaking were realized with the completion of a comprehensive vulnerability assessment in January 2023. This evaluation was designed with an emphasis on anticipating future conditions that could amplify existing vulnerabilities. A detailed report can be found in [Appendix G. Vulnerability Assessment Report](#).

In the context of our conversation, a “vulnerable asset” refers to an essential resource that forms the backbone of our community. These assets encompass a broad range of elements, including our critical infrastructures like transportation systems, public buildings, and utilities; natural resources such as parks, water bodies, and green spaces; as well as economic drivers like businesses, industries, and development projects. Moreover, these assets include the invaluable human capital that is our diverse and dynamic community members, who continually contribute to the growth and resiliency of our county.

To be a Climate Ready Region by 2030, local governments are asked to assess current and future climate risks and work to actively integrate climate planning across government plans, operations, and communications. Climate hazards exist today, will increase in severity through 2030, and these same climate hazards will pose the greatest threats to our county in the middle or late part of the twenty-first century. Any investments in infrastructure that are initiated by 2030 to meet the goal of being a Climate Ready Region, will be in-place for many years beyond that. Therefore, the vulnerability assessment evaluated climate threats for the years 2050 and 2075 as planning timelines that are more in-line with long-term infrastructure lifetimes. By making changes by 2030 with a focus towards longer-term threats, we will ensure that it is focused on projects that will provide a more resilient future.

Our vulnerability assessment methodically catalogued pertinent assets, gauged their exposure to climate hazards, and assigned ratings for each asset's sensitivity and adaptive capacity. The succeeding chapter provides a comprehensive overview of the climate hazards relevant to our county, which assets are most prone to impacts, and offers a summary of the assessment results.

Under the leadership of our County Officials, the County remains dedicated to these climate resiliency efforts. We understand the importance of coordinated actions and continuous adaptations to face the ongoing challenges posed by climate change.

The results of the vulnerability assessment were used to assist in developing climate adaptation actions that consider natural hazards and the most vulnerable asset categories. Further details on action development, evaluation, and prioritization can be found in [Chapter 4 CESMP Actions](#).

Climate Hazards

We reviewed the following climate hazards to assess the vulnerability of our county's assets and vulnerable populations:

- Precipitation
- Temperature
- Drought
- Coastal storms, sea level rise
- High winds/tornadoes

As part of our dedication to maintaining the well-being of the county, we diligently appraised the present-day risks posed by all climate hazards as well as future conditions for the precipitation, temperature, drought, and sea level rise climate hazards for the years 2050 and 2075. The impacts of the climate hazards can vary depending on the amount of change as well as the scale. For example, a high quantity or high intensity of precipitation will impact both the stormwater systems and overland flooding as well as streams and rivers; however, low amounts will produce similar risks as droughts. For the temperature, both high heat and extreme low temperatures were evaluated for the threat to our county. While coastal storms will produce severe impacts, they occur infrequently whereas sea level rise (which can affect the impact of coastal storms) will produce permanent inundation. The results of the climate hazard analysis were used to evaluate the vulnerability of various groups of county assets.

County Assets

The Vulnerability Assessment groups our county's assets into categories intended to align with FEMA's Community Lifelines.¹⁵ This approach aligns with the guidelines followed by the County's Office of Emergency Management.

In this study, we have integrated FEMA's energy and hazardous materials Lifeline categories. In addition, we have expanded the scope to include two more essential categories: our natural resources and socially vulnerable populations. These categories recognize the importance of our environment and underscore our commitment to inclusivity, ensuring that every resident's needs are acknowledged and addressed.

Each asset, integral to the fabric of our county, within these categories is defined and mapped out in **Appendix G. Vulnerability Assessment Report**. Below, we delve into the types of assets that underwent evaluation in our assessment. These assets are not just mere resources but the pillars of our community, the drivers of our economy, and the protectors of our way of life.

Types of County Assets and Infrastructure Evaluated for Vulnerability



Figure 12 below is an example graphic showing the location of transportation infrastructure evaluated for vulnerability to climate change. In addition to the airports, rail stations, railroads, bus stops, and major roads shown in the figure, minor roads, commuter parking lots, sidewalks, bridge locations, port facilities, heliport locations, stormwater management facility locations, stormwater management lines, and culvert geospatial layers were included in the analysis.

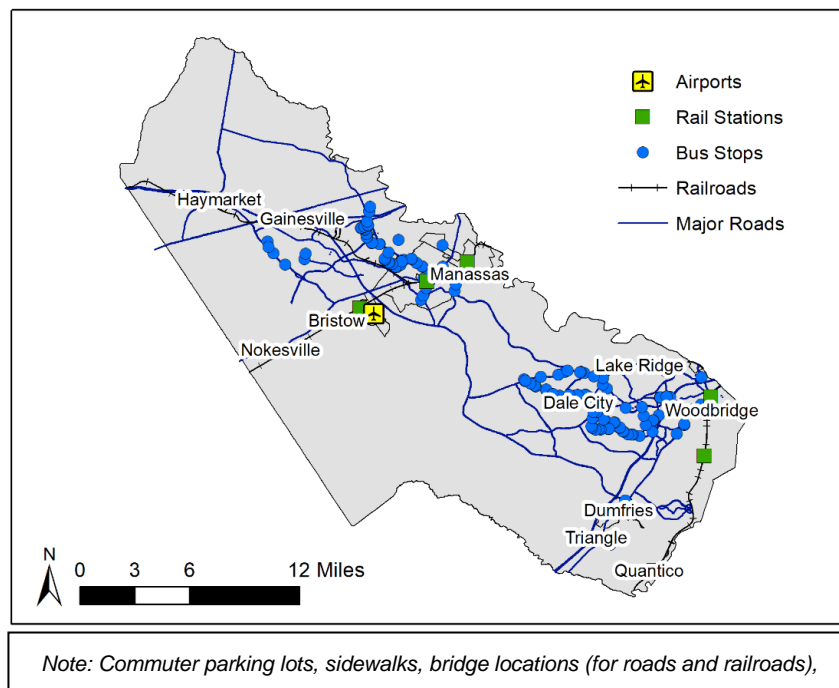


Figure 12. Major Roads, Railroads, Bus Stops, Rail Stations, and Airports included in the Transportation Asset Category

¹⁵ <https://www.fema.gov/emergency-managers/practitioners/lifelines>

Though not fitting the traditional definition of an "asset" category, our assessment includes socially vulnerable populations as a crucial group. To demarcate these populations, we have adopted the use of Equity Emphasis Areas (EEAs), as delineated by a methodology developed by The National Capital Region Transportation Planning Board. The EEAs were developed using tract-level Census data to identify areas that have a significant concentration of low-income and/or minority populations. To identify areas of concentration, the tract percent of four parameters (low-income, African American, Asian, and Hispanic or Latino) were divided against its respective regional average, which resulted in a tract-level Ratio of Concentration. High Ratio of Concentration scores were used to designate EEAs.¹⁶ In our continuous partnership for the prosperity of the community, both the MWCOG and the County have recognized and utilized EEAs as a valuable planning tool. These tools are instrumental in helping us identify and prioritize areas with socially vulnerable populations. The boundaries of these EEAs are illustrated in **Figure 13**.

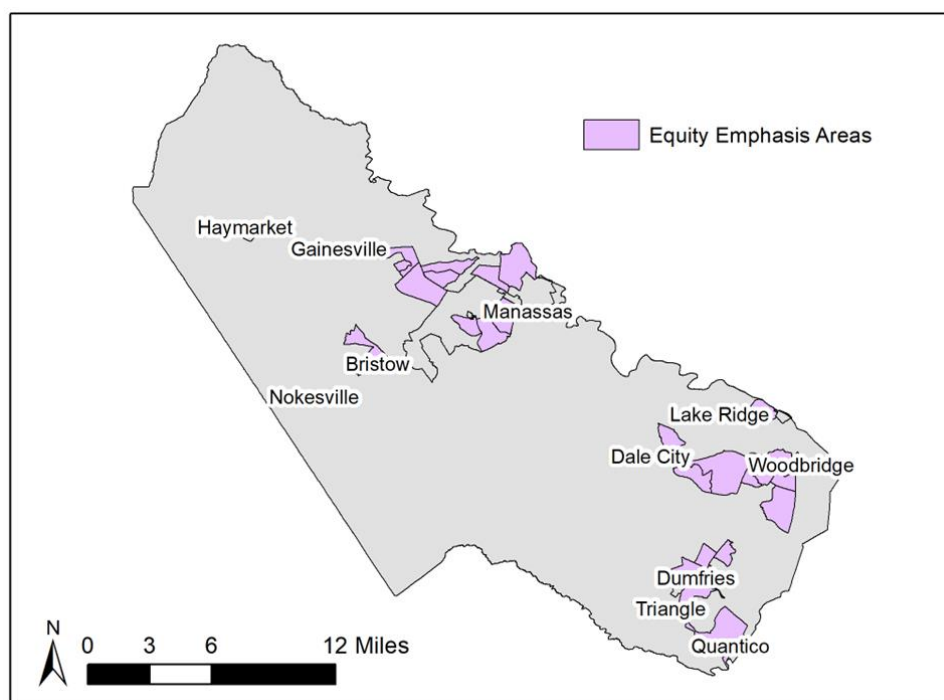


Figure 13. EEAs within Prince William County

Vulnerability Assessment

In our pursuit of safeguarding the county’s vital assets, our Vulnerability Assessment employed a thorough process to determine risk. This process encompassed the evaluation of exposure, sensitivity, and adaptive capacity for each asset category and each natural hazard. Here is a brief description of what each of these measures entails:

- **Exposure** quantifies whether an asset is affected by a climate hazard, and if so, the degree of impact
- **Sensitivity** evaluates the extent to which an asset is impacted when exposed to a climate hazard
- **Adaptive capacity** gauges the capability of an asset to adjust, recover, or resiliently respond to damage inflicted by climate hazards

Based on these metrics, our assessment determined that the following climate hazards exert the most substantial impact on our assets today and for future projections:

- Extreme Temperatures
- Precipitation
- Strong Winds/Tornadoes

Although coastal storms and sea level rise will have a significant impact on areas of the county located along the Potomac River, the overall risk to our county was low due to the limited amount of assets in the coastal floodplain. Drought is a potential threat to the county; however, it was rated low due to the moderate drought

¹⁶ <https://www.mwco.org/assets/1/6/methodology.pdf>

projections countered by the projected increase in precipitation. Earthquakes were evaluated but determined to be of low risk to our county.

In our endeavor to quantify the vulnerability of the county's crucial assets, we assigned numerical values to each rating. These were then added together to calculate vulnerability scores for each asset category, considering each natural hazard and future time horizon. This gave us an assessment of potential risks and challenges we face.

To further streamline our evaluation, the vulnerability scores within each asset category were amalgamated. This collective data was used to attribute a Low, Medium, or High combined vulnerability rating. These ratings offer a clear depiction of the potential risks for two future timelines - the years 2050 and 2075. The specifics of these vulnerability ratings are presented in **Table 3**.

Table 3. Summary of Combined Vulnerability Ratings (2050 and 2075)

Asset Category	Combined Vulnerability Rating	
	2050	2075
Natural Resources	H	H
Socially Vulnerable Populations	H	H
Transportation	H	H
Energy & Hazardous Materials	M	H
Food, Water, and Shelter	M	M
Health and Medical	M	M
Safety and Security	L	L
Communications	L	L

The ratings detailed in **Table 3** offer us an understanding of how susceptible each asset category might be to specific future climate hazards. As a synopsis, our natural resources, socially vulnerable populations, and transportation systems emerge as the asset categories with the highest combined vulnerability ratings across all hazards. These ratings apply to both the projected scenarios of 2050 and 2075. Although these vulnerability ratings are for the future, natural resources, socially vulnerable populations, and transportation are currently the most impacted assets by climate hazards.

These findings guided us in crafting climate adaptation actions and helped assign their respective adaptation scores during the action development and prioritization process.

Chapter 4 CESMP Actions

The CESMP is a guide to action. The actions listed and described in this plan signify a definitive step toward reducing GHG emissions and adapting to climate change. Using the goals as a guide and the analysis completed in Chapters 2 and 3 as a means of understanding our current situation, we now delve into what the actions actually are. Subsequent sections provide some background on how the actions were developed, how the actions can be used to achieve the goals, and more description of the actions themselves.

How the Actions were Developed

The list of CESMP actions demonstrate **what we can do** to reduce emissions and adapt to climate change. The first step in the action development process was to identify current policies and programs that support the 2030 GHG reduction strategies discussed in **Chapter 2 Prince William County Greenhouse Gas Emissions** and address local climate hazards. This helped us understand what's already been done or what actions are currently ongoing. We then wanted to understand the limitation on how much control the County government has to make changes. Finally, we determined areas of opportunity for new action development.

Simultaneously, we identified our community's GHG emissions sources (Chapter 2) and potential vulnerabilities to future climate hazards (Chapter 3), to lay the groundwork for a detailed list of ways to address the Board of County Supervisor goals.

The complete list of new actions is provided in **Appendix A. Complete List of CESMP Actions**. If an action was already underway or in the planning phase and did not need additional support or modification, it was not included in the CESMP list of actions, but rather, considered an existing action and included in **Appendix D. Existing County Government Actions**.

Action Evaluation and Prioritization

The initial draft list of actions underwent a rigorous evaluation process. We assessed their benefits to our community, how well the actions reduce GHG emissions, community health benefits, and improvements to quality of life. We also considered the likelihood the action could be completed considering our resources and how much authority the County government has.

The actions were evaluated using the Climate Action Selection and Prioritization (ASAP) tool. ASAP is a decision-making tool that helps users understand the trade-offs between primary benefits, co-benefits, and feasibility across a range of actions. The ASAP tool is designed to support decision-making, not make decisions itself. By leveraging tools like ASAP, we ensure that every step we take toward a sustainable future is informed, strategic, and advantageous for our community.

During this evaluation process, all actions were evaluated for their impact on specific evaluation criteria. Each evaluation criterion was divided into one of three categories: primary benefits, co-benefits, and feasibility.

- **Primary Benefits:** An estimate of GHG reduction and climate hazard risk reduction resulting from the actions
- **Co-benefits:** Benefits that actions may have in addition to the primary benefits
- **Feasibility:** How easy or difficult it is to implement the action

At the heart of our CESMP is a fundamental commitment to curb GHG emissions and mitigate climate risk. These two aspects were the primary benefits considered in our action evaluation. Additionally, the voices of our community are pivotal to our planning process. Hence, we sought extensive input from our stakeholders. Both County government staff and community members provided feedback on co-benefit and feasibility criteria that are integral to our collective values. The key criteria identified by most stakeholders are detailed in **Table 4**.

Table 4. Action Evaluation Criteria

Criteria Category	Criteria Name	Criteria Definition
Primary Benefits	GHG Reduction Potential	An estimate of GHG reduction potential resulting from the action.
	Climate Risk Reduction Potential	An estimate of climate hazard risk reduction resulting from the action.
Co-Benefits	Organizational Diversity, Equity, and Inclusion	Impact on social, environmental, or economic disparities such as disproportionate levels of air quality, health impacts, access to transit, flood risk, energy burden etc.
	Resource Conservation	Impact on natural resources, such as air, water, raw materials, and the natural environment.
	Savings to Residents and Businesses	Additional costs or savings to residents and businesses.
	Local Employment	Impact on the employment rate, physical access to jobs, income and social mobility, and/or total number of jobs.
Feasibility	Funding Source Identified or Secured	Has full or partial public funding for this action been secured, or has a potential funding source been identified?
	Cost to the County Government	What is the magnitude of upfront, operational, and staffing costs to the County government from the implementation year to 2030?
	Cost Savings to County Government	An initial investment that lowers costs paid by the County government such that cost savings could be used to fund other climate change/adaptation programs.

Each action was rated and scored in the ASAP tool to be compared relative to the other actions. Once scored, the results were reviewed, modified, and vetted by stakeholder groups to answer the question: what 25 actions should we begin with first?

We extended the conversation to the broader community through a public survey and a Townhall meeting, further enriching our understanding of public priority actions. This process resulted in the identification of high, medium, and low priority actions, as defined in [Table 5](#).

Table 5. Priority Level Definitions

Priority Level	Definition
High Priority	<ul style="list-style-type: none"> • Actions we will focus on implementing immediately after CESMP adoption • Actions that are fleshed out with greater detail in this plan, including Implementation Roadmaps to guide our initial steps on implementation
Medium Priority	<ul style="list-style-type: none"> • Actions that scored highly for primary benefits (GHG reduction and climate risk reduction) but were not included in high priority list • Actions that can serve as a starting point for future ideas after we have meaningful progress on priority actions
Low Priority	<ul style="list-style-type: none"> • Actions that address emissions sources within the county and fill in potential policy/programmatic gaps, but have much lower GHG reduction or climate risk reduction impacts • Actions were not favored (or were disfavored) by stakeholder groups

The following describes our method of action prioritization:

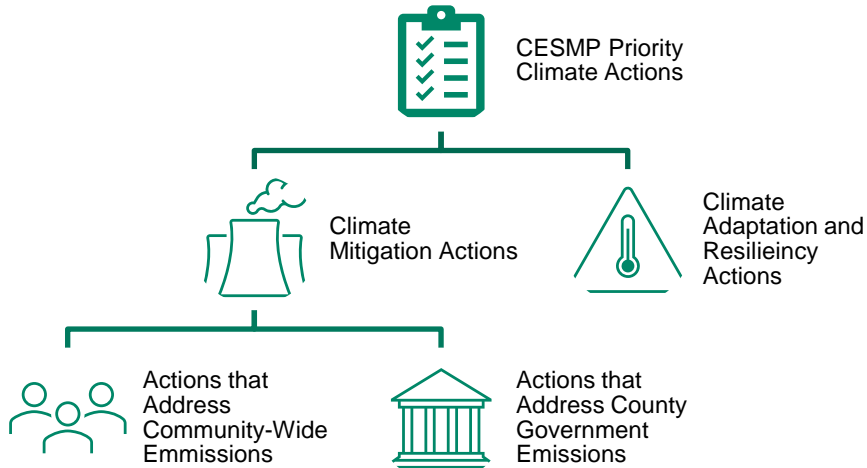
- Prioritize actions that scored highly across all evaluation categories, i.e., actions that produced high GHG or climate risk reduction, co-benefits, and feasibility scores.

- Prioritize actions that the stakeholder groups identified as high priority and integrate their feedback on prioritization considerations and methods.
- Prioritize other actions that produced high GHG reduction or climate risk reduction scores to reach 25 actions as reducing emissions and addressing climate risk are the main goals of the CESMP.

The action development process resulted in 25 high priority actions, 23 medium priority actions, and 11 low priority actions. The following sections describe the 25 high priority actions in more detail. Additionally, Implementation Roadmaps were developed for each high priority action in **Appendix B. Implementation Plan.**

How to Read the List of Actions

The sections below divide the 25 high priority actions into two groups: Climate **Mitigation** Actions (that reduce GHG emissions) and Climate **Adaptation and Resiliency** Actions (that protect us from climate hazards) as shown in the graphic below. Though they are in two separate sections, Mitigation Actions may provide adaptation benefits and Adaptation Actions may provide mitigation benefits. Mitigation Actions are then further divided by the emissions sources they address (community-wide emissions or County government emissions).



Each of the 25 high priority actions are described in more detail using the following format:

<p>Action Number: E.# = Electricity B.# = Buildings T.# = Transportation N.# = Natural Resources A.# = Adaptation</p>	<p>Action Title: Short action title</p>
<p>Action Description: A paragraph description of what the action entails.</p>	
<p>County Goals Supported:</p> <ul style="list-style-type: none"> Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 Source 100% of county-wide electricity from renewable sources by 2035 Achieve 100% renewable electricity in County government operations by 2030 Achieve 100% carbon neutrality in County government operations by 2050 Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 Become a Climate Ready Region and making significant progress to be a Climate Resilient Region by 2030 	
<p>2030 GHG Reduction Strategy:</p> <ul style="list-style-type: none"> Source 92% clean electricity Achieve 50% zero-emission private vehicles Achieve 40% highly efficient and electric heating, ventilation, air conditioning (HVAC) systems and water heaters Replace 57% HFCs with low- or zero- GWP alternatives Shift 5% of total trips from private vehicles to active or public transport Achieve a 60% waste diversion rate Obtain 100% high-efficiency lighting and appliances Achieve 15% zero-emission off-road equipment Reduce aviation emissions by 20% Reduce agricultural emissions by 10% 	<p>Action GHG Reduction Potential*:</p> <ul style="list-style-type: none"> Very High: greater than 500,000 (MTCO₂e) High: 50,000-500,000 MTCO₂e reduced Medium: 10,000-50,000 MTCO₂e reduced Low: less than 10,000 MTCO₂e reduced Unknown: Not Quantified <p>*The GHG reduction potential represents the high/maximum estimate for GHG reductions</p>
<p>Climate Hazard Addressed:</p> <ul style="list-style-type: none"> All Climate Hazards Precipitation High Winds & Tornadoes Sea Level Rise 	

<ul style="list-style-type: none"> Extreme Heat 	
Investment Level: <ul style="list-style-type: none"> Extremely Large Cost = >\$100M Very Large Cost = \$10M-100M Large Cost = \$1M-10M Some Cost = \$100k-1M Very Little Cost = \$0-100k None = No additional costs beyond existing staff time 	Co-Benefits: <ul style="list-style-type: none"> Organizational Diversity, Equity and Inclusion Resource Conservation Savings to Residents and Businesses Local Employment Cost Savings to County Government None + Somewhat Positive ++ Very Positive
Lead Department(s): The department(s) that will lead action implementation.	Primary Partners: Internal or external partners that can aid in action implementation.

The complete list of 60 CESMP actions with descriptions of each action is also provided in [Appendix A. Complete List of CESMP Actions.](#)

Climate Mitigation Actions

While our 2030 GHG reduction scenario ([Chapter 2 Prince William County Greenhouse Gas Emissions](#)) shows **what it will take** for us to achieve the 2030 GHG reduction goal, the climate mitigation actions describe **what we could do** to realize this scenario. Actions that are meant to address community-wide emissions are listed separately from actions that address County government operations emissions.

Climate Mitigation Actions for the Community

There are 15 high priority community climate mitigation actions that address community-wide emission sources (see [Table 6](#)). Actions that also provide climate adaptation benefits are marked with an asterisk.

Table 6. Climate Mitigation Actions for the Community

Sector	Climate Mitigation Actions for the Community
Electricity	E.1: Acquire Clean Electricity Sources for the County
	E.2: Promote Renewable Energy Incentive Programs and Develop Additional Solar Incentives
	E.3: Incentivize Renewable Energy Use in Energy-Intensive Commercial Buildings
	E.4: Promote Existing Green Power Products
Buildings	B.1: Incentivize Energy Efficiency and Electrification Retrofits
	B.2: Propose Green Zoning Regulations
	B.3: Incentivize Energy Efficient and Electric New Construction
	B.4: Promote Energy Efficiency and Electrification Incentives
Transportation	T.1: Improve Pedestrian and Bicycle Infrastructure and Enhance Connectivity
	T.2: Incentivize Transit-Oriented Development
	T.3: Expand Existing Programs that Reduce Single-Occupancy Vehicle Trips
	T.4 Upgrade Public Transit Infrastructure
	T.5: Incentivize Zero-Emission Vehicles and Charging
	T.6: Expand Public EV Charging Network
Natural Resources	N.1: Adopt Natural Open Space Requirements*

*Action also provides climate adaptation benefits

Electricity – E.1	Acquire Clean Electricity Sources for the County
<p>Action Description: Form an opt-out municipal aggregation program to acquire 100% clean electricity for Dominion Energy customers in the community. A municipal aggregation program, also known as community choice aggregation (CCA), allows local governments to negotiate for 100% clean or renewable electricity for all the electricity customers within their jurisdiction. Through a CCA, a local government can purchase and manage their community's electric power supply from a preferred mix of energy sources while the utility continues to provide distribution, billing services, and outage management. In the county, a CCA may be able to be formed in Dominion Energy's territory, but further legal review is needed, especially to determine if one could be formed in Northern Virginia Electric Cooperative's (NOVEC's) territory. If we develop an opt-out program, customers would automatically be enrolled in 100% clean electricity but can opt-out to revert to their traditional service and electricity energy source mix. This action could substantially reduce county-wide electricity emissions, depending on the offered clean electricity mix and how many customers opt-out of the program.</p>	
<p>County Goals Supported:</p> <ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Source 100% of county-wide electricity from renewable sources by 2035 • Achieve 100% renewable electricity in County government operations by 2030 • Achieve 100% carbon neutrality in County government operations by 2050 	
<p>2030 GHG Reduction Strategy:</p> <ul style="list-style-type: none"> • Source 92% clean electricity 	<p>Action GHG Reduction Potential: Very High</p>
<p>Investment Level: Large Cost</p>	<p>Co-Benefits: None</p>
<p>Lead Department: Office of Sustainability</p>	<p>Primary Partners:</p> <ul style="list-style-type: none"> • Facilities and Fleet Management • Finance • Management and Budget • Economic Development

Electricity – E.2	Promote Renewable Energy Incentive Programs and Develop Additional Solar Incentives
<p>Action Description: Provide outreach and education on programs and incentives for residents and businesses to install renewable energy systems, such as federal solar tax credits, community solar programs, net metering, the multifamily shared solar program, solar renewable energy certificates, and Solarize NOVA. Develop additional local renewable energy incentives, such as streamlined solar permitting, in partnership with stakeholders such as the Residential Solar Task Force and local utilities. This would include providing a centralized tool for residents and businesses to reference relevant federal, state, county, and utility incentives and programs.</p>	
<p>County Goals Supported:</p> <ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Source 100% of county-wide electricity from renewable sources by 2035 	
<p>2030 GHG Reduction Strategy:</p> <ul style="list-style-type: none"> • Source 92% clean electricity 	<p>Action GHG Reduction Potential: Medium</p>
<p>Investment Level: Some Cost</p>	<p>Co-Benefits:</p> <ul style="list-style-type: none"> • Local Employment: + • Savings to Residents and Business: +
<p>Lead Department(s):</p> <ul style="list-style-type: none"> • Development Services - Building Development Division • Development Services - Land Development Division • Real Estate Assessments • Office of Sustainability 	<p>Primary Partners:</p> <ul style="list-style-type: none"> • Economic Development • Residential Solar Task Force • Dominion • NOVEC

Electricity – E.3	Incentivize Renewable Energy Use in Energy-Intensive Commercial Buildings
<p>Action Description: Incentivize the use of renewable energy in energy-intensive commercial buildings through a voluntary reporting program, expedited permitting or height bonuses. As commercial building electricity use is forecast to generate roughly 28% of county-wide emissions by 2030, incentivizing emissions reductions in this sector is crucial toward meeting the 2030 GHG reduction target.</p>	
<p>County Goals Supported:</p> <ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Source 100% of county-wide electricity from renewable sources by 2035 	
<p>2030 GHG Reduction Strategy:</p> <ul style="list-style-type: none"> • Source 92% clean electricity 	<p>Action GHG Reduction Potential: High</p>
<p>Investment Level: Large Cost</p>	<p>Co-Benefits: None</p>
<p>Lead Department(s):</p> <ul style="list-style-type: none"> • Development Services • Planning Office • Economic Development 	<p>Primary Partners: Businesses and Data Centers</p>

Electricity – E.4	Promote Existing Green Power Products
Action Description: Promote purchasing utility green power options within the community. Green power products allow customers to purchase renewable or clean electricity on a month-to-month basis through an added fee on their utility bill. Both Dominion and NOVEC offer 100% renewable electricity options.	
County Goals Supported: <ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Source 100% of county-wide electricity from renewable sources by 2035 • Achieve 100% renewable electricity in County government operations by 2030 • Achieve 100% carbon neutrality in County government operations by 2050 	
2030 GHG Reduction Strategy: <ul style="list-style-type: none"> • Source 92% clean electricity 	Action GHG Reduction Potential: High
Investment Level: Some Cost	Co-Benefits: Organizational Diversity, Equity, and Inclusion: +
Lead Department(s): Office of Sustainability	Primary Partners: <ul style="list-style-type: none"> • Communications • Public Works • Dominion and NOVEC

Buildings – B.1	Incentivize Energy Efficiency and Electrification Retrofits
Action Description: Incentivize existing building energy efficiency and electrification retrofits through actions such as streamlined permitting.	
County Goals Supported: <ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 	
2030 GHG Reduction Strategy: <ul style="list-style-type: none"> • Achieve 40% highly efficient and electric HVAC systems and water heaters • Obtain 100% high-efficiency lighting and appliances 	Action GHG Reduction Potential: Medium
Investment Level: Large Cost	Co-Benefits: <ul style="list-style-type: none"> • Resource Conservation: + • Local Employment: + • Savings to Residents and Business: +
Lead Department(s): <ul style="list-style-type: none"> • Development Services – Building Department 	Primary Partners: None identified

Buildings – B.2	Propose Green Zoning Regulations
Action Description: Propose green zoning regulations to incentivize energy- and water-efficient buildings, multifamily and mixed-use areas, and transit-oriented developments. Green zoning involves revising zoning policies to require or incentivize developers to abide by certain sustainable development practices. Denser developments and multifamily housing units typically use less energy than other, more dispersed building types. Additionally, mixed-used and transit-oriented areas significantly reduce the need for vehicle travel, which would also reduce transportation emissions.	
County Goals Supported: <ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 	
2030 GHG Reduction Strategy: <ul style="list-style-type: none"> • Achieve 40% highly efficient and electric HVAC systems and water heaters • Obtain 100% high-efficiency lighting and appliances • Shift 5% of total trips from private vehicles to active or public transport 	Action GHG Reduction Potential: Medium
Investment Level: Some Cost	Co-Benefits: <ul style="list-style-type: none"> • Local Employment: + • Organizational Diversity, Equity, and Inclusion: +
Lead Department(s): Planning Office	Primary Partners: <ul style="list-style-type: none"> • Transportation • Housing • Watershed • Parks and Recreation • Economic Development/Community Development

Buildings – B.3	Incentivize Energy Efficient and Electric New Construction
Action Description: Provide incentives for developers to build energy-efficient or all-electric new developments, such as streamlined permitting.	
County Goals Supported: <ul style="list-style-type: none"> Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 	
2030 GHG Reduction Strategy: <ul style="list-style-type: none"> Achieve 40% highly efficient and electric HVAC systems and water heaters Obtain 100% high-efficiency lighting and appliances 	Action GHG Reduction Potential: Medium
Investment Level: Large Cost	Co-Benefits: None
Lead Department(s): <ul style="list-style-type: none"> Planning Office Development Services 	Primary Partners: None identified

Buildings – B.4	Promote Energy Efficiency and Electrification Incentives
Action Description: Provide outreach and education to residents and businesses about tools, technology, and incentives for building energy efficiency and electrification. This would include providing a centralized webpage or tool for residents and businesses to reference relevant federal, state, and utility incentives, Commercial Property Assessed Clean Energy (C-PACE) information, and County government programs, among other resources.	
County Goals Supported: <ul style="list-style-type: none"> Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 	
2030 GHG Reduction Strategy: <ul style="list-style-type: none"> Achieve 40% highly efficient and electric HVAC systems and water heaters Obtain 100% high-efficiency lighting and appliances 	Action GHG Reduction Potential: Medium
Investment Level: Some Cost	Co-Benefits: <ul style="list-style-type: none"> Resource Conservation: + Savings to Residents and Businesses: +
Lead Department(s): Office of Sustainability	Primary Partners: <ul style="list-style-type: none"> Development Services Communications Office Economic Development Green Business Council

Transportation – T.1	Improve Pedestrian and Bicycle Infrastructure and Enhance Connectivity
Action Description: Improve active transportation infrastructure, sidewalk and trail connectivity, and overall safety to support walking, biking, and rolling. Improvements could include providing bike lockers, installing curb ramps, or installing traffic-calming designs like crosswalk islands or speed humps. This action would involve developing a strategic Active Transportation Plan that includes recommendations for prioritizing infrastructure improvements and outlines new active transportation policies, processes, and infrastructure.	
County Goals Supported: <ul style="list-style-type: none"> Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 	
2030 GHG Reduction Strategy: <ul style="list-style-type: none"> Shift 5% of total trips from private vehicles to active or public transport 	Action GHG Reduction Potential: High
Investment Level: Very Large Cost	Co-Benefits: <ul style="list-style-type: none"> Resource Conservation: + Local Employment: + Savings to Residents and Business: + Organizational Diversity, Equity, and Inclusion: +
Lead Department(s): <ul style="list-style-type: none"> Transportation Parks, Recreation and Tourism 	Primary Partners: <ul style="list-style-type: none"> Planning Office Watershed Service Authority Virginia Department of Transportation (VDOT)* Schools

* PWC can build public roads and sidewalks which are then adopted into the state system and maintained by VDOT. Any public road/sidewalk development proposed by PWC needs to be approved by VDOT and VDOT could override proposed development in any right-of-way.

Transportation – T.2		Incentivize Transit-Oriented Development	
Action Description: Incentivize transit-oriented development (TOD) within ½-mile of high-capacity regional transit stations. This could be done through developer incentives, such as streamlined permitting, or zoning amendments. The County could also require bicycle parking minimums in TOD areas.			
County Goals Supported: <ul style="list-style-type: none"> Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 			
2030 GHG Reduction Strategy: <ul style="list-style-type: none"> Shift 5% of total trips from private vehicles to active or public transport 		Action GHG Reduction Potential: High	
Investment Level: Some Cost		Co-Benefits: <ul style="list-style-type: none"> Resource Conservation: + Local Employment: + Organizational Diversity, Equity, and Inclusion: + 	
Lead Department(s): <ul style="list-style-type: none"> Planning Office Transportation 		Primary Partners: <ul style="list-style-type: none"> Potomac and Rappahannock Transportation Commission (PRTC) Virginia Railway Express (VRE) Development Services 	

Transportation – T.3		Expand Existing Programs that Reduce Single-Occupancy Vehicle Trips	
Action Description: Expand and promote programs that offer transportation demand management services, reduce transit fares, and support teleworking.			
County Goals Supported: <ul style="list-style-type: none"> Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 Achieve 100% carbon neutrality in County government operations by 2050 			
2030 GHG Reduction Strategy: <ul style="list-style-type: none"> Shift 5% of total trips from private vehicles to active or public transport 		Action GHG Reduction Potential: Medium	
Investment Level: Some Cost		Co-Benefits: <ul style="list-style-type: none"> Resource Conservation: + Local Employment: + Savings to Residents and Business: + Organizational Diversity, Equity, and Inclusion: + 	
Lead Department(s): Transportation		Primary Partners: <ul style="list-style-type: none"> Planning Office PRTC 	

Transportation – T.4		Upgrade Public Transit Infrastructure	
Action Description: Partner with county transit operators and VDOT to improve and provide new public transit infrastructure and build out transit nodes. Though the County government does not operate the public buses that service the county, the County government can help provide supportive infrastructure to help increase the efficiency and frequency of bus travel. However, as most public roads and bus infrastructure are maintained by VDOT, County government will partner with VDOT to identify and develop transit priority treatments.			
County Goals Supported: <ul style="list-style-type: none"> Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 			
2030 GHG Reduction Strategy: <ul style="list-style-type: none"> Shift 5% of total trips from private vehicles to active or public transport 		Action GHG Reduction Potential: Medium	
Investment Level: Extremely Large Cost		Co-Benefits: <ul style="list-style-type: none"> Resource Conservation: + Local Employment: + Savings to Residents and Business: + Organizational Diversity, Equity, and Inclusion: + 	
Lead Department(s): Transportation		Primary Partners: <ul style="list-style-type: none"> Planning Office PRTC Virginia Department of Rail and Public Transportation (DRPT) VRE VDOT 	

Transportation – T.5		Incentivize Zero-Emission Vehicles and Charging	
Action Description: Develop incentives and cost-reduction programs for residents and businesses to purchase zero-emission vehicles (ZEVs) or install charging equipment such as streamlined permitting for EV chargers, "group-buy" programs for EV chargers, or EV purchasing co-ops.			
County Goals Supported: <ul style="list-style-type: none"> Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 			
2030 GHG Reduction Strategy: <ul style="list-style-type: none"> Achieve 50% zero-emission private vehicles 		Action GHG Reduction Potential: High	
Investment Level: Large Cost		Co-Benefits: <ul style="list-style-type: none"> Resource Conservation: + Local Employment: + Savings to Residents and Business: + 	
Lead Department(s): <ul style="list-style-type: none"> Transportation Development Services 		Primary Partners: None identified	

Transportation – T.6		Expand Public EV Charging Network	
Action Description: Expand public EV charging infrastructure especially along main routes and in popular destinations. This would include developing an EV Infrastructure Plan to guide community deployment and considerations for electric bike charging.			
County Goals Supported: <ul style="list-style-type: none"> Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 			
2030 GHG Reduction Strategy: <ul style="list-style-type: none"> Achieve 50% zero-emission private vehicles 		Action GHG Reduction Potential: High	
Investment Level: Very Large Cost		Co-Benefits: <ul style="list-style-type: none"> Resource Conservation: + Local Employment: ++ Savings to Residents and Business: + Organizational Diversity, Equity, and Inclusion: + 	
Lead Department(s): <ul style="list-style-type: none"> Transportation Facilities and Fleet Management 		Primary Partners: <ul style="list-style-type: none"> VDOT VRE PRTC 	

Natural Resources – N.1		Adopt Natural Open Space Requirements	
Action Description: Establish minimum Natural Open Space (NOS) guidelines to encourage preservation of NOS, if appropriate, in new and existing development. NOS is "open space with natural resource benefits within the boundaries of a development such as native forests; topographic features; critical habitats for threatened and endangered species and species of special concern; natural creeks, streams and lakes; and natural wetlands that are set aside as an area to remain undisturbed during development and in perpetuity for the preservation of the natural resources contained therein and for the passive use and enjoyment of the residents of the development and/or the public at large."			
County Goals Supported: <ul style="list-style-type: none"> Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 Become a Climate Ready Region and make significant progress to be a Climate Resilient Region by 2030 			
2030 GHG Reduction Strategy: NA		Action GHG Reduction Potential: Unknown Climate Hazard: Extreme Heat	
Investment Level: Some Cost		Co-Benefits: Resource Conservation: ++	
Lead Department(s): <ul style="list-style-type: none"> Public Works - Watershed County Arborist 		Primary Partners: <ul style="list-style-type: none"> Planning Office County Attorney's office Owners of open space areas (homeowners associations [HOAs], commercial owners, environmental trusts, etc.) 	

Climate Mitigation Actions for County Government

There are three high priority County government climate mitigation actions that address County government operations emission sources (see [Table 7](#)). Though not explicitly listed as an action in the CESMP, one of our initial steps will be to create a County government operations GHG inventory to better measure and track progress toward achieving carbon neutrality in County government operations by 2050. Further discussion of how actions can help meet other government GHG and renewable energy goals are described in the [Chapter 5 Meeting the County Goals](#).

Table 7. Climate Mitigation Actions for County Government

Climate Mitigation Actions for County Government	Sector
E.5: Install Solar on County Government Facilities	Electricity
B.5: Transition to Net Zero County Government Facilities	Buildings
T.7: Adopt Zero- or Low-Emissions County Fleet	Transportation

Electricity – E.5		Install Solar on County Government Facilities	
Action Description: Develop solar projects on our County government facilities through direct ownership or third-party ownership models such as Power Purchase Agreements (PPAs).			
County Goals Supported:			
<ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Source 100% of county-wide electricity from renewable sources by 2035 • Achieve 100% renewable electricity in County government operations by 2030 • Achieve 100% carbon neutrality in County government operations by 2050 			
2030 GHG Reduction Strategy:		Action GHG Reduction Potential: Low	
<ul style="list-style-type: none"> • Source 92% clean electricity 			
Investment Level: Large Cost		Co-Benefits:	
		<ul style="list-style-type: none"> • Local Employment: + • Cost Savings to County Government: + 	
Lead Department(s): Fleets and Facilities Management		Primary Partners: Departments with facilities not managed by Facilities and Fleet:	
		<ul style="list-style-type: none"> • Community Services • Housing and Community Development • Fire & Rescue • Parks, Recreation & Tourism • Public Works • Adult Detention Center 	

Buildings – B.5		Transition to Net Zero County Government Facilities	
Action Description: Develop a net-zero emissions building plan for County government facilities, which will include implementing an energy benchmarking program and procuring 100% clean electricity for all County government operations.			
County Goals Supported:			
<ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Source 100% of county-wide electricity from renewable sources by 2035 • Achieve 100% renewable electricity in County government operations by 2030 • Achieve 100% carbon neutrality in County government operations by 2050 			
2030 GHG Reduction Strategy:		Action GHG Reduction Potential: Medium	
<ul style="list-style-type: none"> • Source 92% clean electricity • Achieve 40% highly efficient and electric HVAC systems and water heaters • Replace 57% HFCs with low- or zero- GWP alternatives • Obtain 100% high-efficiency lighting and appliances 			
Investment Level: Very Large Cost		Co-Benefits:	
		<ul style="list-style-type: none"> • Resource Conservation: + • Cost Savings to County Government: + 	
Lead Department(s):		Primary Partners: Departments with facilities not managed by Facilities and Fleet:	
<ul style="list-style-type: none"> • Facilities and Fleet Management • Finance – Risk and Wellness Services 		<ul style="list-style-type: none"> • Community Services • Housing and Community Development • Fire & Rescue • Parks, Recreation & Tourism • Public Works • Adult Detention Center 	

Transportation – T.7		Adopt Zero- or Low-Emissions County Fleet	
Action Description: Transition County fleet to zero- or low-emissions vehicles and ensure supporting infrastructure is open to other fleets.			
County Goals Supported: <ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Achieve 100% carbon neutrality in County government operations by 2050 			
2030 GHG Reduction Strategy: <ul style="list-style-type: none"> • Achieve 50% zero-emission private vehicles 		Action GHG Reduction Potential: Low	
Investment Level: Extremely Large Cost		Co-Benefits: <ul style="list-style-type: none"> • Resource Conservation: + • Cost Savings to County Government: ++ 	
Lead Department(s): Fleets and Facilities Management		Primary Partners: None identified	

Climate Adaptation and Resiliency Actions

The climate adaptation and resiliency actions (**Table 8**) provide opportunities for us to address existing and future climate hazards that impact our county. Actions that also provide climate mitigation benefits through tree sequestration or reduce energy use are marked with an asterisk.

Table 8. Climate Action and Resiliency Actions

Climate Adaptation and Resiliency Actions	Climate Hazard Addressed
A.1: Develop Adaptation Plans for Critical Facilities	All Climate Hazards
A.2: Manage Stormwater Flooding Outside of the Floodplain	Precipitation
A.3: Improve Power Resiliency for Critical Infrastructure	High Winds & Tornadoes, Extreme Temperature
A.4: Implement Shoreline Protection and Nature-Based Solutions	Sea Level Rise
A.5: Restore Streams to Reduce Flooding	Precipitation
A.6: Incentivize Technology for Residents to Make Homes Adaptive*	Extreme Heat
A.7: Plan Alternative Evacuation Routes for Flood-prone Areas	Precipitation

* Action also provides climate mitigation benefits

Climate Adaptation – A.1	Develop Adaptation Plans for Critical Facilities
Action Description: Develop site-level adaptation plans for critical facilities and service areas considering current and future climate change hazards.	
Climate Hazard: <ul style="list-style-type: none"> All Climate Hazards 	
Investment Level: Some Cost	Co-Benefits: <ul style="list-style-type: none"> Savings to Residents and Businesses: ++ Organization Diversity, Equity and Inclusion: + Cost Savings to County Government: ++
Lead Department(s): Office of Emergency Management	Primary Partners: <ul style="list-style-type: none"> Facilities and Fleet Management (for County facilities) Risk and Wellness (for some County facilities) External critical facility owners

Climate Adaptation – A.2	Manage Stormwater Flooding Outside of the Floodplain
Action Description: Increase understanding of flooding in areas outside of the delineated FEMA floodplain through modeling and/or historic flood records. Develop and implement mitigation actions to reduce stormwater flooding.	
Climate Hazard: <ul style="list-style-type: none"> Precipitation 	
Investment Level: Large Cost	Co-Benefits: Cost Savings to the County Government: +
Lead Department(s): Office of Emergency Management	Primary Partners: <ul style="list-style-type: none"> Public Works – Watershed VDOT

Climate Adaptation – A.3	Improve Power Resiliency for Critical Infrastructure
Action Description: Improve the resiliency of electrical infrastructure for publicly owned essential services and infrastructure.	
Climate Hazard: <ul style="list-style-type: none"> Extreme Temperature High Winds & Tornadoes 	
Investment Level: Large Cost	Co-Benefits: <ul style="list-style-type: none"> Local Employment: + Savings to Residents and Businesses: + Organization Diversity Equity and Inclusion: + Cost Savings to County Government: +
Lead Department(s): <ul style="list-style-type: none"> Office of Emergency Management Critical Infrastructure Owners County Energy Providers 	Primary Partners: <ul style="list-style-type: none"> Facilities and Fleet Management Parks & Rec Fire

Climate Adaptation – A.4	Implement Shoreline Protection and Nature-Based Solutions
Action Description: Develop guidance to prioritize nature-based solutions for shoreline protection for coastal areas.	
Climate Hazard: • Sea level rise	
Investment Level: Large Cost	Co-Benefits: • Resource Conservation: ++ • Savings to Residents and Businesses: + • Organization Diversity, Equity and Inclusion: + • Cost Savings to County Government: +
Lead Department(s): Public Works – Watershed	Primary Partners: • Development Services - Land Development Division • Office of Emergency Management • Parks, Recreation and Tourism

Climate Adaptation – A.5	Restore Streams to Reduce Flooding
Action Description: Develop and implement stream restoration projects in support of reduced flooding outcomes.	
Climate Hazard: • Precipitation	
Investment Level: Large Cost	Co-Benefits: • Resource Conservation: ++ • Savings to Residents and Businesses: + • Organizational Diversity, Equity and Inclusion: + • Cost Savings to County Government: +
Lead Department(s): • Public Works, Watershed Team	Primary Partners: • Planning Office • Office of Emergency Management

Climate Adaptation – A.6	Incentivize Technology for Residents to Make Homes Adaptive
Action Description: Provide additional incentives or subsidies for residents of low-income housing and rental properties to install or retrofit buildings with climate adaptive technologies to reduce energy, reduce water use, reduce waste heat, and minimize urban heat gain.	
Climate Hazard: • Extreme Heat	
Action GHG Reduction Potential: • Low	
Investment Level: Large Cost	Co-Benefits: • Resource Conservation: ++ • Savings to Residents and Businesses: + • Organizational Diversity, Equity and Inclusion: ++
Lead Department(s): Office of Sustainability	Primary Partners: • Development Services • Dominion Energy

Climate Adaptation – A.7	Plan Alternate Evacuation Routes for Flood-prone Areas
Action Description: Develop localized evaluation routes throughout PWC and socialize with the public.	
Climate Hazard: • Precipitation	
Investment Level: Large Cost	Co-Benefits: None Identified
Lead Department(s): Office of Emergency Management	Primary Partners: None Identified

Chapter 5 Meeting the County Goals

The CESMP provides a list of actions to address the following goals:

1. **Cut GHG Emissions County-Wide by 2030:** Reduce GHG emissions county-wide to 50% below 2005 levels by 2030
2. **Use 100% Renewable Electricity County-Wide by 2035:** Source 100% of county-wide electricity from renewable sources by 2035
3. **Use 100% Renewable Electricity in County Government Operations by 2030:** Achieve 100% renewable electricity in the County government operations by 2030
4. **Become Carbon Neutral for County Government Operations by 2050:** Achieve 100% carbon neutrality in the County government operations by 2050
5. **Prepare for Climate Change:** Become a Climate Ready Region and make significant progress to be a Climate Resilient Region by 2030

The complete list of actions provided in [Appendix A. Complete List of CESMP Actions](#) indicates the goals each action supports. Our goals are aggressive. However, they are not significantly different from the broader region in Virginia. We recognize that although meeting these goals will be challenging, we are committed to immediate action. The sections below discuss how we may meet each of these five goals, and strategies that could be used to increase our likelihood of success.

Goal 1: Greenhouse Gas Reduction

Our **2030 GHG Emissions Reduction Scenario** shows **what it will take** to achieve the 2030 goal, while the **Climate Mitigation Actions** show **what we can do** to achieve the reduction scenario strategies and ultimately the 2030 goal. In Virginia, counties cannot force businesses and residents (by means of law) to purchase only electric vehicles. Similarly, we cannot force all businesses and residents to use only carbon free electricity. There will always be a portion of our county's GHG emissions that we can neither control nor eliminate completely without external support. What we *can* do is incentivize this type of behavior and make reasonable estimates (low and high) that a portion of the population will work with us on achieving these goals. So how close can we get to meeting our GHG reduction goals?

Figure 14 shows what our 2030 county-wide emissions levels might be under different scenarios. The bottom line shows the 2030 goal trajectory, and the top line shows the effect of doing nothing. The middle lines show the effects of varying degree of actions in and outside of our control. If we were to implement all actions listed in the CESMP, there is a gap of about 500,000-1,400,000 MTCO₂e shown as the shaded pink area. This includes the current and future effects of existing regulations and the impact of the market.

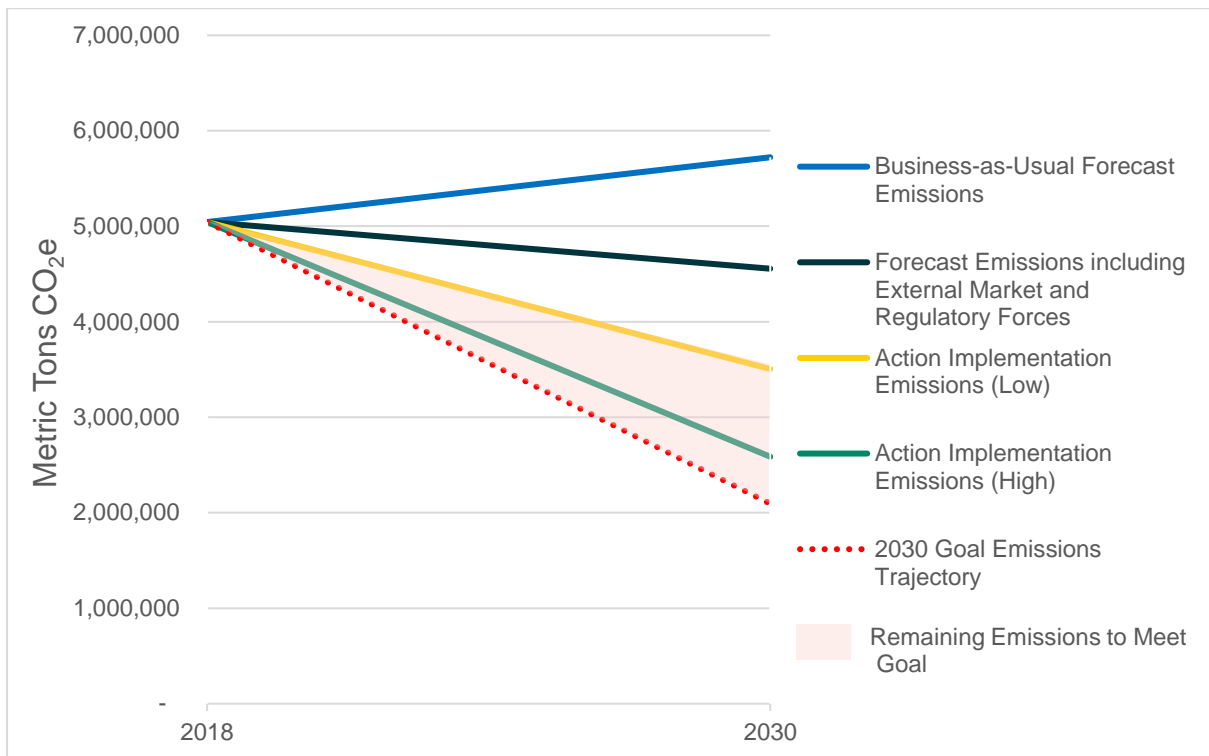


Figure 14. GHG Reduction Potential and Remaining Emissions

The GHG emission gap in **Figure 14** highlights the importance of implementing a municipal aggregation program (also known as community choice aggregation or CCA) through action E.1: Acquire Clean Electricity Sources for the County. In the low action implementation scenario, it is assumed that a CCA is only enacted in Dominion territory, while in the high action implementation scenario, a CCA is enacted for both Dominion and NOVEC territory. The CCA action alone could generate 800,000-1,600,000 MTCO₂e in emissions reductions for the county by 2030, which represents 23-46% of the reductions needed to meet the 2030 goal. Without a CCA, the other clean energy actions may only generate 2-12% of the reductions needed to meet the 2030 target, which means the emissions gap to meet the 2030 goal would be widened from 500,000-1,400,000 MTCO₂e to 1,700,000-2,400,000 MTCO₂e. **Figure 15** illustrates potential action implementation emissions levels if a CCA program is not implemented.

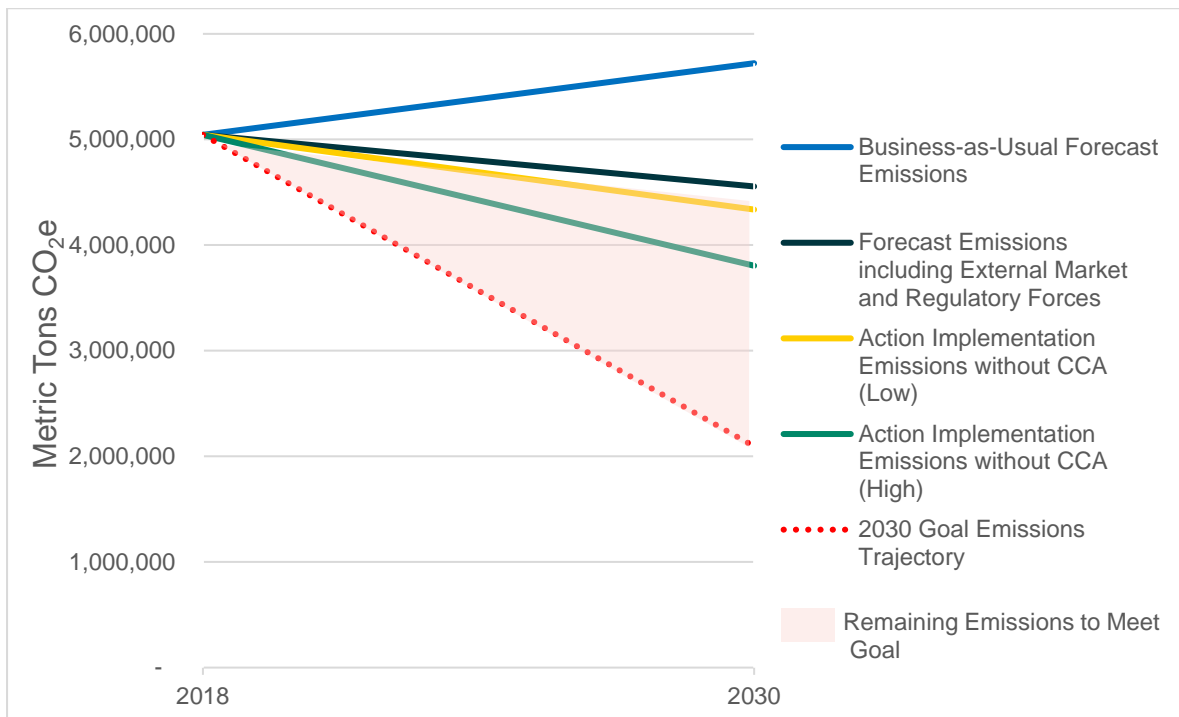


Figure 15. GHG Reduction Potential and Remaining Emissions without a CCA Program

Even with the successful implementation of a CCA program, there will still most likely be additional measures needed to meet the GHG reduction goal, as shown in [Figure 14](#). This gap could be met through three different but complementary strategies:

1. Gaining more County government control over actions that impact our GHG emissions through advocating for ourselves at the state and national level (see discussion in [Opportunities for External Advocacy and Action](#))
2. Considering the positive effects that forests and trees have on reducing GHG emissions, and/or
3. Purchasing qualified carbon offsets

A discussion on how to integrate forests and trees into our GHG inventory and how we might consider carbon offsets are provided in the sections below.

Integrating Forests and Trees

Forests and trees naturally play a positive role in reducing the effects of climate change and GHG emissions by capturing CO₂. MWCOC calculated the reduction of CO₂ emissions due to forest and trees in the county from 2005 to 2020. This data showed that including the effects of forests and trees in our GHG inventories would decrease total annual emissions by roughly 7%. This ultimately makes it easier for us to meet our GHG reduction goals by shrinking the gap between what we need to do and what we can do.

As MWCOC noted that there are significant uncertainties in these estimates, the effects of forests and trees were not included in our inventory analysis or emissions forecasting. Though these estimates are highly uncertain, these measurements will most likely improve in accuracy over time and can be vetted by County government staff, leading to their potential inclusion toward meeting the 2030 GHG reduction goal.

If we include forest and tree emissions flux in all of our GHG inventories, and assume that 2020 levels of forest and tree emissions flux remain constant to 2030, then the gap between the 2030 high action implementation emissions levels and the 2030 GHG reduction goal emissions levels shrinks from 500,000 MTCO₂e to 260,000 MTCO₂e (see [Figure 16](#)). Though it is not certain that these land use trends will be sustained by 2030, these emissions estimates could be incorporated into our GHG inventories in the future to help close the emissions reduction gap.

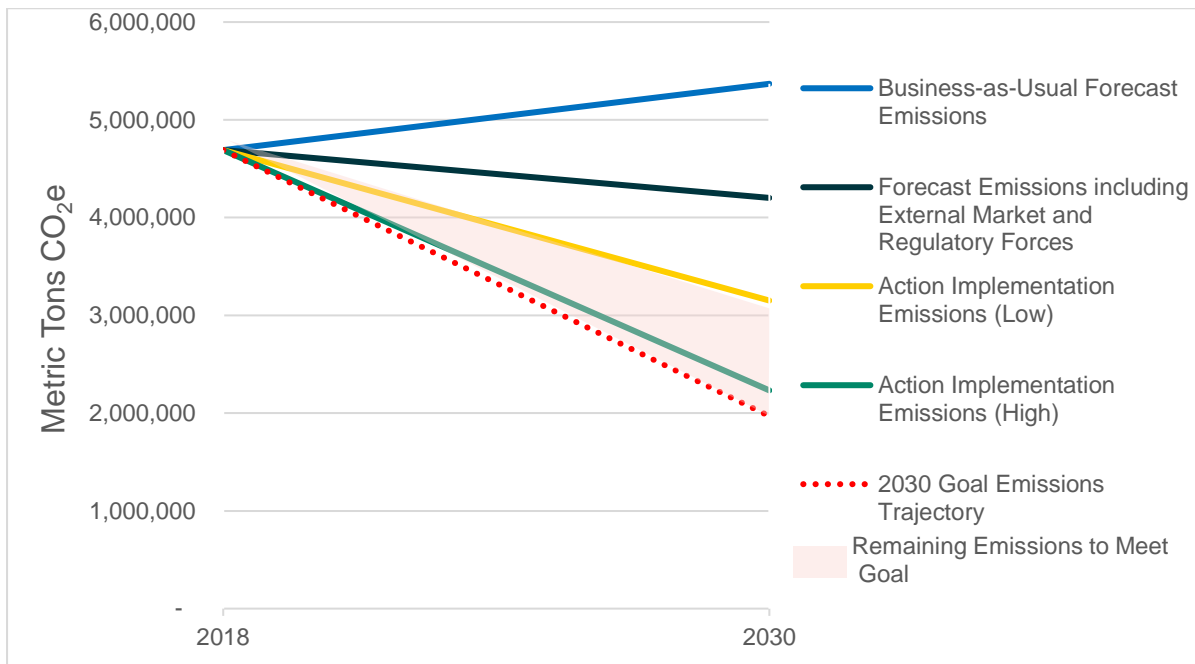


Figure 16. GHG Reduction Potential and Remaining Emissions with Forest and Tree Emissions/Removals

Carbon Offsets

Another way of closing the gap between what we need to do and what we can do is by purchasing quality carbon offsets. Carbon offsets represent the reduction or removal of GHG emissions that compensates for emissions emitted somewhere else. The purchase of a carbon offset represents a one-time GHG reduction acquisition from another party creating the reductions. This purchase must be repeated on an annual basis to maintain goal achievement.

Carbon offsets can be generated by a variety of activities, including those that reduce emissions and those that remove carbon from the atmosphere. Offset projects that **reduce** emissions represent projects that would avoid potential future emissions, such as using renewable energy or cleaner cookstoves, or physically storing the carbon that would have been released, such as through carbon capture and storage systems on a fossil fuel power plant. Offset projects that **remove** emissions represent projects that remove carbon dioxide directly from the atmosphere, such as through reforestation, soil carbon enhancement, or direct air capture with carbon capture and storage. Most offsets available today represent emission reductions, which are necessary but not sufficient to achieve net zero in the long run. As carbon removals scrub carbon directly from the atmosphere, they play a hugely important role in stabilizing GHG emissions in the atmosphere. Therefore, entities should prioritize carbon removal projects over emission reduction projects when purchasing carbon offsets.

Though carbon offsets are typically used to meet a net zero goal, we are exploring using them to meet the interim 2030 GHG reduction goal. Carbon offsets are a potential “last resort” option if we cannot meet the 2030 goal through our own direct actions. Alternatively, money spent on offsets could instead be spent on local GHG reduction programs. However, we could risk not meeting the 2030 GHG reduction goal if we do not purchase offsets. If necessary, we will purchase verified carbon offsets from carbon removal projects annually to meet our 2030 reduction goal. Because there is no single governing body that certifies carbon offsets, there are a variety of non-profit third-party companies that check carbon offset claims, ensure they are valid, and certify the offsets. We will review available verified offsets, determine which ones are “high quality” (e.g., which are focused on long-term removals), and complete a cost analysis of the offset choices before purchasing.

Goal 2 and 3: Renewable Energy Goals

Our goal is to achieve 100% clean electricity in county operations by 2030 and county-wide by 2035. One action in the CESMP would substantially contribute toward meeting both the government and county-wide goals: a community choice aggregation program (see action E.1). If we enact a community choice aggregation program, we may be able to aggregate the electric load of all Dominion electricity customers within our jurisdiction and negotiate for 100% clean or renewable electricity for those customers, but further legal review is needed. If enacted by 2030, this would represent a substantial step to meeting the government and county-wide renewable goals.

However, further legal review will need to be conducted to determine if a community choice aggregation program could be formed in NOVEC territory. If a community choice aggregation program cannot be formed, we will have to rely on other local actions to address emissions from NOVEC customers or any Dominion customers that opt-out of the program. These other actions include:

- Utility green power purchasing (action E.4),
- Local renewable installations (actions E.2 and E.5), and
- Virtual Power Purchase Agreements (VPPAs), with a last resort option of purchasing Green-e Energy certified unbundled renewable energy certificates (RECs) on the open market.

PPAs are where a third-party developer installs, owns, and operates the energy system while the customer purchases the system's electric output for a predetermined period. In a VPPA, the energy system is developed off-site, and the electricity is sold into the wholesale market instead of directly consumed by the customer. RECs are a market-based instruments that certify the bearer owns one megawatt-hour of electricity generated from a renewable energy resource. Unbundled RECs are sold separately from the electricity that was generated, while bundled RECs are sold with the electricity. Green-e Energy certification ensures that the RECs are high-quality and not double-counted. To meet the community-wide renewable electricity goal, we could purchase and retire unbundled RECs on behalf of residents and businesses to cover any remaining electricity consumption that is not generated by renewable energy sources. We could follow a similar tactic of REC purchasing to meet our government operations renewable electricity goal.¹⁷

Onsite County Government Solar Feasibility

Even though County government electricity use is a small portion of total county-wide electricity use, the amount of space and funds needed to produce all County government electricity from onsite solar is currently infeasible. We estimated that County government operations used 64-80 gigawatt-hours of electricity in 2018 (roughly 1% of total county-wide electricity). To fully meet this electricity demand with onsite solar, we would need to install 275 acres of solar panels, or over roughly 200 football fields. If we were to directly purchase these panels, it could cost roughly \$130 million. However, the costs of renewable energy could be significantly cheaper through a PPA where a third-party developer installs, owns, and operates the energy system while the customer purchases the system's electric output for a predetermined period. Because it is unlikely that we could install enough onsite solar to meet our 100% renewable electricity goal for County government operations by 2030, we will most likely need to pursue a combination of local renewables (action E.5), utility green energy purchasing (action E.4), VPPAs, and purchasing RECs to meet this goal.

Goal 4: County Government Carbon Neutrality

The County set an ambitious goal of achieving carbon neutrality for County government operations by 2050. Carbon neutrality is achieved when our County government emits just as much GHG emissions as it removes/offsets. County government emissions typically include County government building and facility energy use, County government fleet and equipment fuel use, and solid waste and wastewater treatment emissions from County government waste. Though we have not yet developed a County government operations GHG inventory, local government emissions are typically a small portion of overall community emissions (likely <5%). The actions we should pursue to achieve carbon neutrality will depend on the emissions sources we include in our County government GHG inventory. Therefore, the first step to develop a carbon neutrality pathway will be to create a baseline County government operations GHG emissions inventory. Though County government carbon neutrality achievement was not specifically analyzed in the CESMP, actions have been developed to reduce County government emissions by 2030, as listed in [Climate Mitigation Actions for County Government](#). Additionally, achieving our goal of 100% renewable electricity for County government operations by 2030 will also greatly help in achieving the County government carbon neutrality goal.

¹⁷ Currently, MWCOG uses a location-based method to calculate electricity emissions, which uses an average electricity emissions factor that reflects energy sources used throughout the regional grid. Alternatively, the market-based method allocates electricity emissions from energy generators to consumers based on "contractual instruments." The emissions reduction impact of any clean electricity purchasing recommendation in the CESMP, such as municipal aggregation or purchasing RECs, would not be reflected through the location-based accounting method, but would be reflected through the market-based method. The County will work with MWCOG to determine if the market-based electricity emissions can be calculated along with location-based emissions in the future.

Alignment with Strategic and Comprehensive Plan Goals

Our 2021-2024 Strategic Plan¹⁸ and 2040 Comprehensive Plan¹⁹ outline goals and action strategies to guide the growth and development of the community. The Strategic Plan provides key policy guidance for service delivery and resource allocation decisions while the Comprehensive Plan articulates the goals and policies that the Board of County Supervisors relies on to make informed land use development decisions and investments in public infrastructure. Both Plans support climate-related actions that reduce GHG emissions and increase local climate resiliency. The CESMP actions have been mapped to related Strategic Plan and Comprehensive Plan action strategies in [Appendix C. CESMP Actions Mapped to Strategic Plan and Comprehensive Plan Action Strategies](#).

Opportunities for External Advocacy and Action

Because our County government cannot directly control or influence many community-wide emissions sources or assets, the ability to meet the 2030 emissions reduction goal and 2030 Climate-Ready Region goal may rely on significant external support from market forces, public and private entities, and state- and national-level regulation.

Table 9 below provides a list of opportunities to advocate for ourselves at the local, state and federal levels. In addition to advocacy, we strive to build and maintain strong partnerships with entities that impact our community and influence our ability to reduce GHG emissions, procure clean energy, and increase our resiliency.

Table 9. External Advocacy and Action Opportunities by Sector

Sector	Opportunities for External Advocacy and Action
Buildings	<ul style="list-style-type: none"> Advocate for a low-carbon building code/more aspirational codes and vote on energy code updates Advocate for quicker adoption of the most recent International Energy Conservation Code in Virginia Encourage adaptation planning for private businesses by providing examples of adaptation plans for our county's critical facilities
Electricity	<ul style="list-style-type: none"> Advocate for a more aggressive state-wide Renewable Portfolio Standard Advocate for policies to help overcome barriers to community choice aggregation program adoption in Virginia Work with Dominion and NOVEC to develop electrification incentives and promote expansion of electrical infrastructure to accommodate growing building and vehicle electrification Work with Dominion and NOVEC to promote grid resiliency through actions such as microgrid development or undergrounding of power wires
Transportation and Off-road equipment	<ul style="list-style-type: none"> Work with Potomac and Rappahannock Transportation Commission to advocate for transit service expansion and fleet electrification Advocate for more state and national incentives and mandates for purchasing EVs
Waste	<ul style="list-style-type: none"> Advocate for the expansion of Balls Ford Road Compost Facility to accept more food waste
Wastewater	<ul style="list-style-type: none"> Advocate for high-efficiency wastewater treatment processes and state-wide programs aimed at helping local wastewater treatment facilities in their decarbonization efforts
Land Use	<ul style="list-style-type: none"> Advocate for a stronger state tree preservation requirement program through State Code

Beyond this list, there are many additional implementation mechanisms that would require authorization at the state level before the County could enact them. The County will continue to identify these mechanisms and seek additional legislative authorization as we implement the CESMP.

¹⁸ https://www.pwcva.gov/assets/2021-09/2021-2024_Strategic_Plan-FINAL.pdf

¹⁹ <https://www.pwcva.gov/department/planning-office/prince-william-County-comprehensive-plan>

Chapter 6 Action Implementation and Monitoring

In addition to the specific actions identified through the analysis described above, the CESMP includes three foundational program-wide sustainability initiatives designed to improve the County's ability to monitor and implement the plan:

1. Implementation of an "Adaptive Management" approach that improves our ability to make decisions in the face of uncertainty and complexity
2. Assessments for climate mitigation and resiliency impacts performed by the county to provide data on a project's impact on greenhouse gas emissions, renewable and fossil energy mix, and climate resiliency metrics
3. Institutional capacity-building to support sustainability, including staffing capacity to pursue federal grants for green programs and capacity for communication and outreach that will engage residents and businesses in the voluntary measures recommended in the CESMP

Adaptive Management:

Implementation of the CESMP will be a dynamic effort that will require taking an Adaptive Management approach of continuous data collection, analysis, and reassessment. Adaptive Management is an intentional and iterative approach designed for decision making in situations characterized by volatility (rapid change), uncertainty, complexity, and ambiguity. The County intends to implement the CESMP through a process similar to the one employed by the Chesapeake Bay Program, shown in [Figure 17](#) below. This process provides a framework to make decisions and adjustments in response to rapidly evolving technologies, policies, strategies, and funding opportunities. Note that stakeholder input is a continuous element of the process.

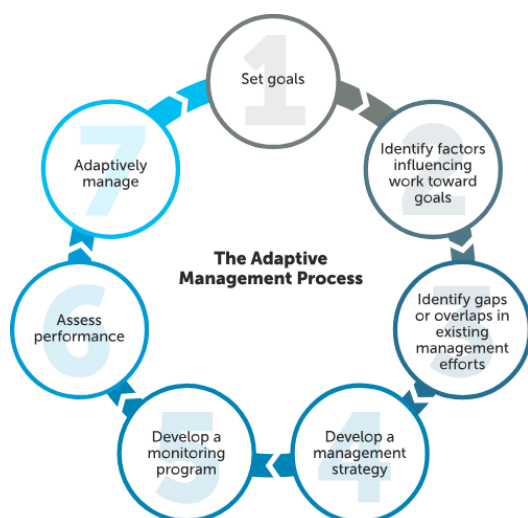


Figure 17. Adaptive Management Process²⁰

The Adaptive Management framework has several features that make it well-suited for the CESMP:

- **Data-Driven Decision-Making:** Adaptive Management is rooted in the scientific method, using data to inform decisions. This is crucial in a field where new data and understandings are continuously emerging.
- **Resource Optimization:** Resources for climate mitigation and adaptation are often limited. Adaptive Management allows for the continual reassessment of action plans and resource allocation to ensure that we are always employing the most cost-effective strategies.

²⁰ Source: <https://www.chesapeakebay.net/what/what-guides-us/decisions>

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- **Stakeholder Engagement:** Adaptive Management encourages continuous stakeholder participation, which will be crucial in a plan that requires collective action from county government, residents, and businesses.
- **Policy Alignment:** Policies at the regional, state, and federal levels are continuously evolving. An adaptive approach allows the county to quickly realign its strategies to be complementary with broader policies, optimizing the likelihood of achieving our goals.
- **Technological Advances:** The landscape of renewable energy and sustainable technologies is rapidly evolving. Adaptive Management enables the CESMP to incorporate new technologies and methods as they become available, without requiring a full restructuring of the plan.
- **Accountability and Transparency:** The regular monitoring and evaluation built into Adaptive Management will allow us to transparently track and report progress, ensuring accountability and keeping the public informed.
- **Risk Management:** By continually assessing the effectiveness of our actions in real-time, we can quickly identify and manage emerging risks, ensuring that the county remains resilient in the face of changing climate conditions.

By using an Adaptive Management approach, the County will be better equipped to meet the ambitious goals set forth in the CESMP, allowing us to quickly respond to new challenges and opportunities in our ongoing efforts to mitigate the impacts of climate change and ensure the resiliency and sustainability of the county. As a next step, we will need to develop a system for annually assessing the impact of the proposed actions towards meeting the climate mitigation and climate resiliency goals. This work has already begun through the development of Implementation Roadmaps for the 25 high priority actions (see [Appendix B. Implementation Plan](#)). The roadmaps identify the County government departments that will lead implementation; supporting partners; implementation steps; action cost range; and high-level performance indicators (which will form the basis of the monitoring and performance assessment steps). The Implementation Plans also include descriptions of additional cost saving considerations for the actions. These are general descriptions of potential cost savings as many actions would require further analysis of feasibility studies to determine exact savings. When budget requests are made for the actions, the requests will include a more in-depth analysis of costs and savings.

The Implementation Roadmaps are fluid and may change as the county's emission sources, funding sources, and department roles change. They are not a requirement for lead departments to complete each implementation step or a guarantee that all actions will be implemented. They are simply a recommended starting point to begin action. Given the complexity and magnitude of the systems we are managing, we need to act now with the best current information available. The Office of Sustainability will have an oversight role in guiding and tracking implementation, but actual implementation will be led by the respective departments.

As a part of the Adaptive Management approach, we expect that methodologies for analysis of the County's emissions will continue to evolve over time. In the future, we expect to incorporate the following into CESMP updates or as part of action implementation steps:

1. Validate and integrate forest carbon sequestration estimations into GHG inventories
2. Assess how commercial building owners and businesses may use renewable energy to reduce their carbon intensity
3. Forecast clean energy growth in the electric grid
4. Account for the effects of the Federal Inflation Reduction Act (IRA) and other legislation on the carbon intensity of the electric grid and on vehicle emissions reductions
5. Conduct a more detailed analysis of the effectiveness of smart growth measures on vehicle miles traveled and emissions reductions

Additionally, we recommend incorporating the social cost of carbon in the methodology as a metric for quantifying action impact. The social cost of carbon is an estimation of the cost in dollars of either negative implications of adding a ton of carbon emissions to the atmosphere, or the benefit of reducing a ton of carbon emissions. For example, the EPA currently estimates the social cost of reducing a ton of carbon in 2030 to be around \$230.²¹ If

²¹ "Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review": EPA External Review Draft of Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances

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the county were to meet the 2030 goal of reducing emissions by 50% from a 2005 baseline, the benefit to society would be valued at an estimated \$575M per year.

Throughout implementation of the CESMP, we will need continuous engagement and participation of our stakeholders. Many of the actions proposed in this CESMP would have county-wide impacts if implemented. Additionally, many of the actions will be led by key County agencies and support of the County Government Core Team. It is our intention to stand up a review committee with representation from relevant industries, technical experts, and the community that would meet regularly to assess progress toward the goals.

Assessments for Climate Mitigation and Resiliency Impacts:

The County currently conducts environmental reviews for rezonings, comprehensive plan amendments (CPAs), special use permits (SUPs), and major road projects. These reviews rate projects in terms of their conformance to goals of the Comprehensive Plan, Strategic Plan, Schools Plan, and other County planning documents, as well as compliance with environmental regulations.

In the future, County staff recommends that the Board consider amending relevant County regulations and policies, consistent with applicable law, to assess greenhouse gas emissions, to assess renewable and fossil energy mix, and to assess climate resiliency metrics. This would provide additional information about the potential environmental impacts of specific rezoning and SUP applications, Capital Improvement Program (CIP) projects, and CPAs on the community based on the Board's adopted Climate Mitigation and Resiliency Goals.

The Office of Sustainability is requesting an Environmental Analyst position to assist with developing and/or reviewing these assessments.

Institutional Capacity:

To implement the CESMP, one of the necessary first steps is to build up institutional capacity to execute the foundational elements of the plan. This includes key activities such as increasing staff capacity to pursue federal grants for green programs and the capacity for communication and outreach that will engage residents and businesses in the voluntary measures recommended in the CESMP.

To begin implementation, the Office of Sustainability is hiring a Climate and Energy Manager to provide the necessary support to begin to stand up projects and programs for the high priority actions in the CESMP. The County will also utilize the \$1.04M in CIP funding that has been allocated by the Board via Resolutions 21-663 and 22-573 for the CESMP to kick-start actions that are related to County infrastructure. Projects with CIP funding allocated are included below.

Projects with CIP Funding Allocated:

- Installing solar on County buildings identified in feasibility study that will be completed December 2023 (Action E.5)
- Conduct feasibility study for electrification of County buildings (Action B.5)
- Transition of high-pressure sodium streetlights to LED (estimated 200 streetlights) (Action B.7)

We recommend consideration of CIP funds for FY25 to implement the below projects.

FY25 CIP Fund Requests for \$10M:

- Begin to implement recommendations from feasibility study for electrification of County-owned buildings (Action B.5)
- Begin to implement recommendations from feasibility study to convert County fleet to low- or zero-emission vehicles that will be completed Spring 2024 (Action T.7)
- Development of greenhouse gas inventory for County government operations (Action B.5)
- Installing solar on buildings identified in feasibility study that will be completed December 2023 (Action E.5)

In addition to the CIP funds that have already been allocated for CESMP implementation and FY25 CIP funds, the following general fund budget requests for FY25 would provide the institutional capacity needed for the first year of implementation:

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- Sustainability Communications and Outreach Manager – Manage grant writing opportunities and communications with the public, including campaigns about available resources and incentives.
- Environmental Analyst – Stand up the Adaptive Management system for analyzing progress towards the Climate Mitigation and Resiliency goals. This would include development and review of assessments for impacts of major projects on Climate Mitigation and Resiliency goals and tracking CESMP implementation costs and savings.

Lastly, we recommend that the CESMP is incorporated into the Comprehensive Plan through an amendment to the Comprehensive Plan, and that the action strategies of the CESMP are incorporated into the County's next Strategic Plan. This step would help fulfill the mandate in Board Resolution 20-773 to "incorporate into the Comprehensive Plan goals of 100% of Prince William County's electricity to be from renewable sources by 2035, for Prince William County Government operations to achieve 100% renewable electricity by 2030, and for Prince William County Government to be 100% carbon neutral by 2050." This would also support implementation of the many sustainability strategies already established in the Comprehensive Plan and 2021-2024 Strategic Plan ([Appendix C. CESMP Actions Mapped to Strategic Plan and Comprehensive Plan Action Strategies](#)).

Appendix A. Complete List of CESMP Actions

Sector	Actions	Action Priority	Cut GHG Emissions	Prepare for Climate Change	Use 100% Renewable Electricity County-Wide by 2035	Become Carbon Neutral for County Government	Use 100% Renewable Electricity in County Government by 2030
Energy	E.1: Acquire Clean Electricity Sources for the County <i>Form an opt-out municipal aggregation program to acquire 100% clean electricity for the community.</i>	High	0		0	0	0
	E.2: Promote Renewable Energy Incentive Programs and Develop Additional Solar Incentives <i>Provide outreach and education on programs and incentives for residents and businesses to install renewable energy systems. Develop additional renewable energy incentives, such as streamlined solar permitting, in partnership with stakeholders such as the Residential Solar Task Force.</i>	High	0		0		
	E.3: Incentivize Renewable Energy Use in Energy-Intensive Commercial Buildings <i>Incentivize the use of renewable energy in energy-intensive commercial buildings (e.g., through expedited permitting or height bonuses).</i>	High	0		0		
	E.4: Promote Existing Green Power Products <i>Promote purchasing utility green power options within the community.</i>	High	0		0		
	E.5: Install Solar on County Government Facilities <i>Develop solar projects on County government facilities.</i>	High	0		0	0	0
Buildings	B.1: Incentivize Energy Efficiency and Electrification Retrofits <i>Incentivize existing building energy efficiency retrofits (e.g., streamlined permitting).</i>	High	0				
	B.2: Propose Green Zoning Regulations <i>Propose green zoning regulations to incentivize water- and energy-efficient buildings, multifamily and mixed-use areas, and transit-oriented developments.</i>	High	0				

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Sector	Actions	Action Priority	Cut GHG Emissions	Prepare for Climate Change	Use 100% Renewable Electricity County- Wide by 2035	Become Carbon Neutral for County Government	Use 100% Renewable Electricity in County Government by 2030
Buildings (cont.)	B.3: Incentivize Energy Efficient and Electric New Construction <i>Provide incentives or streamlining for developers who build to a more energy-efficient standard set by the County government or use all-electric systems and equipment.</i>	High	O				
	B.4: Promote Energy Efficiency and Electrification Incentives <i>Provide outreach and education to residents and businesses about the tools, technology, and incentives for building energy efficiency and electrification.</i>	High	O				
	B.5: Transition to Net Zero County Government Facilities <i>Develop a net-zero building plan for County government facilities, which will include implementing an energy benchmarking program and procuring 100% clean electricity for all County government operations.</i>	High	O			O	
	B.6: Create All-electric Guidelines for New Construction of County Government Facilities <i>Develop an all-electric new construction requirement for all new County government facilities.</i>	Medium	O			O	
	B.7: Create Policy to Increase Energy Efficiency in County Government Facilities <i>Adopt a County government energy policy that outlines operational and purchasing requirements that increase energy efficiency.</i>	Medium	O			O	
	B.8: Implement Building Energy Benchmarking <i>Implement a voluntary commercial building energy benchmarking and reporting program with the intent to transition to a building energy performance standard.</i>	Low	O				
	T.1: Improve Pedestrian and Bicycle Infrastructure and Enhance Connectivity <i>Improve active transportation infrastructure and improve sidewalk and trail connectivity to support walking, biking, and rolling, with improvements such as providing bike lockers, installing curb ramps, or installing traffic-calming designs like crosswalk islands or speed humps.</i>	High	O				

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Sector	Actions	Action Priority	Cut GHG Emissions	Prepare for Climate Change	Use 100% Renewable Electricity County- Wide by 2035	Become Carbon Neutral for County Government	Use 100% Renewable Electricity in County Government by 2030
Transportation (cont.)	T.2: Incentivize Transit-Oriented Development <i>Support transit-oriented development within 1/2-mile of transit stations.</i>	High	0				
	T.3: Expand Existing Programs that Reduce Single-Occupancy Vehicle Trips <i>Work with major employers to expand the Transportation Demand Management and Transit Fare Buy Down Program (expanding Strategic Plan program) and promote teleworking.</i>	High	0				
	T.4: Upgrade Public Transit Infrastructure <i>Partner with county transit operators to improve and provide new public transit infrastructure and build out transit nodes (e.g., priority bus lanes, bus stops, priority signaling).</i>	High	0				
	T.5: Incentivize Zero-Emission Vehicles and Charging <i>Develop incentives for residents and businesses to purchase ZEVs or install charging equipment (e.g., through streamlined permitting or "group-buy" programs).</i>	High	0				
	T.6: Expand Public EV Charging Network <i>Expand public EV charging infrastructure, especially along main routes and in popular destinations.</i>	High	0				
	T.7: Adopt Zero- or Low-Emissions County Fleet <i>Transition County government fleet to zero-/low-emissions vehicles and ensure supporting infrastructure is open to other fleets.</i>	High	0			0	
	T.8: Encourage E-Bike and E-Scooter Adoption <i>Promote the use of e-bikes and e-scooters through enhanced infrastructure and incentives.</i>	Medium	0				
	T.9: Educate on Existing Zero-Emission Vehicle Incentives and Rebates <i>Provide outreach and education on existing ZEV incentives or rebates.</i>	Medium	0				

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Sector	Actions	Action Priority	Cut GHG Emissions	Prepare for Climate Change	Use 100% Renewable Electricity County- Wide by 2035	Become Carbon Neutral for County Government	Use 100% Renewable Electricity in County Government by 2030
Transportation (cont.)	T.10: Promote Zero-Emission Bus and Rail Transition <i>Partner with public transit operators to promote the transition to zero-emission buses, including school buses, and rail systems (e.g., providing charging station infrastructure).</i>	Medium	○				
	T.11: Support Zero- or Low-Emissions County Government Contracting of Off-Road Equipment <i>Adopt a policy that encourages the County government to contract with businesses operating low- or zero-emission off-road equipment.</i>	Medium	○			○	
	T.12: Adopt County Government Zero-Emission Off-Road Policy <i>Adopt a government zero-emissions off-road vehicles and equipment policy that requires low- or zero-emissions replacements.</i>	Medium	○			○	
	T.13: Discount Transit Passes for Residents <i>Continue free local OmniRide service and offer discounts for other services such as rail.</i>	Low	○				
	T.14: Launch Electric Equipment Lending Program <i>Start a lending library where residents can check out electric landscaping equipment and expand to other low-emissions tools and equipment.</i>	Low	○				
Natural Resources	N.1: Adopt Natural Open Space Requirements <i>Establish minimum NOS guidelines to encourage preservation of NOS, if appropriate in new and existing development.</i>	High	○	○			
	N.2: Launch Suburban and Rural Tree Planting Initiative <i>Implement a tree planting and maintenance program to expand suburban and rural tree cover.</i>	Medium	○	○			
	N.3: Update Tree Cover Regulations <i>Update tree cover regulations utilizing 2008 enabling legislation to increase the percent of required tree cover for new development projects.</i>	Medium	○	○			
	N.4: Support Sustainable Farming Practices <i>Provide outreach and education to the agricultural community on sustainable farming practices that reduce fertilizer use and increase soil carbon sequestration.</i>	Low	○				

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Sector	Actions	Action Priority	Cut GHG Emissions	Prepare for Climate Change	Use 100% Renewable Electricity County-Wide by 2035	Become Carbon Neutral for County Government	Use 100% Renewable Electricity in County Government by 2030
Waste	W.1: Implement County-Wide Composting <i>Implement a county-wide composting program to provide free food waste composting services to residents, businesses, and the agricultural sector.</i>	Medium	0				
	W.2: Promote Sustainable Purchasing Policy <i>Develop a government sustainable purchasing policy for County government purchasing decisions to promote use of sustainable products, such as those made from recycled materials, and prohibit the use of single use plastics and Styrofoam to-go containers.</i>	Medium	0			0	
	W.3: Mandate Commercial Food Waste Diversion <i>Require commercial businesses to divert food scraps either through food recovery or composting programs.</i>	Low	0				
Adaptation	A.1: Develop Adaptation Plans for Critical Facilities <i>Develop site-level adaptation plans for critical facilities and service areas considering future climate change hazards.</i>	High			0		
	A.2: Manage Stormwater Flooding Outside of the Floodplain <i>Develop plans for stormwater system upgrades based on future conditions stormwater modeling data and historic flooding information.</i>	High			0		
	A.3: Improve Power Resiliency for Critical Infrastructure <i>Improve the resiliency of electrical infrastructure for publicly owned essential services and infrastructure.</i>	High			0		
	A.4: Implement Shoreline Protection and Nature-Based Solutions <i>Conduct feasibility studies to evaluate shoreline protection measures against erosion and flood, incentivizing nature-based solutions. Develop long-term plans to address sea level rise for at-risk public and private property.</i>	High			0		
	A.5: Restore Streams to Reduce Flooding <i>Develop stream corridor restoration projects to improve conveyance and mitigate flooding.</i>	High			0		

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Sector	Actions	Action Priority	Cut GHG Emissions	Prepare for Climate Change	Use 100% Renewable Electricity County- Wide by 2035	Become Carbon Neutral for County Government	Use 100% Renewable Electricity in County Government by 2030
Adaptation (cont.)	A.6: Incentivize Technology for Residents to Make Homes Adaptive <i>Provide incentives or subsidies for residents of low-income housing and rental properties to install or retrofit buildings with climate adaptive technologies to reduce energy, reduce water use, reduce waste heat, and minimize urban heat gain.</i>	High		○		○	
	A.7: Plan Alternate Evacuation Routes for Flood-prone Areas <i>Identify alternate evacuation routes for roads and bridges identified as vulnerable to flooding and/or sea level rise.</i>	High		○			
	A.8: Expand Building Insulation Standards to Protect Against Extreme Heat <i>Increase standards for insulation in new construction buildings and homes for resiliency against extreme heat events.</i>	High	○	○			
	A.9: Protect Existing Buildings Against High Winds <i>Identify structures for high wind retrofits and implement retrofits on existing structures.</i>	Medium		○			
	A.10: Protect County Infrastructure from Flooding <i>Identify residential and commercial infrastructure vulnerable to future flooding and evaluate if infrastructure should be elevated, relocated, or floodproofed.</i>	Medium		○			
	A.11: Incentivize Nature-based Solutions to Reduce Flooding in Residential Properties <i>Develop program to provide incentives and promote rain gardens, conservation landscapes, green roofs, water harvesting, and permeable pavement for residential properties.</i>	Medium		○			
	A.12: Improve Water Infrastructure for Extreme Precipitation Events <i>Update water and drainage infrastructure design standards to address the projected increase in intensity of precipitation, including the use of retrofits and/or green infrastructure in new construction.</i>	Medium		○			
	A.13: Urban Heat Island Relief Program <i>Incentivize urban designs that facilitate air movement to alleviate heat islands (e.g., increasing urban tree cover).</i>	Medium	○	○			

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Sector	Actions	Action Priority	Cut GHG Emissions	Prepare for Climate Change	Use 100% Renewable Electricity County- Wide by 2035	Become Carbon Neutral for County Government	Use 100% Renewable Electricity in County Government by 2030
Adaptation (cont.)	A.14: Adopt Guidelines to Use Nature-based Solutions on County Government Construction <i>Develop guidelines on how to incorporate nature-based solutions into County government projects.</i>	Medium		0			
	A.15: Improve Grid Resiliency During Extreme Weather <i>Evaluate resilient energy systems such as microgrids or other distributed energy resources within the county to provide stable energy supply during times of extreme weather.</i>	Medium		0			
	A.16: Expand Tax Credits for Conservation of Natural Resources <i>Expand tax credits for conservation of floodplains and natural buffers, such as wetlands and riverbank tree planting, in vulnerable areas.</i>	Medium			0		
	A.17: Develop Plan to Preserve Estuaries and Wetlands To Reduce Flooding <i>Map projected future sea levels and identify existing wetlands that may be impacted. Develop a plan to preserve these spaces and use them to mitigate runoff and flood impacts where possible.</i>	Medium			0		
	A.18: Training for Community Members on Climate Change and Mental Health <i>Provide professional development training for teachers, support staff and other community members to support child and youth mental health related to climate change.</i>	Medium			0		
	A.19: Increase Protection from the Sun at Childcare Centers <i>Develop guidelines for shade for schools and childcare centers' grounds.</i>	Medium	0	0			
	A.20: Incentivize Improved Cooling Equipment in Apartments <i>Incentivize expanded access to reliable, efficient cooling for apartments.</i>	Low	0	0			
	A.21: Incentivize Businesses to Reduce Water Usage <i>Develop incentives, training and technical assistance programs for significant water use reductions including rainwater and greywater harvesting and onsite blackwater treatment with a focus on industrial and commercial properties.</i>	Low	0	0			

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Sector	Actions	Action Priority	Cut GHG Emissions	Prepare for Climate Change	Use 100% Renewable Electricity County- Wide by 2035	Become Carbon Neutral for County Government	Use 100% Renewable Electricity in County Government by 2030
Adaptation (cont.)	A.22: Protect Electrical Infrastructure from High Winds <i>Partner with energy providers to increase resiliency of the electrical grid including hardening infrastructure and/or burying power lines where appropriate.</i>	Low		0			
	A.23: Expand Community Outreach for Education on Climate Change Adaptation <i>Expand existing "Ready Prince William" Community Outreach and Preparedness Campaign to support the development of accessible technology to provide climate information to individuals and industries to enhance collective understanding.</i>	Low		0			
	A.24: Support Agriculture Resiliency <i>Identify support for farmers to prepare for and recover from extreme weather, such as access to more accurate weather data, harvest support, drought resistant crops, backup generation, and livestock evacuation.</i>	Low		0			

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Appendix B. Implementation Plan

Appendix B.1 Estimated Budget for CESMP Actions

Appendix B.2 How to Read an Implementation Roadmap

Appendix B.3 Implementation Plans

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Appendix B.1 Estimated Budget for CESMP High Priority Actions

The following table represents estimated first year costs and an estimated high-level cost range for the years 2025 through 2030 leading up to the goal year of 2030 for the high priority actions. The actions are listed in order of low to high costs. Also noted are the estimated GHG reduction potential and additional cost considerations. Actions listed near the top with high estimated GHG reduction potential would be considered actions with a low cost per ton of GHG reduction.

These are considered high-level estimated cost ranges for action implementation. In many cases, a feasibility study or further analysis would need to be completed to determine exact costs and cost savings. When budget requests are made for the actions, more specific cost savings information will be evaluated and included for Board review. For more information on what is included in these costs, see the Implementation Plans in this Appendix.

Action Title	2025 – 2030 Costs			Estimated GHG Reduction Potential	Additional Cost Considerations
	Estimated Year 1 Costs	Low	High		
N.1: Adopt Natural Open Space Requirements	\$0	\$100,000	\$500,000		Provides cost savings to the County by sequestering carbon, preventing erosion, and improving water quality.
T.2: Incentivize Transit-Oriented Development	\$200,000	\$200,000	\$200,000	High	Provides cost savings for residents with less reliance on single-occupancy vehicle trips.
B.2: Propose Green Zoning Regulations	\$500,000	\$500,000	\$1,000,000	Medium	
A.1: Develop Adaptation Plans for Critical Facilities	\$200,000	\$600,000	\$600,000		
E.2: Promote Renewable Energy Incentive Programs and Develop Additional Solar Incentives	\$200,000	\$1,000,000	\$1,000,000	Medium	Provides support for actions E.2, E.4 and B.4 through funding a shared outreach position.
T.3: Expand Existing Programs that Reduce Single-Occupancy Vehicle Trips	\$200,000	\$1,000,000	\$1,000,000	Medium	Provides cost savings for residents with less reliance on single-occupancy vehicle trips.
E.3: Incentivize Renewable Energy Use in Energy-Intensive Commercial Buildings	\$0	\$1,000,000	\$10,000,000	High	
E.4: Promote Existing Green Power Products	\$200,000	\$1,000,000	\$1,000,000	High	Provides support for actions E.2, E.4 and B.4 through funding a shared outreach position.
B.4: Promote Energy Efficiency and Electrification Incentives	\$200,000	\$1,000,000	\$1,000,000	Medium	Provides support for actions E.2, E.4 and B.4 through funding a shared outreach position.

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Action Title	Estimated Year 1 Costs	2025 – 2030 Costs		Estimated GHG Reduction Potential	Additional Cost Considerations
		Low	High		
A.3: Improve Power Resilience for Critical Infrastructure	\$0	\$1,000,000	\$5,000,000		
A.6: Incentivize Technology for Residents to Make Homes Adaptive	\$200,000	\$2,400,000	\$2,400,000		Provides cost savings for qualifying residents by reducing energy bills. Outreach programs connect residents to existing weatherization and utility programs that provide services at no cost.
A.2: Manage Stormwater Flooding Outside of the Floodplain	\$0	\$3,000,000	\$3,000,000		Provides cost savings to the County and residents by preventing flood damage and improving water quality.
A.7: Plan Alternate Evacuation Routes for Flood-prone Areas	\$500,000	\$3,200,000	\$3,200,000		
E.1: Acquire Clean Electricity Sources for the County	\$1,200,000	\$4,000,000	\$5,000,000	Very High	Could result in utility savings depending on negotiations. Changes in County government electricity costs could increase or decrease electricity costs.
B.1: Incentivize Energy Efficiency and Electrification Retrofits	\$200,000	\$5,000,000	\$5,000,000	Medium	Provides cost savings for residents and businesses through streamlined permitting or energy efficiency.
B.3: Incentivize energy efficient and electric new construction	\$0	\$5,000,000	\$5,000,000	Medium	Provides utility cost savings.
T.5: Incentivize Zero-Emission Vehicles and Charging	\$0	\$5,000,000	\$5,000,000	High	Provides cost savings for residents and businesses by streamlining permitting for EV charging stations. An increase in public EV charging stations results in less need for residents to install personal chargers. This is a particular benefit for residents in multi-family housing.
A.4: Implement Shoreline Protection and Nature-Based Solutions	\$200,000	\$5,000,000	\$5,000,000		Provides support for actions A.4 and A.5 through funding a shared position.

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Action Title	Estimated Year 1 Costs	2025 – 2030 Costs		Estimated GHG Reduction Potential	Additional Cost Considerations
		Low	High		
A.5: Restore Streams to Reduce Flooding	\$200,000	\$5,000,000	\$5,000,000		Provides cost savings to the County by preventing erosion and improving water quality.
E.5: Install Solar on County Government Facilities	\$0	\$9,000,000	\$9,000,000	Low	Provides support for actions A.4 and A.5 through funding a shared position. Will generate \$250k annual cost savings for the first ten buildings with diminishing returns for additional buildings.
T.6: Expand Public EV Charging Network	\$200,000	\$25,000,000	\$50,000,000	High	Provides cost savings to the County by preventing erosion and stream degradation.
T.1: Improve Pedestrian and Bicycle Infrastructure and Enhance Connectivity	\$200,000	\$50,000,000	\$50,000,000	High	
T.4: Upgrade Public Transit Infrastructure	\$200,000	\$100,000,000	\$250,000,000	Medium	Provides utility cost savings for the County.
Total Estimated 2025-2030:	\$4,200,000	\$222,000,000	\$411,900,000		

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The following table represents estimated first year costs and an estimated cost range for the following years 2030 through 2050 for the high priority actions that require longer implementation timelines to be completed. Action implementation timeline is 2030-2050 to meet goal of county government operations being carbon neutral by 2050. Feasibility study or further analysis would be especially important for these actions to determine exact costs and cost savings.

Action Title	Estimated Year 1 Costs	2030 – 2050 Costs		Estimated GHG Reduction Potential	Additional Cost Considerations
		Low	High		
B.5: Transition to Net-Zero for County Government Facilities	\$400,000	\$10,000,000	\$100,000,000	Medium	Provides utility cost savings for the County.
T.7: Adopt Zero- or Low-Emissions County Fleet	\$0	\$200,000,000	\$350,000,000	Low	Provides cost savings on vehicle maintenance, fuel tank maintenance, and fuel costs in comparison with internal combustion engine (ICE) vehicles. Cost estimate does not include existing vehicle replacement budget. Current estimated cost to replace an ICE vehicle fleet by 2050 is \$170,000,000. Anticipated significant improvements in specialty vehicle EV options in the next 20 years. Federal tax credits can assist with offsetting the purchase of EV's.
Total Estimated 2030-2050:		\$400,000	\$210,000,000	\$450,000,000	

Estimated costs for the high priority actions years 2025 through 2050 are summarized in the table below.

Timeline	Estimated Year 1 Costs	Low	High
Total Estimated 2025-2030:	\$4,200,000	\$222,000,000	\$411,900,000
Total Estimated 2030-2050:	\$400,000	\$210,000,000	\$450,000,000
Total Estimated 2025-2050:	\$4,600,000	\$432,000,000	\$861,900,000

Appendix B.2 How to Read an Implementation Roadmap

Action Title	The action number and title	
Action Description	Description of action as reflected in the CESMP text	
Related County Goal(s)	County goals that the action contributes toward meeting	
Climate Action Topic	Climate action topic the action addresses: Electricity, Buildings, Transportation, Waste, Natural Resources, Climate Adaptation	
GHG Reduction Potential/Climate Hazard	<p>Action's GHG reduction potential range and/or climate hazard addressed.</p> <p>GHG Reduction Potential (represents the high/maximum estimate for GHG reductions):</p> <ul style="list-style-type: none"> • Very High: greater than 500,000 MTCO₂e reduced • High: 50,000-500,000 MTCO₂e reduced • Medium: 10,000-50,000 MTCO₂e reduced • Low: less than 10,000 MTCO₂e reduced • Unknown: Not Quantified <p>Climate Hazard:</p> <ul style="list-style-type: none"> • All Climate Hazards • Precipitation • High Winds & Tornadoes • Sea Level Rise • Extreme Heat 	
Lead Department(s)	Department(s) that will be leading action implementation	
Supporting Departments/Partners	Departments or other entities that can support action implementation	
Implementation Steps	High-level steps to implement action	
Potential County Action Cost Range (2025-2030)	Includes County government first year budget requests and ongoing cost considerations from 2025-2030. Does not include existing staff time costs or upfront/operational savings generated by the action. Does not consider existing funds available that would have been spent in a business-as-usual scenario if the action was not implemented (e.g., costs for purchasing fossil fuel cars versus costs for purchasing electric cars at time of replacement).	
Performance Indicators	Output Indicators: Measurable result of action (i.e., miles of bike lanes built, kilowatts of renewable energy installed)	Outcome Indicators: Outcomes needed to achieve the GHG reduction strategies and County goals (i.e., increase in bicycle mode share, electricity emissions reduced)

Appendix B.3 Implementation Plans

E.1: Acquire Clean Electricity Sources for the County

Action Title	E.1: Acquire Clean Electricity Sources for the County	
Action Description	Form an opt-out municipal aggregation program to acquire 100% clean electricity for Dominion Energy customers in the community. A municipal aggregation program, also known as community choice aggregation (CCA), allows local governments to negotiate for 100% clean or renewable electricity for all the electricity customers within their jurisdiction. Through a CCA, a municipality can purchase and manage their community's electric power supply from a preferred mix of energy sources while the utility continues to provide distribution, billing services, and outage management. In the county, a CCA may be able to be formed in Dominion Energy's territory, but further legal review is needed, especially to determine if one could be formed in NOVEC's territory. If we develop an opt-out program, customers would automatically be enrolled in 100% clean electricity but can opt-out to revert to their traditional service and electricity energy source mix. This action could substantially reduce county-wide electricity emissions, depending on the offered clean electricity mix and how many customers opt-out of the program.	
Related County Goal(s)	<ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Source 100% of county-wide electricity from renewable sources by 2035 • Achieve 100% renewable electricity in County Government operations by 2030 • Achieve 100% carbon neutrality in County Government operations by 2050 	
Climate Action Topic	Electricity	
GHG Reduction Potential	Very High	
Lead Department	<ul style="list-style-type: none"> • Office of Sustainability 	
Supporting Departments/Partners	<ul style="list-style-type: none"> • Facilities and Fleet Management • Finance • Management and Budget • Economic Development 	
Implementation Steps	<ul style="list-style-type: none"> • Release request for information (RFI) which will include: <ul style="list-style-type: none"> ○ Study on electric grid capacity/feasibility to provide 100% clean electricity for the entire community ○ Study on potential conflicts or complications of forming a CCA with Dominion but not NOVEC (note: NOVEC cannot partake in a CCA) • Develop a CCA feasibility study • Release a request for proposals (RFPs) • Hire an expert on CCA to manage contract under Office of Sustainability • Assess conflicts with County government electricity purchasing contracts 	
Potential County Action Cost Range (2025-2030)	<p>TOTAL: \$4M-\$5M</p> <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ○ Hiring new staff member: \$200k ○ Developing feasibility study: \$1M • Other Cost Considerations: <ul style="list-style-type: none"> ○ Start-up costs (\$3.7M – referenced from Loudoun County feasibility study) • Ongoing Cost Considerations: <ul style="list-style-type: none"> ○ New staff salaries ○ Changes in County government electricity costs (could increase or decrease electricity costs) 	
Performance Indicators	<p>Output Indicators</p> <ul style="list-style-type: none"> • % participation rate in program • % clean or renewable kWh provided to community • Cost of electricity (\$/kWh) 	<p>Outcome Indicators</p> <ul style="list-style-type: none"> • CCA electricity emissions factor • Community-wide electricity emissions

E.2: Promote Renewable Energy Incentive Programs and Develop Additional Solar Incentives

Action Title	E.2: Promote Renewable Energy Incentive Programs and Develop Additional Solar Incentives	
Action Description	Provide outreach and education on programs and incentives for residents and businesses to install renewable energy systems, such as federal solar tax credits, community solar programs, net metering, the multifamily shared solar program, solar renewable energy certificates and Solarize NOVA. Develop additional local renewable energy incentives, such as streamlined solar permitting, in partnership with stakeholders such as the Residential Solar Task Force and local utilities. This would include providing a centralized tool for residents and businesses to reference relevant federal, state, County, and utility incentives and programs.	
Related County Goal(s)	<ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Source 100% of county-wide electricity from renewable sources by 2035 	
Climate Action Topic	Electricity	
GHG Reduction Potential	Medium	
Lead Department	<ul style="list-style-type: none"> • Development Services - Building Development Division • Development Services - Land Development Division • Real Estate Assessments • Office of Sustainability 	
Supporting Departments/Partners	<ul style="list-style-type: none"> • Economic Development • Residential Solar Task Force • NOVEC and Dominion 	
Implementation Steps	<p>Promote Existing Incentives:</p> <ul style="list-style-type: none"> • Develop a centralized webpage or tool on County website for residents and businesses to reference relevant federal, state, County, and utility incentives and programs (PACE, tax credits, multifamily shared solar program, net metering, community solar, solar renewable energy certificates (SRECs), Solarize NOVA) • Integrate Development Services' residential solar local incentives webpage information into tool and ensure tool is periodically updated • Coordinate webpage or tool development with Action B.4: "Promote Energy Efficiency and Electrification Incentives" • Work with Solarize NOVA to promote their services (a community-based outreach initiative sponsored by the Northern Virginia Regional Commission that facilitates the deployment of solar energy to homes and businesses in Northern Virginia, through bulk purchasing and free solar site assessments) • Provide education/outreach to commercial business networks and include incentive information in County presentations to new businesses or businesses considering locating to the county • The Office of Sustainability would lead any education and outreach efforts <p>Develop Additional Incentives:</p> <ul style="list-style-type: none"> • Work with Residential Solar Task Force to develop new solar incentives • Engage with SolSmart Virginia to help make commercial solar permitting faster, easier, and more affordable for businesses • Engage the development community to understand new areas of opportunity in the Zoning code • Evaluate mechanisms to reduce or exempt taxes on solar panels 	
Potential County Action Cost Range (2025-2030)	<p>TOTAL: \$200k-1M</p> <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ○ New staff member to develop new incentives • Ongoing Cost Consideration: <ul style="list-style-type: none"> ○ New staff salary 	
Performance Indicators	<p>Output Indicators</p> <ul style="list-style-type: none"> • Number of county solar installation permits with system size (kW) information 	<p>Outcome Indicators</p> <ul style="list-style-type: none"> • Residential grid electricity use

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	<ul style="list-style-type: none">• Number of ground-mounted versus roof solar systems• Track number of participants throughout county using Solarize NOVA data	<ul style="list-style-type: none">• Residential building emissions• Commercial grid electricity use• Commercial building emissions
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E.3: Incentivize Renewable Energy Use in Energy-Intensive Commercial Buildings

Action Title	E.3: Incentivize Renewable Energy Use in Energy-Intensive Commercial Buildings
Action Description	Incentivize the use of renewable energy in energy-intensive commercial buildings through a voluntary reporting program, expedited permitting, or height bonuses. As commercial building electricity use is forecast to generate roughly 28% of county-wide emissions by 2030, incentivizing emissions reductions in this sector is crucial toward meeting the 2030 GHG reduction target.
Related County Goal(s)	<ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Source 100% of county-wide electricity from renewable sources by 2035
Climate Action Topic	Electricity
GHG Reduction Potential	High
Lead Department	<ul style="list-style-type: none"> • Development Services • Planning Office • Economic Development
Supporting Departments/Partners	<ul style="list-style-type: none"> • Businesses and Data Centers
Implementation Steps	<p>Reporting and Transparency</p> <ul style="list-style-type: none"> • Collaborate with data center companies/developers to discuss the following: <ul style="list-style-type: none"> ○ How local government can help data centers reduce emissions, transition to clean energy sources, and reduce energy use ○ Request disclosure of clean energy generation/purchasing, emissions and offset information, and progress toward any clean energy or emissions goals <ul style="list-style-type: none"> ▪ NOTE: There may be limitations on obtaining energy use and/or equipment information from data centers • Develop a voluntary reporting program to communicate data center clean energy development/usage and emissions reduction progress to the public while emphasizing the amount of new clean energy sources added to grid • <p>Other Incentives</p> <ul style="list-style-type: none"> • Determine the qualifications for buildings to apply to renewable energy incentive program (e.g., incentive only applies to commercial buildings with a minimum energy use intensity, building must procure a minimum % of renewable energy to attain incentive, etc.) • Review the legality of offering incentives to specific commercial building types and excluding other types • Evaluate the current number and projected new development of the qualified buildings in the county • Develop County goals on the percent of qualified developments that will use the incentive • Use County goals to determine the incentive type/amount and number of new staff needed to implement incentives • Evaluate the feasibility and effectiveness of different incentives for renewable energy use for commercial developments, such as: <ul style="list-style-type: none"> ○ Height bonuses where permissible and with proper study on potential community impacts such as viewsheds or noise <ul style="list-style-type: none"> ▪ If a height bonus is granted, require a minimum distance from residential communities ○ Streamlined/expedited permitting <ul style="list-style-type: none"> ▪ Office of Sustainability could provide funding to Building Services to expand permitting team, or new funding could be allocated to Building Services team through increased permit fees elsewhere ▪ NOTE: Data centers are already granted expedited plan reviews/inspections by County as they are targeted industry/priority development

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Potential County Action Cost Range (2025-2030)	TOTAL: \$1M-\$10M <ul style="list-style-type: none">• First Year Budget Requests<ul style="list-style-type: none">○ No additional first year costs (internal staff time)• Ongoing Cost Considerations:<ul style="list-style-type: none">○ Costs dependent on incentive pursued and if new staff are needed		
Performance Indicators	<table border="1"><tr><td>Output Indicators<ul style="list-style-type: none">• % of data centers disclosing energy or emissions information• % of qualified developments using incentive (either square footage or # of developments)• kWh of renewable energy purchased due to incentive</td><td>Outcome Indicators<ul style="list-style-type: none">• Commercial energy use• Commercial emissions</td></tr></table>	Output Indicators <ul style="list-style-type: none">• % of data centers disclosing energy or emissions information• % of qualified developments using incentive (either square footage or # of developments)• kWh of renewable energy purchased due to incentive	Outcome Indicators <ul style="list-style-type: none">• Commercial energy use• Commercial emissions
Output Indicators <ul style="list-style-type: none">• % of data centers disclosing energy or emissions information• % of qualified developments using incentive (either square footage or # of developments)• kWh of renewable energy purchased due to incentive	Outcome Indicators <ul style="list-style-type: none">• Commercial energy use• Commercial emissions		

E.4: Promote Existing Green Power Products

Action Title	E.4: Promote Existing Green Power Products	
Action Description	Promote purchasing utility green power options within the community. Green power products allow customers to purchase renewable or clean electricity on a month-to-month basis through an added fee on their utility bill. Both Dominion and NOVEC offer 100% renewable electricity options.	
Related County Goal(s)	<ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Source 100% of county-wide electricity from renewable sources by 2035 • Achieve 100% renewable electricity in County government operations by 2030 • Achieve 100% carbon neutrality in County government operations by 2050 	
Climate Action Topic	Electricity	
GHG Reduction Potential	High	
Lead Department	Office of Sustainability	
Supporting Departments/Partners	<ul style="list-style-type: none"> • Communications • Public Works • Dominion and NOVEC 	
Implementation Steps	<ul style="list-style-type: none"> • Hire a new communications staff member through Office of Sustainability • Evaluate cost of purchasing green power from Dominion and NOVEC (both offer 100% renewable options) compared to regular utility costs • Work with Dominion and NOVEC to develop education and outreach program to promote green power product purchasing • Work with Dominion and NOVEC to understand their capacity to provide 100% renewable electricity to county customers 	
Potential County Action Cost Range (2025-2030)	TOTAL: ~\$1M <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ◦ Hiring staff member: \$200k • Ongoing Cost Considerations: <ul style="list-style-type: none"> ◦ New staff salary: \$200k/year 	
Performance Indicators	Output Indicators <ul style="list-style-type: none"> • Customer participation rate • # or % of kWh from renewable or clean electricity sources for participating customers 	Outcome Indicators <ul style="list-style-type: none"> • Emissions avoided through green power purchasing

E.5: Install Solar on County Government Facilities

Action Title	E.5: Install Solar on County Government Facilities	
Action Description	Develop solar projects on County government facilities through consideration of direct ownership or third-party ownership models such as PPAs.	
Related County Goal(s)	<ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Source 100% of county-wide electricity from renewable sources by 2035 • Achieve 100% renewable electricity in County Government operations by 2030 • Achieve 100% carbon neutrality in County Government operations by 2050 	
Climate Action Topic	Electricity	
GHG Reduction Potential	Low	
Lead Department	Fleets and Facilities Management	
Supporting Departments/Partners	Departments with facilities not managed by Facilities and Fleet: <ul style="list-style-type: none"> • Community Services • Housing and Community Development • Fire & Rescue • Parks, Recreation & Tourism • Public Works • Adult Detention Center 	
Implementation Steps	<ul style="list-style-type: none"> • Consider language for legal evaluation • Complete solar feasibility study to identify ideal solar locations on County buildings (County already conducted a high-level feasibility study for roughly 65 facilities and identified 10 buildings that it is currently conducting a detailed solar feasibility study on) • Identify funding source for solar installations • Install solar on priority facilities identified through feasibility study • Develop plan to incentivize and/or develop public/private partnerships to place solar panels on/over parking lots across the county 	
Potential County Action Cost Range (2025-2030)	TOTAL: ~\$9M <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ◦ Solar feasibility study already paid for and underway • Ongoing Cost Considerations: <ul style="list-style-type: none"> ◦ Installing solar on top 10 buildings (including construction costs): \$9M • NOTE: If solar is installed on the 10 buildings undergoing detailed solar feasibility study, the solar will generate \$250k annual savings in electric bills, potentially reducing total 2030 costs by \$1M. 	
Performance Indicators	Output Indicators <ul style="list-style-type: none"> • Size (kW) of solar installed on County facilities • Electricity (kWh) produced by government solar systems 	Outcome Indicators <ul style="list-style-type: none"> • Government utility electricity use • Electricity emissions avoided through use of solar • Government building emissions

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B.1: Incentivize Energy Efficiency and Electrification Retrofits

Action Title	B.1: Incentivize Energy Efficiency and Electrification Retrofits	
Action Description	Incentivize existing building energy efficiency and electrification retrofits through actions such as streamlined permitting.	
Related County Goal(s)	Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030	
Climate Action Topic	Buildings	
GHG Reduction Potential	Medium	
Lead Department	<ul style="list-style-type: none"> • Development Services – Building Department 	
Supporting Departments/Partners	None identified	
Implementation Steps	<ul style="list-style-type: none"> • Determine the qualifications for buildings to apply to incentive program, such as a list of acceptable retrofits • Develop county goals on the percent of qualified buildings that will use the incentive • Use county goals to structure incentive type/amount and determine the number of new staff needed to implement incentive program • Evaluate potential incentives for building upgrades or high energy performance, including: <ul style="list-style-type: none"> ○ Streamline/expedited permitting <ul style="list-style-type: none"> ▪ NOTE: Single family residential equipment replacements typically have same day permitting review, but commercial equipment replacement does not • Office of Sustainability could provide funding to Building Services to expand permitting team, or new funding could be allocated to Building Services team through increased permit fees • Consider prioritizing or offering larger incentives to low-income residents or building owners that rent to low-income families • Provide education/outreach on energy cost savings from energy efficiency/electrification retrofits 	
Potential County Action Cost Range (2025-2030)	TOTAL: >\$5M <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ○ Hiring staff member to coordinate/develop incentives: \$200k • Ongoing Cost Considerations: <ul style="list-style-type: none"> ○ New staff salary ○ Implementing incentives 	
Performance Indicators	Output Indicators <ul style="list-style-type: none"> • Building permit data describing equipment replacement and fuel switching • Average permit time 	Outcome Indicators <ul style="list-style-type: none"> • Community electricity use • Community natural gas use

B.2: Propose Green Zoning Regulations

Action Title	B.2: Propose Green Zoning Regulations	
Action Description	Propose green zoning regulations to incentivize energy- and water-efficient buildings, multifamily and mixed-use areas, and transit-oriented developments. Green zoning involves revising zoning policies to require or incentivize developers to abide by certain sustainable development practices. Denser developments and multifamily housing units typically use less energy than other, more dispersed building types. Additionally, mixed-used and transit-oriented areas significantly reduce the need for vehicle travel, which would also reduce transportation emissions.	
Related County Goal(s)	Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030	
Climate Action Topic	Buildings, Transportation	
GHG Reduction Potential	Medium	
Lead Department	Planning Office	
Supporting Departments/Partners	<ul style="list-style-type: none"> • Transportation • Housing • Watershed • Parks and Recreation • Economic Development/Community Development 	
Implementation Steps	<ul style="list-style-type: none"> • Study what changes in the zoning ordinance can be implemented to best promote green developments: • Coordinate local policy revisions to zoning and plans to allow people to live closer to jobs • Set environmental goals for green zoning regulations, for example, protect and connect green open spaces and improve ecological benefits • Conduct a green space or NOS assessment and define strategy for green/space NOS (coordinate with Action N.1: “Adopt Natural Open Space Requirements”) • Develop green zoning around green space strategy 	
Potential County Action Cost Range (2025-2030)	<p>TOTAL: \$500k-\$1M</p> <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ◦ Hiring consultant, including environmental assessment: \$500k • Ongoing Cost Considerations: <ul style="list-style-type: none"> ◦ No additional costs beyond existing staff time 	
Performance Indicators	<p>Output Indicators</p> <ul style="list-style-type: none"> • # of green certified buildings (e.g., LEED) 	<p>Outcome Indicators</p> <ul style="list-style-type: none"> • Residential energy use and emissions • Commercial energy use and emissions

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B.3: Incentivize Energy Efficient and Electric New Construction

Action Title	B.3: Incentivize energy efficient and electric new construction	
Action Description	Provide incentives for developers to build to energy-efficient or all-electric new developments, such as streamlined permitting.	
Related County Goal(s)	Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030	
Climate Action Topic	Buildings	
GHG Reduction Potential	Medium	
Lead Department	<ul style="list-style-type: none"> • Planning Office • Development Services 	
Supporting Departments/Partners	<ul style="list-style-type: none"> • None identified 	
Implementation Steps	<ul style="list-style-type: none"> • Review incentivizing/promoting certain fuel types in new construction • Consider using an energy use intensity metric instead of specific fuel-related requirement • Establish the type of new developments that should qualify for incentive (e.g., all new developments, developments over a certain size, etc.) • Evaluate the projected new development of qualified buildings in the county • Develop County goals on the percent of qualified developments that will use the incentive to build all-electric • Use County goals to determine the incentive type/amount and number of new staff needed to implement expedited permitting or other incentives • Evaluate potential incentives for all-electric new construction, such as: <ul style="list-style-type: none"> ○ Streamlined/expedited permitting for all-electric construction <ul style="list-style-type: none"> ▪ Office of Sustainability could provide funding to Building Services to expand permitting team, or new funding could be allocated to Building Services team through increased permit fees elsewhere ○ Height bonuses where permissible and with proper study on potential community impacts such as viewsheds or noise <ul style="list-style-type: none"> ▪ If a height bonus is granted, require a minimum distance from residential communities 	
Potential County Action Cost Range (2025-2030)	TOTAL: >\$5M <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ○ No additional first year costs (internal staff time) • Ongoing Cost Considerations: <ul style="list-style-type: none"> ○ Potential additional staff to implement incentive programs 	
Performance Indicators	Output Indicators <ul style="list-style-type: none"> • % of new construction that is all-electric (use # of permits for all-electric new construction and permits for mixed-fuel new construction) • Average permit time 	Outcome Indicators <ul style="list-style-type: none"> • Community electricity use • Community natural gas use

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B.4: Promote Energy Efficiency and Electrification Incentives

Action Title	B.4: Promote Energy Efficiency and Electrification Incentives	
Action Description	Provide outreach and education to residents and businesses about tools, technology, and incentives for building energy efficiency and electrification. This would include providing a centralized webpage or tool for residents and businesses to reference relevant federal, state, and utility incentives, C-PACE information, and County programs, among other resources.	
Related County Goal(s)	Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030	
Climate Action Topic	Buildings	
GHG Reduction Potential	Medium	
Lead Department	<ul style="list-style-type: none"> • Office of Sustainability 	
Supporting Departments/Partners	<ul style="list-style-type: none"> • Development Services • Communications Office • Economic Development • Green Business Council 	
Implementation Steps	<ul style="list-style-type: none"> • Develop a centralized webpage or tool for residents and businesses to reference relevant federal, state, and utility incentives, C-PACE information, and County programs, and provide consumer information on available technology and products such as high efficiency heat pumps and replacement of existing air conditioners with higher efficiency units. • Assign a dedicated staff member to maintain and regularly update webpage and conduct outreach to businesses and residents • Coordinate with other departments to report new incentives to dedicated staff member • Coordinate webpage or tool development with Action E.2: “Promote Renewable Energy Incentive Programs and Develop Additional Solar Incentives” • Develop a physical/virtual Guidebook for incentives (as incentives change regularly, Guidebook can direct to website) • Collaborate with HOAs to promote adaptive technologies in residential communities 	
Potential County Action Cost Range (2025-2030)	TOTAL: ~\$1M <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ○ Hiring staff member: \$200k • Ongoing Cost Considerations: <ul style="list-style-type: none"> ○ New staff salary 	
Performance Indicators	Output Indicators <ul style="list-style-type: none"> • # of residents/businesses reached through program 	Outcome Indicators <ul style="list-style-type: none"> • Community electricity use • Community natural gas use

B.5: Transition to Net-Zero County Government Facilities

Action Title	B.5: Transition to Net Zero County Government Facilities
Action Description	Develop a net-zero emissions building plan for County government facilities, which will include implementing an energy benchmarking program and procuring 100% clean electricity for all County government operations.
Related County Goal(s)	<ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Source 100% of county-wide electricity from renewable sources by 2035 • Achieve 100% renewable electricity in County Government operations by 2030 • Achieve 100% carbon neutrality in County Government operations by 2050
Climate Action Topic	Electricity, Buildings
GHG Reduction Potential	Medium
Lead Department	<ul style="list-style-type: none"> • Facilities and Fleet Management • Finance – Risk and Wellness Services
Supporting Departments/Partners	Departments with facilities not managed by Facilities and Fleet: <ul style="list-style-type: none"> • Community Services • Housing and Community Development • Fire & Rescue • Parks, Recreation & Tourism • Public Works • Adult Detention Center
Implementation Steps	<ul style="list-style-type: none"> • Develop a government operations GHG inventory • Hire consultant to develop Net Zero Plan • Develop a plan that includes the following elements: <ul style="list-style-type: none"> ○ Conduct a feasibility study for facility electrification ○ Prioritize buildings for net-zero transition - identify buildings that would be exempt from full electrification ○ Evaluate cost of purchasing 100% green power from Dominion and NOVEC ○ Explore PPA and VPPA options (consider partnering with other local governments to establish VPPAs) • Hire employee to manage green power purchasing and energy benchmarking program • Develop mandatory energy benchmarking program by streamlining existing bill capture program • Conduct staff training for new technologies or processes for facilities (e.g., heat pumps)
Potential County Action Cost Range (2025-2030)	TOTAL: \$10M-\$100M <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ○ Hiring staff member: \$200k ○ Developing plan: \$200k <ul style="list-style-type: none"> ▪ NOTE: Energy Efficiency and Conservation Block Grant Program funds can be applied toward developing Plan • Ongoing Cost Considerations (costs are dependent on results on net-zero study and green power options pursued): <ul style="list-style-type: none"> ○ New staff salary ○ Implementing Net Zero for All Facilities: \$30M <ul style="list-style-type: none"> ▪ Cost includes all facilities transitioning to net-zero (may not occur before 2030) ▪ Does not consider existing equipment replacement budget and any additional cost or savings from replacing equipment with electric options ○ Ongoing cost of purchasing clean electricity through Dominion or NOVEC: \$5-10M <ul style="list-style-type: none"> ▪ Purchasing electricity through VPPA/PPA would be much cheaper and even generate revenue ○ Implementing energy benchmarking program: <\$200k

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Performance Indicators	Output Indicators <ul style="list-style-type: none">• % of new public buildings built to net-zero energy standards• % of total net-zero public buildings• % building participation rate in benchmarking program• % of kWh used that are from clean or renewable sources	Outcome Indicators <ul style="list-style-type: none">• Government building emissions• Government natural gas and fuel oil use
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T.1: Improve Pedestrian and Bicycle Infrastructure and Enhance Connectivity

Action Title	T.1: Improve Pedestrian and Bicycle Infrastructure and Enhance Connectivity
Action Description	Improve active transportation infrastructure, sidewalk and trail connectivity, and overall safety to support walking, biking, and rolling. Improvements could include providing bike lockers, installing curb ramps, or installing traffic-calming designs like crosswalk islands or speed humps. This action would involve developing a strategic Active Transportation Plan that includes recommendations for prioritizing infrastructure improvements and outlines new active transportation policies, processes, and infrastructure.
Related County Goal(s)	Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030
Climate Action Topic	Transportation
GHG Reduction Potential	High
Lead Department	<ul style="list-style-type: none"> • Transportation • Parks, Recreation and Tourism
Supporting Departments/Partners	<ul style="list-style-type: none"> • Planning Office • Watershed • Service Authority • VDOT* • Schools
Implementation Steps	<p>Coordination:</p> <ul style="list-style-type: none"> • Coordinate with other entities that are developing active transportation programming/infrastructure to align all efforts (e.g., PWCS, Parks department, Transportation department, Planning department, and other supporting partners such as Watershed department and Service Authorities) • Continue coordination with the COG Bike and Ped subcommittee to complete the National Capital Bike Trail Network to increase access to opportunities and other activities via non-motorized modes <p>Planning:</p> <ul style="list-style-type: none"> • Hire an active-mobility planning consultant to develop a strategic Active Transportation Plan that includes recommendations for prioritizing infrastructure improvements and outlines new active transportation policies and processes • Ensure Active Transportation Plan development process includes extensive community engagement • Evaluate expansion of County-wide Trails Plan in Comprehensive Plan <ul style="list-style-type: none"> ○ Review Trails and Blueways Council's Aspirational Trails Map and identify additional facilities to include ○ Ensure elements of Active Transportation Plan are also incorporated into update of County-wide Trails Plan • Incorporate the Trails and Blueways Council's Aspirational Trails Map into the forthcoming Parks, Recreation and Tourism Master Plan • Use forthcoming Transportation app to crowd-source data on barriers to pedestrian and bicyclist access to schools and transit and identify priority actions • Identify existing private facilities/community destinations that need bicycle facilities and evaluate incentives that could be provided to encourage visitor bicycle facilities • Evaluate use of counters to track usage of bicycle/pedestrian facilities or hire consultant develop bicycle/pedestrian facility usage counts <p>Incentives and Resources:</p> <ul style="list-style-type: none"> • Coordinate with developers on improving bicycle and pedestrian connectivity • Update the DCSM to include mobility requirements • Continue to implement Comprehensive Plan in formation of trails as part of development projects • Create a bike facility map that notes bike parking, lockers, and showers throughout the county • For new projects, ensure considerations for future trails projects

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	<ul style="list-style-type: none"> • Evaluate different types of districts as an alternate funding mechanism for streetscape infrastructure that VDOT does not need to approve 	
Potential County Action Cost Range (2025-2030)	TOTAL: ~\$50M <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ○ Hiring consultant: \$200k (consultant will development cost estimate to implement Active Transportation Plan strategies) • Ongoing Cost Considerations: <ul style="list-style-type: none"> ○ Dependent on results of the Plans, could include maintenance (mowing) and repair/replacement (bike stations, water fountains, etc.) 	
Performance Indicators	Output Indicators <ul style="list-style-type: none"> • Miles of dedicated bike lane • Miles of trails • # or % of nodes connected • # of bike racks approved as part of new developments 	Output Indicators <ul style="list-style-type: none"> • Commuting travel mode splits from the Census • # or % of students walking or biking to school (through Schools tracking) • Pedestrian and bicyclist morbidity and mortality (Health Authority) • On-road transportation emissions

*The County can build public roads and sidewalks which are then adopted into the state system and maintained by VDOT. Any public road/sidewalk development proposed by the County needs to be approved by VDOT and VDOT could override proposed development in any right-of-way.

T.2: Incentivize Transit-Oriented Development

Action Title	T.2: Incentivize Transit-Oriented Development	
Action Description	Incentivize TOD within 1/2-mile of high-capacity regional transit stations. This could be done through developer incentives, such as streamlined permitting, or zoning amendments. The County could also require bicycle parking minimums in TOD areas.	
Related County Goal(s)	Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030	
Climate Action Topic	Transportation	
GHG Reduction Potential	High	
Lead Department	<ul style="list-style-type: none"> • Planning Office • Transportation 	
Supporting Departments/Partners	<ul style="list-style-type: none"> • PRTC • VRE • Development Services 	
Implementation Steps	<ul style="list-style-type: none"> • Develop a TOD Action Plan • Identify new incentives that would promote TOD, such as streamlined permitting • Explore zoning amendments that would promote TOD • Update the DCSM to: <ul style="list-style-type: none"> ○ Establish parking maximums and reduce parking minimums for TOD areas ○ Enhance bike facilities within multifamily developments • Require bike parking minimums in TOD areas 	
Potential County Action Cost Range (2025-2030)	<p>TOTAL: \$200k</p> <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ○ Hiring a consultant for TOD Action Plan: \$200k • Ongoing Cost Considerations: <ul style="list-style-type: none"> ○ No additional costs beyond existing staff time 	
Performance Indicators	<p>Output Indicators</p> <ul style="list-style-type: none"> • % of qualified developments using incentive (using either square footage or # of developments) 	<p>Outcome Indicators</p> <ul style="list-style-type: none"> • Commuting travel mode splits from the Census • Transit ridership levels • On-road transportation emissions

T.3: Expand Existing Programs that Reduce Single-Occupancy Vehicle Trips

Action Title	T.3: Expand Existing Programs that Reduce Single-Occupancy Vehicle Trips	
Action Description	Expand and promote programs that offer transportation demand management services, reduce transit fares, and support teleworking.	
Related County Goal(s)	<ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Achieve 100% carbon neutrality in County Government operations by 2050 	
Climate Action Topic	Transportation	
GHG Reduction Potential	Medium	
Lead Department	Transportation	
Supporting Departments/Partners	Planning Office PRTC	
Implementation Steps	<ul style="list-style-type: none"> • Support PRTC/OmniRide’s Transportation Demand Management Strategic Plan (Plan includes strategies for working with local employers) • Evaluate opportunities to enhance the County Transportation Demand Management Program by updating the Design and Construction Standards Manual • Continue to promote the Transit Fare Buy Down Program and support reduced transit fares • Evaluate pursuing grant opportunities for additional transit fare reduction programs or expand existing programs • Continue to work with VDOT to expand park and ride lots and encourage carpooling/ridesharing • Promote the Transportation Planning Board’s Commuter Connections program which encourages and incentivizes telework and transit use through employer-provided transit benefits, expanding telework options, providing transit and carpool benefits to employees, alternative work schedules, providing parking cash-outs for employees that drive and receive free paid parking, and reducing subsidized parking at work • Update Comprehensive Plan to support development of infrastructure to aid in teleworking (e.g., rural broadband, free Wi-Fi hotspots) • Work with private sector to encourage development to provide adequate infrastructure to support teleworking • In the Design and Construction Standards Manual update, explore providing parking reduction to developers who commit to providing a certain % of teleworking employees • Coordinate high speed internet infrastructure upgrades with transportation infrastructure projects 	
Potential County Action Cost Range (2025-2030)	TOTAL: \$200k-1M <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ○ New staff member • Ongoing Cost Consideration: <ul style="list-style-type: none"> ○ New staff salary 	
Performance Indicators	Output Indicators <ul style="list-style-type: none"> • % utilization of commuter lots (through periodic snapshots) 	Outcome Indicators <ul style="list-style-type: none"> • Commuting travel mode splits from Census • Transit ridership • On-road transportation emissions

T.4: Upgrade Public Transit Infrastructure

Action Title	T.4: Upgrade Public Transit Infrastructure	
Action Description	Partner with county transit operators and VDOT to improve and provide new public transit infrastructure and build out transit nodes. Though the County government does not operate the public buses that service the county, County government can help provide supportive infrastructure to help increase the efficiency and frequency of bus travel. However, as most public roads and bus infrastructure are maintained by VDOT, County government will partner with VDOT to identify and develop transit priority treatments.	
Related County Goal(s)	Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030	
Climate Action Topic	Transportation	
GHG Reduction Potential	Medium	
Lead Department	<ul style="list-style-type: none"> Transportation 	
Supporting Departments/Partners	<ul style="list-style-type: none"> Planning Office PRTC Virginia DRPT VRE VDOT 	
Implementation Steps	<ul style="list-style-type: none"> Work with transit operators and VDOT to develop Transit Improvement Study Work with VDOT to identify corridors for transit priority treatments (e.g., priority bus lanes, dedicated or shared bus lanes, priority signaling, etc.) Identify grants to build out mobility hubs or transit centers Work with OmniRide and the broader community to identify priority locations for bus stops 	
Potential County Action Cost Range (2025-2030)	<p>TOTAL: \$100-\$250M</p> <ul style="list-style-type: none"> First Year Budget Requests: <ul style="list-style-type: none"> Feasibility study for transit infrastructure: \$100-200k Ongoing Cost Considerations: <ul style="list-style-type: none"> Implementing feasible range of improvements by 2030: \$100-250M Implementing all priority treatments/improvements past 2030: \$250-500M May incur maintenance costs for mobility hubs and transit centers, but not other priority treatments maintained by VDOT 	
Performance Indicators	<p>Output Indicators</p> <ul style="list-style-type: none"> Miles of dedicated transit lanes 	<p>Outcome Indicators</p> <ul style="list-style-type: none"> Commuting travel mode splits from Census Transit ridership On-road transportation emissions

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T.5: Incentivize Zero-Emission Vehicles and Charging

Action Title	T.5: Incentivize Zero-Emission Vehicles and Charging	
Action Description	Develop incentives for residents and businesses to purchase ZEVs or install charging equipment, such as through streamlined permitting for EV chargers, "group-buy" programs for EV chargers, or EV purchasing co-ops.	
Related County Goal(s)	Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030	
Climate Action Topic	Transportation	
GHG Reduction Potential	High	
Lead Department	<ul style="list-style-type: none"> • Transportation • Development Services 	
Supporting Departments/Partners	None identified	
Implementation Steps	<ul style="list-style-type: none"> • Establish a Workgroup to identify priority ZEV incentives • Evaluate implementing streamlined permitting for EV chargers • Consider making EV chargers a "permitted accessory use" so they do not require site plan review. Consider changes to EV site plan approval process that would help streamline or expedite the process. • Evaluate creating "group-buy" programs for charging stations or vehicles or establishing EV purchasing cooperatives • Evaluate integrating EV charging standards into Design and Construction Standards Manual update • Consider integrating electric bike purchasing and charging incentives • 	
Potential County Action Cost Range (2025-2030)	TOTAL: >\$5M <ul style="list-style-type: none"> • First Year Budget Requests <ul style="list-style-type: none"> ○ No additional first year costs (internal staff time) • Ongoing Cost Considerations: <ul style="list-style-type: none"> ○ Funding for group-buy programs or cooperatives ○ Potential additional staff 	
Performance Indicators	Output Indicators <ul style="list-style-type: none"> • City EV charger installation permit data • # of incentive program participants • Average permitting time 	Outcome Indicators <ul style="list-style-type: none"> • On-road transportation emissions • # of registered EV/ZEVs in county (EV Hub website)

T.6: Expand Public EV Charging Network

Action Title	T.6: Expand Public EV Charging Network	
Action Description	Expand public EV charging infrastructure especially along main routes and in popular destinations. This would include developing an EV Infrastructure Plan to guide community deployment and considerations for electric bike charging.	
Related County Goal(s)	Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030	
Climate Action Topic	Transportation	
GHG Reduction Potential	High	
Lead Department	<ul style="list-style-type: none"> • Transportation • Facilities and Fleet Management 	
Supporting Departments/Partners	<ul style="list-style-type: none"> • VDOT • VRE • PRTC 	
Implementation Steps	<ul style="list-style-type: none"> • Develop EV Infrastructure Plan for community deployment • Conduct regional EV gap analysis to identify most critical gaps in EV charging network • Install EV charging at publicly owned facilities • Incentivize newly constructed buildings in the community to accommodate EV charging • Implement combined solar and EV charger buying cooperatives (see Arlington County) • Coordinate County-installed public EV charging with VDOT's National Vehicle Infrastructure Plan • Identify source of grant matching funds (no dedicated funding currently) 	
Potential County Action Cost Range (2025-2030)	<p>TOTAL: \$25-\$50M</p> <ul style="list-style-type: none"> • First Year Budget Requests <ul style="list-style-type: none"> ◦ EV Study: \$100-\$200k • Ongoing Cost Considerations: <ul style="list-style-type: none"> ◦ Charger maintenance 	
Performance Indicators	<p>Output Indicators</p> <ul style="list-style-type: none"> • # public EV chargers installed • % utilization rate • % of chargers currently working (i.e., uptime) 	<p>Outcome Indicators</p> <ul style="list-style-type: none"> • On-road transportation emissions • # of registered EV/ZEVs in county (EV Hub website)

T.7: Adopt Zero- or Low-Emissions County Fleet

Action Title	T.7: Adopt Zero- or Low-Emissions County Fleet	
Action Description	Transition County fleet to zero- or low-emissions vehicles and ensure supporting infrastructure is open to other fleets.	
Related County Goal(s)	<ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Achieve 100% carbon neutrality in County Government operations by 2050 	
Climate Action Topic	Transportation	
GHG Reduction Potential	Low	
Lead Department	Fleets and Facilities Management	
Supporting Departments/Partners	None identified	
Implementation Steps	<ul style="list-style-type: none"> • Hire a consultant to develop an EV Fleet Transition Study • Hire a consultant to develop an EV Charging Infrastructure Study (for both community-wide and County fleet charging) • Evaluate if hybrid electric vehicles and plug-in hybrid electric vehicles should be included in fleet transition • Identify funding source and tax incentives for EVs • Purchase and install EVSE • Purchase zero or low emissions vehicles • Conduct staff training on vehicle use 	
Potential County Action Cost Range (2025-2030)	<p>TOTAL: \$200-350M</p> <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ○ EV Fleet Transition Study: \$200k ○ EV Charging Infrastructure Study: \$200k • Ongoing Cost Considerations: \$200-350M <ul style="list-style-type: none"> ○ Installing charging infrastructure ○ Transitioning fleet <ul style="list-style-type: none"> ▪ Cost does not consider existing vehicle replacement budget and any additional cost or savings from replacing vehicles with low or zero emissions options ○ Maintaining charger stations ○ Annual EV fuel costs will be lower than gas or diesel vehicle fuel costs 	
Performance Indicators	Output Indicators <ul style="list-style-type: none"> • % total fleet that is low or zero-emission • GHGs offset, kWh used, # of sessions (from ChargePoint Chargers data) 	Outcome Indicators <ul style="list-style-type: none"> • Gasoline and diesel used by government fleet • County fleet emissions

N.1: Adopt Natural Open Space Requirements

Action Title	N.1: Adopt Natural Open Space Requirements	
Action Description	<p>Establish minimum natural open space (NOS) guidelines to encourage preservation of NOS, if appropriate, in new and existing development.</p> <p>NOS is “open space with natural resource benefits within the boundaries of a development such as native forests; topographic features; critical habitats for threatened and endangered species and species of special concern; natural creeks, streams and lakes; and natural wetlands that are set aside as an area to remain undisturbed during development and in perpetuity for the preservation of the natural resources contained therein and for the passive use and enjoyment of the residents of the development and/or the public at large.”</p>	
Related County Goal(s)	<ul style="list-style-type: none"> • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 • Become a Climate Ready Region and making significant progress to be a Climate Resilient Region by 2030 	
Climate Action Topic	Natural Resources, Climate Adaptation	
GHG Reduction Potential	Unknown	
Lead Department	<ul style="list-style-type: none"> • Public Works - Watershed • County Arborist 	
Supporting Departments/Partners	<ul style="list-style-type: none"> • Planning Office • County Attorney’s office • Owners of open space areas (HOAs, commercial owners, environmental trusts, etc.) 	
Implementation Steps	<ul style="list-style-type: none"> • Review legal guidance with County Attorney regarding this action • Explore the ability to incorporate NOS requirements for a larger variety of zoning districts instead of just an open space requirement • Develop a NOS corridor overlay for the entire county and identify areas that should be targeted for preservation of substantial tracts to create wildlife habitat and facilitate safe wildlife movement • Translate the new Conservation Residential concept that was approved with the updated Comp Plan into specific standards in the Zoning Ordinance – this would help to codify standards in those districts for requiring undisturbed open space that preserves forests. This district should also have standards for restoration of forests for open fields that will not be used for farming • Prioritize minimizing land disturbance during construction and leaving terrain in a natural state • Evaluate initiating more robust tree-save rules in the Zoning Ordinance and the Design and Construction Manual • Utilize Equity and Inclusion Screening Assessment Tool to understand demographic impacts as action is being implemented 	
Potential County Action Cost Range (2025-2030)	<p>TOTAL: \$100k-\$500k</p> <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ○ No additional first year costs (internal staff time) • Ongoing Annual Cost Considerations: <ul style="list-style-type: none"> ○ Potential costs from legal fees 	
Performance Indicators	<p>Output Indicators</p> <ul style="list-style-type: none"> • Total area or % of NOS in the county • Total area or % of open space in the county • Acres of wildlife corridors • Tree Cover Inventory 	<p>Outcome Indicators</p> <ul style="list-style-type: none"> • Land use emissions • Average carbon sequestration potential per acre of NOS • Loss/gain of tree cover

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A.1: Develop Adaptation Plans for Critical Facilities

Action Title	A.1: Develop Adaptation Plans for Critical Facilities	
Action Description	Develop site-level adaptation plans for critical facilities and service areas considering current and future climate change hazards.	
Related County Goal(s)	Become a Climate Ready Region and making significant progress to be a Climate Resilient Region by 2030	
Climate Action Topic	Climate Adaptation	
Climate Hazard	All Climate Hazards	
Lead Department	<ul style="list-style-type: none"> Office of Emergency Management 	
Supporting Departments/Partners	<ul style="list-style-type: none"> Facilities and Fleet Management (for County facilities) Risk and Wellness (for some County facilities) External critical facility owners 	
Implementation Steps	<ul style="list-style-type: none"> Review existing list of critical facilities in the county and determine which facilities the County's Office of Emergency Management has authority to create adaptation plans for Review any existing adaptation plans for critical facilities within the county Develop adaptation plan framework(s) for different types or groups of critical facilities Complete adaptation plans for critical facilities that the County has authority over Provide GIS data and technical support to encourage adaptation plan development for critical facilities that the County does not have the authority to create Utilize Equity and Inclusion Screening Assessment Tool to understand demographic impacts as action is being implemented 	
Potential County Action Cost Range (2025-2030)	TOTAL: \$600K (consider starting goal around 2027 and completing in 3 years) <ul style="list-style-type: none"> First Year Budget Requests: <ul style="list-style-type: none"> Hiring staff to review work and develop template: \$200k Ongoing Cost Considerations: <ul style="list-style-type: none"> Staff Support (Senior Emergency Management Planner): \$200K/year 	
Performance Indicators	Output Indicators <ul style="list-style-type: none"> % of county's critical facilities with adaptation plans # of technical assistance requests from external critical facility owners that the County supported each year 	Outcome Indicators <ul style="list-style-type: none"> # of critical facilities that begin acting on completed adaptation plans

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A.2: Manage Stormwater Flooding Outside of the Floodplain

Action Title	A.2: Manage Stormwater Flooding Outside of the Floodplain	
Action Description	Increase understanding of flooding in areas outside of the delineated FEMA floodplain through modeling and/or historic flood records. Develop and implement mitigation actions to reduce stormwater flooding.	
Related County Goal(s)	Become a Climate Ready Region and making significant progress to be a Climate Resilient Region by 2030	
Climate Action Topic	Climate Adaptation	
Climate Hazard	Precipitation	
Lead Department	<ul style="list-style-type: none"> • Office of Emergency Management 	
Supporting Departments/Partners	<ul style="list-style-type: none"> • Public Works – Watershed • VDOT 	
Implementation Steps	<ul style="list-style-type: none"> • Review work done in this area by the County’s Office of Emergency Management (including ongoing flood resiliency plan which will include data development and filling in gaps in flood mapping) • Develop mitigation actions for areas that are identified as vulnerable to stormwater flooding (including stormwater improvements, transportation infrastructure updates, building adaptation, etc.) • Implement mitigation actions • Utilize Equity and Inclusion Screening Assessment Tool to understand demographic impacts as action is being implemented 	
Potential County Action Cost Range (2025-2030)	<p>TOTAL: >\$3M</p> <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ○ No initial funding needed <ul style="list-style-type: none"> ▪ \$1.2M has already been allocated for the flood resiliency assessment ▪ \$150K has been allocated for mitigation measures in FY23 ▪ \$600K requested for FY24 for implementation for mitigation measures • Ongoing Annual: <ul style="list-style-type: none"> ○ Implementation (will depend on the mitigation actions determined in the flood resiliency assessment): \$500K/year 	
Performance Indicators	<p>Output Indicators</p> <ul style="list-style-type: none"> • Key performance indicators in the flood resiliency plan (will get updated as the plan progresses) • Status of implementation on items that come out of the plan 	<p>Outcome Indicators</p> <ul style="list-style-type: none"> • Reduction in closed roads and swift water rescues

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A.3: Improve Power Resiliency for Critical Infrastructure

Action Title	A.3: Improve Power Resiliency for Critical Infrastructure	
Action Description	Improve the resiliency of electrical infrastructure for publicly owned essential services and infrastructure.	
Related County Goal(s)	Become a Climate Ready Region and making significant progress to be a Climate Resilient Region by 2030	
Climate Action Topic	Climate Adaptation	
Climate Hazard	Extreme Temperature; High Winds/Tornadoes	
Lead Department	<ul style="list-style-type: none"> • Office of Emergency Management • Critical Infrastructure Owners • County Energy Providers 	
Supporting Departments/Partners	<ul style="list-style-type: none"> • Facilities and Fleet Management • Parks & Rec • Fire 	
Implementation Steps	<ul style="list-style-type: none"> • Review work done in this area by the County's Office of Emergency Management including the existing list of county buildings without available backup power • Rank county buildings by criticality • Complete electrical assessment studies • Develop plan to fund backup power and/or micro grids • Purchase and implement backup power for county facilities in order of criticality, as funding is available • Use low-carbon alternatives to diesel wherever possible 	
Potential County Action Cost Range (2025-2030)	<p>TOTAL: \$1-5M</p> <ul style="list-style-type: none"> • First Year Budget Request: <ul style="list-style-type: none"> ○ Electrical assessment by existing staff: \$250K-\$500K • Ongoing Annual: <ul style="list-style-type: none"> ○ Dependent on selected projects ○ Purchase/installation for all facilities and annual maintenance of 5-10% of total cost: \$1M-\$5M 	
Performance Indicators	<p>Output Indicators</p> <ul style="list-style-type: none"> • % of critical infrastructure implemented with backup power • # of mission essential / primary mission essential functions supported with backup power 	<p>Outcome Indicators</p> <ul style="list-style-type: none"> • Reduced downtime for critical facilities

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A.4: Implement Shoreline Protection and Nature-Based Solutions

Action Title	A.4: Implement Shoreline Protection and Nature-Based Solutions	
Action Description	Develop guidance to prioritize nature-based solutions for shoreline protection for coastal areas.	
Related County Goal(s)	Become a Climate Ready Region and making significant progress to be a Climate Resilient Region by 2030	
Climate Action Topic	Climate Adaptation	
Climate Hazard	Sea level rise	
Lead Department	<ul style="list-style-type: none"> • Public Works – Watershed Team 	
Supporting Departments/Partners	<ul style="list-style-type: none"> • Development Services - Land Development Division • Office of Emergency Management • Parks, Recreation and Tourism 	
Implementation Steps	<ul style="list-style-type: none"> • Compile available information and studies on existing and planned shoreline protection and nature-based solutions within the county including existing implementation progress for county properties • Fund and implement nature-based solutions on existing County property in coastal areas • Fund and implement incentive program to encourage coastal shoreline protection and nature-based solutions on existing private property • Utilize Equity and Inclusion Screening Assessment Tool to understand demographic impacts as action is being implemented 	
Potential County Action Cost Range (2025-2030)	TOTAL: >\$5M <ul style="list-style-type: none"> • First Year Budget Requests <ul style="list-style-type: none"> ◦ One FTE to review existing studies/projects and develop plan for implementing nature-based solutions on existing County properties in the coastal zone: \$200K • Ongoing Cost Considerations: <ul style="list-style-type: none"> ◦ New staff salary 	
Performance Indicators	Output Indicators <ul style="list-style-type: none"> • Shoreline miles where projects have been completed 	Outcome Indicators <ul style="list-style-type: none"> • Decreased emergency shoreline stabilization projects

A.5: Restore Streams to Reduce Flooding

Action Title	A.5: Restore Streams to Reduce Flooding	
Action Description	Develop and implement stream restoration projects in support of reduced flooding outcomes.	
Related County Goal(s)	Become a Climate Ready Region and making significant progress to be a Climate Resilient Region by 2030	
Climate Action Topic	Climate Adaptation	
Climate Hazard	Precipitation	
Lead Department	<ul style="list-style-type: none"> Public Works, Watershed Team 	
Supporting Departments/Partners	<ul style="list-style-type: none"> Planning Office Office of Emergency Management 	
Implementation Steps	<ul style="list-style-type: none"> Review existing stream restoration projects, develop lessons learned, and develop a list of potential stream restoration project areas on County-owned property with focus on flood mitigation potential Secure funding for stream restoration projects Implement stream restoration projects with focus on flood mitigation Utilize Equity and Inclusion Screening Assessment Tool to understand demographic impacts as action is being implemented 	
Potential County Action Cost Range (2025-2030)	<p>TOTAL: >\$5M</p> <ul style="list-style-type: none"> First Year Budget Request: <ul style="list-style-type: none"> One FTE to evaluate current stream restoration projects and determine flood mitigation potential: \$200K Ongoing Cost Considerations: <ul style="list-style-type: none"> New staff salary Funding from stormwater fee and DEQ grant funding supports current work For additional ramp-up current staff could support additional work, but need consultant for implementation 	
Performance Indicators	<p>Output Indicators</p> <ul style="list-style-type: none"> Stream miles restored Flood conveyance capacity (acres) added since start of project 	<p>Outcome Indicators</p> <ul style="list-style-type: none"> None identified

A.6: Incentivize Technology for Residents to Make Homes Adaptive

Action Title	A.6: Incentivize Technology for Residents to Make Homes Adaptive	
Action Description	Provide additional incentives or subsidies for residents of low-income housing and rental properties to install or retrofit buildings with climate adaptive technologies to reduce energy, reduce water use, reduce waste heat, and minimize urban heat gain.	
Related County Goal(s)	<ul style="list-style-type: none"> • Become a Climate Ready Region and making significant progress to be a Climate Resilient Region by 2030 • Reduce GHG emissions county-wide to 50% below baseline 2005 levels by 2030 	
Climate Action Topic	Buildings, Climate Adaptation	
Climate Hazard	High Heat	
Lead Department	<ul style="list-style-type: none"> • Office of Sustainability 	
Supporting Departments/Partners	<ul style="list-style-type: none"> • Development Services • Dominion Energy 	
Implementation Steps	<ul style="list-style-type: none"> • Identify technology that the County would encourage use of to make homes adaptive • If possible, identify buildings that have highest energy bills compared to other buildings of the same size/age. Or consider starting with older buildings to help prioritize outreach • Review existing State/National funding programs that residents could use and advertise this available funding • Develop new County-run incentive programs to encourage the use of adaptive technology • Utilize Equity and Inclusion Screening Assessment Tool to understand demographic impacts as action is being implemented 	
Potential County Action Cost Range (2025-2030)	<p>TOTAL: >\$2.4M</p> <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ○ One FTE to support implementation (would include assessments and plan development for the first year): \$200k • Ongoing Cost Considerations: <ul style="list-style-type: none"> ○ New staff salary ○ Grant funding: \$200k/year ○ One FTE salary: \$200K/year 	
Performance Indicators	<p>Output Indicators</p> <ul style="list-style-type: none"> • # of households contacted/year • % of residences (that have been identified as having the most benefit from adaptive technology) within the county that have been granted the incentive/grant 	<p>Outcome Indicators</p> <ul style="list-style-type: none"> • Residential energy consumption

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A.7: Plan Alternate Evacuation Routes for Flood-prone Areas

Action Title	A.7: Plan Alternate Evacuation Routes for Flood-prone Areas	
Action Description	Develop localized evaluation routes throughout the county and socialize with the public.	
Related County Goal(s)	Become a Climate Ready Region and making significant progress to be a Climate Resilient Region by 2030	
Climate Action Topic	Climate Adaptation	
Climate Hazard	Precipitation	
Lead Department	<ul style="list-style-type: none"> • Office of Emergency Management 	
Supporting Departments/Partners	<ul style="list-style-type: none"> • None Identified 	
Implementation Steps	<ul style="list-style-type: none"> • Review flood-prone areas that affect evacuation routes • Develop alternative evacuation routes • Develop plan to implement road closures and rerouting • Implement plan • Utilize Equity and Inclusion Screening Assessment Tool to understand demographic impacts as action is being implemented 	
Potential County Action Cost Range (2025-2030)	<p>TOTAL: ~\$3.2M</p> <ul style="list-style-type: none"> • First Year Budget Requests: <ul style="list-style-type: none"> ○ Gap analysis, vulnerability assessment, data pull and tool development: \$500k • Ongoing Cost Considerations: <ul style="list-style-type: none"> ○ One FTE salary: \$200K/year ○ Recurring costs (including data systems): \$250k 	
Performance Indicators	Output Indicators <ul style="list-style-type: none"> • # of evacuation routes established 	Outcome Indicators <ul style="list-style-type: none"> • None identified

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Appendix C. CESMP Actions Mapped to Strategic Plan and Comprehensive Plan Action Strategies

Actions	Comprehensive Plan Action Strategies	Strategic Plan Action Strategies
E.1: Acquire Clean Electricity Sources for the County	H5.9	SG2: C., SG2: E
E.2: Promote Renewable Energy Incentive Programs and Develop Additional Solar Incentives	H5.4, H5.6, H5.7, H5.9	SG2: C., SG2: E, SG2: F
E.3: Incentivize Renewable Energy Use in Energy-Intensive Commercial Buildings	H5.9	SG2: C., SG2: E
E.4: Promote Existing Green Power Products	H5.9	SG2: C., SG2: E
E.5: Install Solar on County Government Facilities	H5.9	SG2: C., SG2: E
B.1: Incentivize Energy Efficiency and Electrification Retrofits	H5.4	SG2: E
B.2: Propose Green Zoning Regulations	LU8.1, LU8.3, H5.2, H5.3, H5.4, H5.4, H5.10	SG2: B., SG2: E
B.3: Incentivize Energy Efficient and Electric New Construction	H5.3, H5.4, H5.7	SG2: B., SG2: E
B.4: Promote Energy Efficiency and Electrification Incentives	H5.4, H5.7	SG2: E
B.5: Transition to Net Zero County Government Facilities		SG2: A., SG2: B., SG2: E
B.6: Create All-electric Guidelines for New Construction of County Government Facilities		SG2: A., SG2: B., SG2: E
B.7: Create Policy to Increase Energy Efficiency in County Government Facilities		SG2: A., SG2: B., SG2: E
B.8: Implement Building Energy Benchmarking		SG2: E
T.1: Improve Pedestrian and Bicycle Infrastructure and Enhance Connectivity	G3.9, G3.10, LU8.2, LU8.4	SG2: E, TM2: A
T.2: Incentivize Transit-Oriented Development	G3.9, G3.10, LU8.1, LU8.2, LU8.4, LU8.5, H5.2, H5.10	SG2: E
T.3: Expand Existing Programs that Reduce Single-Occupancy Vehicle Trips	G3.9, G3.10, LU8.2	SG2: E, TM4: A
T.4: Upgrade Public Transit Infrastructure	G3.9, G3.10, G3.11, LU8.2	SG2: E
T.5: Incentivize Zero-Emission Vehicles and Charging	G3.9, G3.10, RP3.1	SG2: E
T.6: Expand Public EV Charging Network	G3.9, G3.10, RP3.1	SG2: D., SG2: E
T.7: Adopt Zero- or Low-Emissions County Fleet	G3.9, G3.10, RP3.1	SG2: D., SG2: E
T.8: Encourage E-Bike and E-Scooter Adoption	G3.9, G3.10, LU8.2	SG2: E
T.9: Educate on Existing Zero-Emission Vehicle Incentives and Rebates	G3.9, G3.10, RP3.1	SG2: E
T.10: Promote Zero-Emission Bus and Rail Transition	G3.9, G3.10, G3.11, RP3.1, LU8.2	SG2: E

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Actions	Comprehensive Plan Action Strategies	Strategic Plan Action Strategies
T.11: Support Zero- or Low-Emissions County Government Contracting of Off-Road Equipment	G3.9, G3.10, RP3.1	SG2: E
T.12: Adopt County Government Zero-Emission Off-Road Policy	G3.9, G3.10, RP3.1	SG2: D, SG2: E
T.13: Discount Transit Passes for Residents	G3.9, G3.10, LU8.2	SG2: E
T.14: Launch Electric Equipment Lending Program		SG2: E
N.1: Adopt Natural Open Space Requirements	H5.2, H5.11	SG2: E, EC1: A, EC1: B, EC1: C
N.2: Launch Suburban and Rural Tree Planting Initiative		SG2: E
N.3: Update Tree Cover Regulations		SG2: E, EC1: A, EC1: B
N.4: Support Sustainable Farming Practices		SG2: E
W.1: Implement County-Wide Composting		SG2: E
W.2: Promote Sustainable Purchasing Policy		SG2: E
W.3: Mandate Commercial Food Waste Diversion		SG2: E
A.1: Develop Adaptation Plans for Critical Facilities	H5.2	
A.2: Manage Stormwater Flooding Outside of the Floodplain		EC5: B, EC5: C
A.3: Improve Power Resiliency for Critical Infrastructure	H5.7	
A.4: Assess Shoreline Protection and Nature-Based Solutions		EC5: B
A.5: Restore Streams to Reduce Flooding		EC5: B
A.6: Incentivize Technology for Residents to Make Homes Adaptive		SG2: B, SG2: E
A.7: Plan Alternate Evacuation Routes for Flood-prone Areas		EC5: B
A.8: Expand Building Insulation Standards to Protect Against Extreme Heat		SG2: E
A.9: Protect Existing Buildings Against High Winds	H5.12	
A.10: Protect County Infrastructure from Flooding		EC5: B, EC5: C
A.11: Incentivize Nature-based Solutions to Reduce Flooding in Residential Properties	H5.2	
A.12: Improve Water Infrastructure for Extreme Precipitation Events	H5.2	
A.13: Urban Heat Island Relief Program	H5.2	SG2: E
A.14: Adopt Guidelines to Use Nature-based Solutions on County Government Construction	H5.2	
A.15: Improve Grid Resiliency During Extreme Weather	H5.7	
A.16: Expand Tax Credits for Conservation of Natural Resources		EC1: A
A.17: Develop Plan to Preserve Estuaries and Wetlands To Reduce Flooding		EC1: A

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Actions	Comprehensive Plan Action Strategies	Strategic Plan Action Strategies
A.18: Training for Community Members on Climate Change and Mental Health		EC5: D
A.19: Increase Protection from the Sun at Childcare Centers		SG2: E
A.20: Incentivize Improved Cooling Equipment in Apartments	H5.4	SG2: B, SG2: E
A.21: Incentivize Businesses to Reduce Water Usage	H5.4	SG2: B, SG2: E
A.22: Protect Electrical Infrastructure from High Winds	H5.7	
A.23: Expand Community Outreach for Education on Climate Change Adaptation		EC5:D
A.24: Support Agriculture Resiliency		

Key

Comprehensive Plan Action Definitions

H5.2	Promote mixed-use, well connected, and walkable neighborhoods that are resilient communities with lower carbon emissions. Consider enhanced Design and Construction Standards Manual (DCSM) requirements to mitigate impacts from the construction and infrastructure projects, especially on water quality.
H5.3	Promote construction design options to build sustainable, green neighborhoods. Explore funding opportunities, design implications, and practical solutions to reduce residents' energy cost burden and encourage the housing industry to build environmentally sustainable housing.
H5.4	Research energy-conserving building design standards and incentivize implementation of any adopted standards. Energy-efficient affordable housing focused on sustainability and the reduction of utility costs benefits renters and homeowners. To avoid rising rents, consider energy saving cost reduction measures to support both property owners in fixed rent situations and homeowners.
H5.6	Streamline County approval of solar panels installed at private homes and businesses.
H5.7	Support coordination between County and state departments and agencies and utility companies to improve outreach and access to funding that supports home/improvement and maintenance, including energy efficient audits, upgrades and retrofits, weatherization assistance, solar panel installation, and age in place maintenance and construction.
H5.9	Increase percentage of renewable energy utilized by the County to support reduction of greenhouse gas emissions. Implement MWCOG targets to reduce greenhouse gas emissions from all sources within the county to 50% of 2005 level by 2030, and to be carbon-neutral by 2050.
H5.10	Reduce auto-centric development patterns to reduce transportation costs and HOUSING Page 17 environmental impacts. Support future housing growth at transit supportive densities, with a variety of housing types, especially in designated activity centers and corridors. Track the number of new dwelling units proposed and/or built inside and outside of activity centers as a measure of sustainability growth and to enhance funding opportunities.

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H5.12	Support cultural and civic facilities (libraries, firehouses, museums, state and County parks, landmarks, and County facilities) as disaster preparedness and relief centers that provide emergency social services in times of distress (cooling station, food distribution, widespread power outage, or hurricane/tornado relief shelter).
G3.9	Coordinate with the County's Office of Sustainability on supporting the CESMP and ensure that mobility projects support the County's Climate Mitigation and Resiliency Goals.
G3.10	Develop short-term and long-term mobility policies to support the County's adopted regional Climate Mitigation and Resiliency Goals.
G3.11	Coordinate with regional partners to identify programs and initiatives that support reduction of greenhouse gas emission goals in support of climate resiliency.
LU8.1	Support higher-density residential uses in transit-oriented developments such as Town Centers, Activity Centers, Redevelopment Corridors, and near employment areas. Higher residential densities are encouraged to be located near or with access to mass transit stations like the Virginia Railway Express, bus routes, and other transit nodes and facilities.
LU8.2	Support affordable housing incentives with appropriate buffering and design in accordance with the bonus density applicable to each transect.
LU8.3	Consider travel modes other than the automobile to better connect and integrate residential uses with non-residential uses.
LU8.4	Strategically designate residential land use to encourage development of housing to accommodate the population growth projections with consideration for expanding affordable housing and multigenerational households.
LU8.5	Adopt Complete Streets policies that improves safety and mobility in new residential development and study existing neighborhoods that need to improve the local street and pedestrian connections to enhance the community.
RP3.1	Promote the utilization of vehicles that use alternative fuels and other measures, including electricity, to reduce air quality and noise impacts.

Strategic Plan Action Definitions

SG2: A	Ensure the County leads by example by implementing energy-conserving building design standards for future county infrastructure and facilities and retrofit county infrastructure and facilities as opportunities arise.
SG2: B	Establish energy-conserving building design standards and incentivize and encourage implementation in public and private buildings.
SG2: C	Increase and incentivize the usage and implementation of alternative and renewable energy sources throughout the county.
SG2: D	Implement incorporation of environmentally sustainable vehicles, such as hybrid and/or electric vehicles, into the county's fleet and encourage the installation of vehicle recharge stations.
SG2: E	Implement MWCOG targets to reduce greenhouse gas emissions from all sources within the county to 50% of 2005 level by 2030, and to be carbon-neutral by 2050.

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SG2: F	Streamline County approval of solar panels being installed at private homes and businesses.
TM2: A	Improve connectivity of sidewalks and trails (paved and unpaved) for pedestrians and cyclists.
TM4: A	Continue and expand telework options for County employees.
EC1: A	Prioritize minimizing land disturbance during construction and leaving natural terrain in a natural state. When not feasible, evaluate alternatives such as tree-banking programs.
EC1: B	Evaluate initiating tree-save rules in the Zoning Ordinance/DCSM.
EC1: C	Promote reforestation and meadow development with native plants on county land and on private land.
EC5: B	Continue to update maps and monitor flood prone locations in the county.
EC5: C	Work with local, state, and federal agencies to identify funding for projects that would reduce or eliminate the risk of repetitive flooding.
EC5: D	Work with emergency management agencies to create and implement flood risk education programs.

Appendix D. Existing County Government Actions

The following is a list of actions, programs, and projects that we already have underway. These actions either try to mitigate GHG emissions or improve climate resiliency and hazard mitigation in the county.

Existing GHG Mitigation Actions

Natural Resources

1. The County recently secured annual funding and a full-time employee to expand upon an existing reforestation program. The program is now expanded to allow 10-acre non-agricultural lots to apply which is expected to substantially increase participation in the county.
2. In response to recent regulations, the County is currently working with the State on tree preservation requirements for new development.
3. Plant effluent water reuse is utilized within the water treatment plant which helps to reduce potable water usage by 1.5 million gallons per day.
4. Ongoing customer water savings initiatives are in place such as public education and flyers inserts in bills. An ongoing recommended watering program is in place which directs even and odd address for homes to water on different days.

Energy Conservation

5. In 2022, the County's wastewater treatment plant's inefficient electric-resistance heating and conventional lighting was converted to high-efficiency lighting and high-efficiency heat pumps.
6. The County is actively applying for Federal Energy Efficiency and Conservation Block Grant (EECBG) to be applied to energy efficiency programs for our facilities.
7. The County has achieved 82% LED lighting in its general government facilities and is striving towards 100% LED lighting. LED lighting retrofit projects completed to date offset 1,466 metric tons of CO₂e annually.
8. The County is striving to achieve LEED Gold accreditation in new and future building designs.
9. The County monitors and benchmarks energy consumption of general government operations and reassesses annually the priorities for energy conservation improvements.
10. The County has completed energy audits at 35 facilities since 2018 and continually hires outside consultants to assist with development of energy conservation measures.
11. The County shares energy management strategy and provides training for the personal development of facilities maintenance personnel.
12. The County leverages building automation to implement advanced energy conservation strategies in its largest facilities.
13. The County uses analytics to ensure automation strategies are implemented properly and sustained. Analytics also identify new building automation deficiencies as they arise in real time.

Transportation

14. There is a Commuter Choice funded Transportation Demand Management marketing campaign for the I-66 corridor and Transit Fare Buy Down Program for 5 OmniRide Bus Routes.
15. There are sidewalk and trail improvement efforts covered in the Capital Improvement Program. The current program includes three standalone bike/pedestrian projects and thirteen transportation projects that include bike/pedestrian facilities.

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16. A First/Last Mile Study is being conducted at Neabsco Commuter Garage via MWCOG. A consultant did an analysis of a 1-mile walkshed of the garage and provided recommendations to provide pedestrian improvements and cost estimates. Various recommendations included exploring micro-mobility: e-bikes/e-scooters, sidewalk connectivity, sidewalk improvements to include safety features, and desired paths (putting in trails where people are naturally walking).
17. Yorkshire Corridor Improvements Study grant received via MWCOG tasks the consultant to provide actionable recommendations to build off existing planned improvements to make Route 28 a more walkable, transit-oriented corridor. This will include a gap analysis of first/last mile connections, review of planned project scopes and existing and future land use and recommendations for prioritized pedestrian, bicycle and/or micro-mobility connections and transit supportive infrastructure. This project will include coordination with the City of Manassas, the City of Manassas Park and OmniRide, which operates bus services on the corridor.
18. The Board recently approved providing a local match to the Woodbridge Pedestrian Bridge that will connect the Woodbridge VRE to a new development on the other side of Route 1. Transportation is beginning the design process of a pedestrian bridge over Route 15 in Gainesville. Staff is looking to find other sources of funding to allow the project to proceed beyond the design stage.
19. The County is adopting a new Mobility Chapter of the Comprehensive Plan which aims to reduce lane miles and focus on transit and non-motorized transportation.
20. The County is updating the Transportation chapter of the Design and Construction Standards which will be informed by a Green Infrastructure planning study.
21. The County has hired a consultant to conduct a fleet right sizing study to develop a long-term fleet renewal plan. Once the initial plan is developed, a modified fleet sustainability plan will be developed that will identify opportunities to replace conventionally fueled vehicles (CFV) with alternative fuel vehicles (AFV) with an emphasis on zero or possibly low emission vehicles.
22. The County has purchased five electric vehicles for our fleet and have been installing charging stations to support them. There are plans to continue to purchase more EVs.
23. A Green Infrastructure Study grant received through MWCOG tasks a consultant to provide a clear roadmap to implementing green infrastructure into planned capital projects in the county, many of which already have dedicated funding. The project will also inform long term policy decisions through the review and recommendation of applicable policies, specifically into the Prince William Design and Construction Standards Manual. This will allow the County to include green infrastructure recommendations in future projects and help secure funding for the enhanced project scopes.

Waste

24. There are reuse and clothing and shoe collection programs at the Prince William County Landfill and the Balls Ford Road Compost facilities. The reuse program was recently reinstated in July 2022. The clothing program has collected 4,500 pounds through Calendar Year 2022.
25. There is a public outreach program promoting source reduction and reuse as part of ongoing outreach and education programs. The County partners with Keep Prince William Beautiful on Fix-It Fairs.
26. The County promotes "grasscycling" (leaving grass clippings on the lawn) and backyard composting.
27. The County promotes backyard composting including the sale of low-cost compost bins, with a total of 31 bins sold in Fiscal Year 2022.
28. The County has plans to promote a food scraps recovery program with the commercial sector, expand residential organics collection to include food scraps, and expand our glass recycling drop-off collection program. A draft plan for this work was presented to the Board in Fall 2022.
29. Starting in October 2021, the County began implementing a year-round residential yard waste collection program. As of Calendar Year 2022, the yard waste program has diverted more than 2,000 tons from our county landfill to the Balls Ford Road Compost facility.

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30. The implementation of five glass recycling drop-off centers has increased glass recycling from 17 to 575 tons from Calendar Year 2018 to 2021.

Existing Renewable Electricity Actions

1. The County has recently established a Residential Solar Task Force with industry members to provide education, receive feedback on permitting processes, and define opportunities to improve the processes. Recommendations from the task force will directly inform our streamlining actions.
2. A consultant is analyzing the feasibility of solar installations for ten government facilities. The consultant is developing County Government standards for photovoltaic (PV) solar design to be used in future solar installation Requests for Proposals (RFP). The consultant is assessing county government options for financing PV systems on government facilities.
3. A PV solar array on the McCoart Administrative Building offsets 15 metric tons of CO₂e annually.
4. Our county landfill currently captures methane and uses it to produce approximately 6.7 MW of electricity to NOVEC annually. We plan to retire the generators and work with a private company to build a new facility to use captured methane more efficiently by converting it into renewable natural gas.
5. The Board authorized a Fee Reduction Program for residential solar projects that waives all home solar project fees from September 1, 2023, through June 30, 2024.

Existing Adaptation/Resiliency Actions

All Hazards

6. The County Emergency Operations Plan outlines all aspects of response and recovery for the community to include all aspects of mass care, survivor support, public information, damage assessment, public reporting, etc. All aspects of the Emergency Operations Plan should continue to be supported and enhanced, where necessary to continue to support the community's needs.
7. The Ready Prince William community outreach and engagement program seeks to integrate existing community partners and volunteering efforts in preparedness, response, and recovery. The County is actively working to enhance this program.
8. The County's Office of Emergency Management coordinates with other County, Regional, and State agencies to provide technical assistance resources for specific facilities, including universities, schools, day care centers, assisted living facilities, healthcare facilities, etc. This can include information on hazard risk, information for facility emergency action plans, and routinely participates in plan reviews, stakeholder meetings, trainings, and exercises, as requested by facilities.

Flooding

9. FEMA manages floodplain mapping for the county. The Office of Emergency Management and Department of Public Works are conducting a Flood Resiliency Plan and supporting "small area plans" that develop mitigation actions for flooded areas and communities. This will also address, where able, future flooding risk and assessing community vulnerability to flooding risk.
10. Storm surge zones have already been mapped by FEMA and existing data shows critical infrastructure within this zone and the rest of the special flood hazard area.
11. The backbone of a County Automated Flood Warning System is now operational with four water depth gauges at key areas of riverine flooding. The system will gauge adjusted rainfall rates to identify flooding trends for each basin. There are future plans to add rain gauges, weather stations, and additional water level sensors to expand county-wide coverage. The system will support early warning capabilities and data collection to determine county-wide flooding trends. We are using several grant funding sources to continue the build out of the rest of the system.
12. The County actively participates in FEMA's Community Rating System. The County recently advanced from CRS Class 7 rating to Class 6, meaning that the county residents and businesses will see a 20 percent discount on their flood insurance premiums issued or renewed from Oct. 1, 2023, an increase from 15 percent last year. The County plans to continue to participate in the Community Rating System program

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and actively find ways to maintain and enhance all eligible program areas to increase resiliency and provide flood insurance discounts for residents who live in a special flood hazard area.

13. The County's Office of Emergency Management coordinates community outreach and engagement through the Ready Prince William program. Flood preparedness and flood insurance outreach efforts routinely occur through this program, including providing a detailed flood preparedness brochure in the annual real estate tax mailing, a targeted campaign for Dam Safety Day to ensure all homeowners who live downstream from a dam understand the flood risk associated with the Dam, and proclamation of Flood Awareness Week in the Spring each year.
14. Many hazard risk assessment programs already exist in the county regarding technical assistance for specific facilities, including universities, schools, day care centers, assisted living facilities, healthcare facilities, etc.

Extreme Heat

15. The Office of Emergency Management has established warming and cool centers coupled with triggers and escalation levels. These locations are primarily the libraries throughout the community, but the Office of Emergency Management has also established additional locations identified if libraries are not suitable to the needs of the incident, including the use recreation centers and other facilities. Extreme Heat procedures are currently in place. A comfort center plan for extreme heat/cold mass care support is in development for the County. If a resident signs up for PWC Alerts, and opts into weather watches and warnings, they will receive notifications for heat advisories. This is supported by the County's Emergency Operations Plan.

Tornadoes

16. Community tornado safe rooms are targeted by FEMA for states and communities in tornado alley and other areas that have significant early warning of a tornado coming to allow individuals time to go to a community safe room. This is not feasible in our county, as tornadoes are relatively rare in this area and there is a very short working time as they can occur very quickly from a severe thunderstorm cell. The preparedness messaging used instead is focused on teaching individuals how to identify a safe room in their house, place of work, etc. that they can quickly and safely get to should a tornado pop up quickly.

Infrastructure Resiliency

17. The Prince William County Service Authority (PWCSA) and Virginia American Water is in coordination with Fairfax Water to secure supply, leading to better regional resiliency of water supply.
18. Action Strategy G3.5 in the Comprehensive Plan aims to prioritize improvements to vulnerable infrastructure as identified by VTrans Vulnerability Assessment. This consideration is currently included as prioritization factor for transportation projects submitted for state funding. DOT has an active project, the Route 28 Bypass, in an area with existing flooding and is pursuing enhanced stormwater management measures to better prepare the area for future floods. Impact projects are funded by SMART SCALE (beginning Round 5 which funds projects in Fiscal Years 2026-2027) through the Virginia Office of Intermodal Planning and Investment.
19. The County implements watershed studies, stormwater retrofits, and small drainage improvement projects as needed. We have undertaken several stream restoration projects to improve the quality of our local streams and waterways. We stream restoration program identifies projects through field inspections and watershed studies.
20. Public Works' is seeking funding to conduct detailed watershed studies for flood control to implement climate adaptation strategies, assess the adequacy and capacity of existing stormwater infrastructure, and propose DCSM changes for changes in precipitation patterns over the years.
21. PWCSA has an established pipe cured in-place pipe lining and Infiltration and Inflow Reduction program to keep 1,150 miles of sanitary sewers operating at capacity.
22. PWCSA works with county businesses to prevent Fats, Oil and Grease from entering the sewer where it can cause blockage. The program conducts periodic inspections of business to maintain compliance and ensure routine maintenance of grease traps and interceptors.
23. PWCSA includes nutrient management plans in landscape contracts to reduce nutrient runoff.

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24. PWCSA is in the design phase of a large design-build project for facility-wide improvements at the H.L. Mooney Advanced Water Reclamation Facility to replace/renew/refurbish assets. The project includes a new headworks to increase peak flow capacity at the plant.
25. The County maintains a Mutual Aid Debris Removal Operations Plan and Prince William County Debris Management Plan. We maintain a contractor for debris management emergency response services. We also maintain primary and secondary Monitoring Debris Management Contractors.

Appendix E. List of Stakeholder Groups Involved in CESMP Development

Figure E.1 describes the composition and roles of the five primary stakeholder groups engaged throughout the plan development process. The County's Office of Sustainability, as a member of the County Government Core Team, led the development of the plan and facilitated the stakeholder engagement.



Figure E.1. Primary Stakeholders

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Figure E. 2 outlines the members of the County Government Core Team that participated in the development of the CESMP.



Figure E. 2. County Departments Involved in Developing the CESMP

The Joint Environmental Task Force

Communication between the County Government and the Prince William County School (PWCS) system was important throughout the CESMP development process. Because the PWCS system operates separately from our County government operations, PWCS operations are not considered under the County government's direct influence. Therefore, PWCS energy use and emissions are not included under our County government climate goals of 100% renewable energy by 2030 or carbon neutrality by 2050. However, as PWCS emissions are included in the county-wide goals of 50% GHG emissions reduction by 2030 and 100% renewable energy by 2035, they were still a critical partner to engage in CESMP development. PWCS representatives were invited to participate in the CESMP Workgroups. Notably, the Joint Environmental Task Force (JET) was developed to foster the relationship and increase communication channels to address climate change and environmental sustainability proactively and equitably. The creation of the JET was authorized on June 22, 2021, by the Board of County Supervisors and stood up in February 2023. The JET provides a forum for informing, advising, collaborating, and addressing county-wide issues and aligning institutional policies and practices pertaining to climate change and environmental sustainability through the equity lens being continuously applied by both the county and the PWCS. This task force will also recommend to the Board of County Supervisors and to the School Board funding priorities that are identified by the CESMP.

Workgroup Participants

1 Buildings and Decarbonization

- Building Trades- GPI Consulting Engineering
- Virginia Pace Authority
- Northern Virginia Electric Cooperative
- Prince William Service Authority
- Prince William Residential Solar Taskforce
- Prince William County Schools
- George Mason University VA Climate Center
- Northern Virginia Community College
- Data Center Coalition
- Citizen's Climate Lobby
- Prince William Commercial Development Committee
- Northern Virginia Building Industry Associations - Developer Rep
- Northern Virginia Building Industry Associations- Builder Rep

2 Transportation and Land Use

- Virginia Railway Express
- Potomac and Rappahannock Transportation Commission
- Lake Ridge Occoquan Coles Civic Association
- Woodbridge Potomac Communities Civic Association
- Mid County Civic Association of Prince William
- HOA Roundtable
- Prince William Conservation Alliance
- Active Transportation Groups - Biking
- Northern Virginia Regional Commission
- Trails and Blueways Council
- Metropolitan Washington Council of Governments
- Prince William County Schools Transportation
- Prince William Economic Development
- Northern Virginia Building Industry Associations

3 Climate Adaptation and Resiliency for Vulnerable Population

- Virginians Organized for Interfaith Community Engagement
- Student Representative
- Community Partners in Equity and Inclusion
- Senior Citizen Advocacy
- Veteran's Commission
- Chesapeake Climate Action Network
- Institute for Public Health
- Tenants and Workers United
- Prince William Department of Social Services Rep for Homeless Populations

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Figure E. 3. Complete List of Technical Workgroup Participants

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Appendix F. Greenhouse Gas Inventory and Analysis

Appendix F.1 Greenhouse Gas Inventory

Appendix F.2 Electric Grid Resource Mix

Appendix F.3 Greenhouse Gas Reduction Strategies

Appendix F.4 Method for Developing GHG Emission Reduction Strategies

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Appendix F.1 2018 Greenhouse Gas Inventory

MWCOG develops our GHG inventories every two to three years following guidance from the U.S. Community Protocol – an inventory reporting protocol to guide U.S. local governments in calculating and reporting their community’s GHG emissions.²² MWCOG previously developed the inventories for 2005, 2012, 2015, 2018, and 2020. As our goal is to reduce county-wide GHG emissions by 50% from a 2005 baseline by 2030, the 2005 inventory represents the GHG emissions baseline against which we measure our emissions reduction progress. Total emissions in 2005 were 4,190,056 MTCO₂e. In 2018, we generated approximately 5,044,135 MTCO₂e – a **20% increase** from 2005 levels. To progress toward the 50% reduction goal by 2030, 2018 county-wide emissions needed to show a 26% **decrease** below 2005 levels – which means emissions are not currently on track for goal achievement.

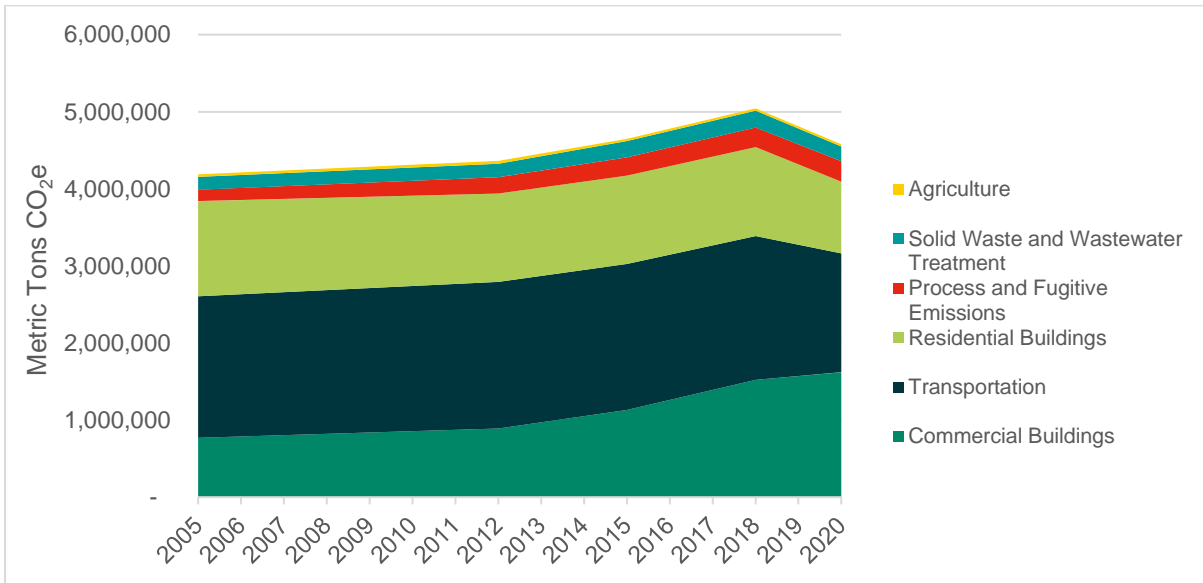


Figure F.1 Prince William County GHG Emissions 2005 – 2020

²² <https://www.mwcoq.org/documents/2022/12/09/greenhouse-gas-emissions-inventories-methodology-guide-climate--energy-greenhouse-gas/>

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Table F 1. 2018 County GHG Emissions Inventory

Emissions Type	Emissions Activity or Source	2018 Emissions (MTCO ₂ e)	% of Total Emissions
Residential Energy	Electricity	724,067	14%
	Natural Gas	412,703	8%
	Fuel Oil	9,889	<1%
	Liquefied Petroleum Gas	7,150	<1%
Commercial Energy	Electricity	1,359,354	27%
	Natural Gas	157,959	3%
	Fuel Oil	2,621	<1%
	Liquefied Petroleum Gas	1,246	<1%
Transportation and Mobile Emissions	On Road Transportation	1,636,658	32%
	Passenger Air Travel	62,539	1%
	Rail Transportation	2,598	<1%
	Off Road Mobile Sources	164,404	3%
Process and Fugitive Emissions	Hydrofluorocarbon & Refrigerant Emissions	238,364	5%
	Natural Gas Fugitive Emissions	16,625	<1%
Solid Waste Treatment	Landfill Waste	214,717	4.3%
Agriculture	Enteric Fermentation	13,397	<1%
	Manure Management	1,461	<1%
	Agricultural Soils	15,051	<1%
Wastewater Treatment	Septic System Emissions	1,502	<1%
	Sewer System Treatment Emissions	1,160	<1%
	Sewer System Effluent Discharge Emissions	668	<1%
TOTAL		5,044,135	

Appendix F.2 Electric Grid Resource Mix

The information below is from the EPA eGRID data for the SERC Virginia/Carolina subregion.²³

Generation Resource Mix (%)											
	Coal	Oil	Gas	Other Fossil	Nuclear	Hydro	Biomass	Wind	Solar	Geothermal	Other unknown/ purchased fuel
2018	19.1%	0.6%	34.6%	0.1%	37.8%	2.3%	2.8%	0.4%	2.2%	0.0%	0.1%
2021	13.4%	0.2%	38.1%	0.2%	38.8%	1.9%	2.3%	0.4%	4.7%	0.0%	0.1%

²³ <https://www.epa.gov/eGRID/historical-eGRID-data>

Appendix F.3 Greenhouse Gas Reduction Strategies

2030 Greenhouse Gas Reduction Strategy	Percent of 2030 GHG Reductions Needed to Meet Goal
92% clean electricity	57%
50% of passenger and medium-duty vehicles are ZEV	24%
40% of HVAC systems and water heaters are highly efficient and electric	8%
57% HFCs replaced with low- or zero-GWP alternatives	4%
5% reduction in passenger vehicle travel by reducing the amount of VMT or shifting to active or public transport	2%
60% waste diversion rate	2%
100% high-efficiency lighting and appliances	1%
15% zero emissions off-road equipment	1%
20% reduction in aviation emissions	<1%
10% reduction in agriculture emissions	<1%

Appendix F.4 Method for Developing GHG Emission Reduction Strategies

The first step in developing the GHG reduction scenarios was to evaluate how external regulatory, or market forces would impact emissions over time. Reductions from these forces are reflected in the blue hatched wedge at the top of the chart in [Figure 11](#). These external forces include:

- Virginia's Renewable Portfolio Standard (RPS), which requires electricity generation from 30% renewables by 2030 for Phase I utilities and 41% for Phase II utilities.
- Market forecasts for EV adoption, where approximately 17% of passenger vehicles are assumed to be EVs 2030.
- Reductions in hydrofluorocarbons use under the Kigali Amendment, where industrialized nations like the United States must reduce production and consumption of HFCs to about 15% of 2012 levels by 2036.
- Market forecasts for electric off-road construction equipment, which are assumed to be 10% electric by 2030.

These external factors result in roughly 32% of the emissions reductions needed to meet the 2030 goal. The impact of these external forces may be large, but local action is still necessary to meet the 2030 goal.

Emissions Impact of Other External Regulatory and Market Forces

The emission impact of certain external regulatory or market forces, such as impacts from the Inflation Reduction Act (IRA) or the Infrastructure Investment and Jobs Act (IIJA), were not integrated into our GHG reduction scenario but could help to further reduce local emissions, especially in the electricity, buildings, and transportation sectors.

Enacted in 2022, the IRA is a federal law which aims to curb inflation by investing into domestic energy production while promoting clean energy, among other actions. The IIJA is a federal law enacted in 2021 that directs spending toward transportation, electric, and other infrastructure improvements. Because the IRA and IIJA provide US-wide funding and financing opportunities and do not require a discrete number of emissions reductions or clean energy use, the emissions impact of these laws was not quantified in the emissions forecasts or included in the 2030 GHG reduction scenario. However, both the IRA and IIJA will likely help to reduce emissions in the county due to their promotion of clean energy, electric vehicles, and public transit. Studies have estimated the IRA will have minimal impact on transportation emissions by 2030 but could decrease emissions in the US power sector by roughly 50-60% by 2030 as compared to business-as-usual emissions.^{24,25} However, these studies do not specifically analyze how these reductions will interact with any state's RPS, which requires a certain percentage of renewable energy and will therefore also decrease power sector emissions. Another study found that the IIJA could increase or decrease transportation emissions +/- 1% in 2030 compared to a base case scenario depending on the direction of investment.²⁶ At the time of our 2030 GHG reduction scenario development, IRA and IIJA impacts were not integrated into the EV market forecast study that was used to forecast external impacts on our transportation emissions. In the future, IRA and IIJA impacts may be integrated into both EV forecasts and Virginia renewable energy forecasts and could be used in county emissions forecasting updates. This could help us better understand the overall impact of these laws on our future emissions and GHG reduction scenario.

Though the IRA and IIJA will most likely help spur clean energy integration into the regional electrical grid and improve transportation infrastructure, they will not be enough to guarantee that we achieve our 2030 GHG reduction goal or 2035 renewable energy goal. Therefore, including potential emissions reductions from the IRA, IIJA or other forces in the 2030 reduction scenario would not change the focus of actions presented in the CESMP. Because the CESMP is a living document, the emission impacts of new measures and regulations can be monitored and incorporated in future GHG forecasting updates.

²⁴ Ramseur, J. L. (2023). U.S. Greenhouse Gas Emissions Trends and Projections from the Inflation Reduction Act. Congressional Research Service. <https://crsreports.congress.gov/product/pdf/IN/IN12082>

²⁵ Sherlock, M. F. (2023). Tax Credits for "Clean Electricity"—Projected Effects on CO2 Emissions and the Generation Mix. Congressional Research Service. <https://crsreports.congress.gov/product/pdf/IN/IN12082>

²⁶ Georgetown Climate Center. (2021, 12 16). Georgetown Law. Retrieved from <https://www.georgetownclimate.org/articles/federal-infrastructure-investment-analysis.html>

Building upon these external regulatory and market forces, multiple 2030 GHG reduction scenarios were developed to demonstrate what it will take to achieve our 2030 GHG reduction goal. After reviewing these scenarios, we selected the preferred 2030 reduction scenario to show what it will take to reach the 2030 goal and guide climate action development.

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Appendix G. Vulnerability Assessment Report