PRIORITY CLIMATE ACTION PLAN

Washington-Arlington-Alexandria
DC-VA-MD-WV Metropolitan Statistical Area

Prepared for the U.S. EPA as a deliverable for the Climate Pollution Reduction Grants (CRPG) Program, section 60114(a) of the Inflation Reduction Act

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Metropolitan Washington
Council of Governments

DISCLAIMER

This project has been funded wholly or in part by the United States Environmental Protection Agency (EPA) under assistance agreement 5D - 95316301 – 0 to the Washington D.C. Department of Energy and Environment (DOEE). DOEE engaged the Metropolitan Washington Council of Governments (COG) through a subgrant (GAN-FY23-COG-189) to develop this Priority Climate Action Plan (PCAP). The contents of this document do not necessarily reflect the views and policies of the EPA, nor does the EPA endorse trade names or recommend the use of commercial products mentioned in this document.

COG is an independent, non-profit association that brings area leaders together to address major regional issues in the District of Columbia, suburban Maryland, and Northern Virginia. COG's membership is comprised of 300 elected officials from 24 local governments, the Maryland and Virginia state legislatures, and U.S. Congress.

The Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statistical Area (MSA) PCAP was developed to meet the requirements of the Climate Pollution Reduction Grants (CPRG) program, Inflation Reduction Act Section 60114(a). It does not replace or supersede the COG 2030 Climate and Energy Action Plan, rather it provides a set of priorities for the MSA that will enable governments and other stakeholders in the region to seek competitive implementation funding through the CPRG program, Inflation Reduction Act Section 60114(b).

CREDITS

COG staff responsible for CPRG program deliverables include:

- Jeffrey King, Director, Climate, Energy, and Air Programs
- Maia Davis, Senior Environmental Planner
- Alissa Boggs, Environmental Planner
- Kelsey Boatwright, Associate Researcher
- Robert Christopher, Environmental Planner
- Timothy Masters, Environmental Planner

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COG deeply appreciates the contributions of the CPRG Steering and Technical Committees, COG Committees and multiple stakeholders across the MSA.

Steering Committee Roster

- Brittany Whited, District of Columbia DOEE
- Allison Tjaden, Maryland Department of Environment (MDE)
- Virginia Burke, Maryland Department of Transportation (MDOT)
- Deron Lovaas, MDOT
- Thomas Ballou, Virginia Department of Environmental Quality (DEQ)
- Erin Belt, Virginia Department of Transportation (VDOT)
- Beth Groth, Charles County
- Kristin Mielcarek, Frederick County
- Sarah Kogel-Smucker, Montgomery County
- Erica Bannerman, Prince George's County
- Michelle Bailey Hedgepeth, Town of Bladensburg
- Mati Bazurto, City of Bowie
- Erik Valentine, City of College Park
- Jenny Willoughby, City of Frederick
- Anthony Berger, City of Gaithersburg
- Luisa Robles, City of Greenbelt
- Bill Eger, Arlington County
- Demetra McBride, Arlington County
- Lorien Lemmon, Clarke County
- Laura Loveday, Culpeper County
- Joe Kroboth, Loudoun County
- Giulia Manno, Prince William County
- Garrey Curry, Rappahannock County
- Bonnie Jewell, Rappahannock County
- Ryan Freed, City of Alexandria
- Andy Young, City of Falls Church
- Matthew Arcieri, City of Manassas
- Joseph Beach, Washington Suburban Sanitary Commission (WSSC) Water
- Cristi Bickham, WSSC Water

Technical Committee Roster

- Jenn Hatch, DOEE
- Vimal Amin, MDE
- Allison Tjaden, MDE
- Virginia Burke, MDOT
- Deron Lovaas, MDOT
- Thomas Ballou, DEQ
- Angela Conroy, DEQ
- Erin Belt, VDOT
- Kristin Mielcarek, Frederick County
- Lindsey Robinett Shaw, Montgomery County
- Erica Bannerman, Prince George's County
- Mati Bazurto, City of Bowie
- Michele Blair, City of Laurel
- Amanda Campbell, City of Rockville
- Dorothy Estrada, City of Takoma Park
- Drew Stilson, Arlington County
- Kate Daley, Fairfax County
- John Morrill, Fairfax County
- Marc Aveni, Loudoun County
- Samantha Heitsch, City of Alexandria
- Stefanie Kupka, City of Fairfax
- Andy Young, City of Falls Church
- Richard Moore, ConnectedDMV
- Chris Peot, DC Water
- Maureen Holman, DC Water
- Dale Medearis, PhD, Northern Virginia Regional Commission (NVRC)
- Kate Roetzer, Washington Metropolitan Area Transit Authority (WMATA)
- Fred Lees, WSSC Water
- Diane McGahagan, WSSC Water
- Robert Taylor, WSSC Water

COG would like to acknowledge the contributions of multiple COG and TPB committees, including:

- Air and Climate Public Advisory Committee (ACPAC)
- Built Environment and Energy Advisory Committee (BEEAC)
- Chief Equity Officers Committee (CEOC)
- Climate, Energy and Environment Policy Committee (CEEPC)
- Food and Agriculture Regional Member (FARM) Policy Committee
- Metropolitan Washington Air Quality Committee (MWAQC)
- MWAQC Technical Advisory Committee (MWAQC-TAC)
- Regional Electric Vehicle Deployment (REVD) Working Group
- TPB Community Advisory Committee (TPB-CAC)
- TPB Technical Committee (TPB-Tech)

Additional stakeholders who engaged with COG are listed in Appendix F.

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ACRONYMS LIST

ACPAC	Air and Climate Public Advisory Committee
ATV	All-terrain vehicles
BAU	Business-as-usual
BEEAC	Built Environment and Energy Advisory Committee
BEPS	Building energy performance standards
BIPOC	Black, Indigenous, and People of Color
BRIC	FEMA Building Resilient Infrastructure for Communities
CBO	Community-based organizations
CCA	Community choice aggregation
CCAP	Comprehensive Climate Action Plan
CECAP	Community-wide Energy and Climate Action Plan
CEEPC	Climate, Energy and Environment Policy Committee
CEOC	Chief Equity Officers Committee
CGA	Common Grain Alliance
CHP	Combined heat and power
CMAQ	Congestion Mitigation and Air Quality
COG	(Metropolitan Washington) Council of Governments
CPRG	Climate Pollution Reduction Grants
CSNA	Climate Solutions Now Act
DERA	Diesel Emissions Reduction Act
DEQ	Virginia Department of Environmental Quality
DOE	U.S. Department of Energy
DOEE	D.C. District Department of Energy and Environment
DPOR	Department of Professional and Occupational Regulation
EEA	Equity Emphasis Areas
EV	Electric vehicles
ESPC	Energy Savings Performance Contract
FACS	Faith Alliance for Climate Solutions
FARM	Food and Agriculture Regional Member
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GCoM	Global Covenant of Mayors
GGRA	Greenhouse Gas Reduction Act
GHG	Greenhouse gas
GWRCCC	Greater Washington Region Clean Cities Coalition
HUD	Housing and Urban Development
ILSR	Institute for Local Self-Reliance
IPCC	Intergovernmental Panel on Climate Change
IRA	Inflation Reduction Act
LIDAC	Low-Income, Disadvantaged Community
MCEC	Maryland Clean Energy Center
MDE	Maryland Department of the Environment

MEA	Maryland Energy Administration
MSA	Metropolitan Statistical Area
MWAA	Metropolitan Washington Airports Authority
MWAQC	Metropolitan Washington Air Quality Committee
NVRC	Northern Virginia Regional Commission
PACE	Property Assessed Clean Energy
PCAP	Priority Climate Action Plan
REC	Renewable energy certificate
REVD	Regional Electric Vehicle Deployment
RHE	Rockville Housing Enterprises
SELC	Southern Environmental Law Center
SEU	Sustainable Energy Utility
STBG	Surface Transportation Block Grant
TPB	Transportation Planning Board
VMT	Vehicle miles traveled
WMATA	Washington Metropolitan Area Transit Authority
WSSC	Washington Suburban Sanitary Commission
WRRF	Water Resource Recovery Facility
WVSWMB	West Virginia Solid Waste Management Board
ZEV	Zero-emission vehicle

EXECUTIVE SUMMARY

Air pollution and climate change pose significant threats to communities and ecosystems worldwide, including the Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statistical Area (MSA). The diverse communities in metropolitan Washington face health risks like respiratory and cardiovascular illnesses from exposure to air pollutants while climate change leads to additional risks like extreme heat, increased frequency and severity of extreme weather events, and flooding, which all pose additional risks to the safety and well-being of community members.

In light of these interconnected challenges, urgent and coordinated action by leaders is imperative to reduce air pollution and greenhouse gas (GHG) emissions to combat climate change and safeguard communities, particularly those most vulnerable to the impacts of climate change.

Gross GHG emissions for the MSA in 2020 were 61.4 million metric tons of carbon dioxide equivalent ($MMTCO_2e$). Net GHG emissions amounted to 54.2 $MMTCO_2e$ after accounting for the sequestration of GHG emissions attributed to the MSA's forests and green spaces.

In a business-as-usual (BAU) scenario, modeling results indicate that gross emissions are projected to increase by 38% between 2020-2050. Increased emissions are projected to be primarily from the buildings sector due to continued development and increased population growth.

Actions to improve air quality and reduce GHG emissions are underway, coordinated by the Metropolitan Washington Council of Governments (COG) staff and participating governments. COG, alongside Maryland, Virginia, Washington D.C., and many county and city governments within the MSA, have set ambitious goals to reduce GHG emissions. They have also created climate action plans and engaged with local residents and organizations to shape the future of climate resilience and mitigation in their jurisdictions.

The prospect of receiving funding from the Climate Pollution Reduction Grant (CPRG) to expand and accelerate these efforts would bring additional benefits to the MSA, including low-income, disadvantaged communities (LIDACs).

This Priority Climate Action Plan (PCAP) presents eight vital measures to reduce air pollution and GHG emissions in the MSA, summarized in Table 1. These measures were developed through a collaborative and iterative process with the many government offices and committees within the MSA and the states it crosses, as well as other stakeholders such as community-based organizations, private sector actors, utilities, planning boards and committees, and more. These are practical and achievable strategies spanning buildings and clean energy, transportation, waste, and land use sectors.

Table 1 represents cumulative GHG reductions or sequestration in the short term (2025 – 2030) and the long-term (2025 – 2050). In some instances, already existing modeling efforts from COG were used, and in other situations new modeling was conducted. The values presented in Table 1 are not additive as there may be areas of overlap between measures. This might result in double counting when comparing it to the clean and renewable energy measure, which also accounts for emissions reductions from cleaner electricity.

Table 1. Summary of PCAP Measures

Sector	Measure	Cumulative 2025-2030 GHG reductions ($MMTCO_2e$)	Cumulative 2025-2050 GHG reductions ($MMTCO_2e$)
Buildings and Clean Energy	Accelerate the deployment of energy efficiency solutions and decarbonization of residential, institutional, municipal, and commercial buildings.	5.00	66.67
Buildings and Clean Energy	Accelerate the deployment of clean and renewable energy.	2.66	11.24
Buildings and Clean Energy	Study, plan for, and deploy district energy and microgrid opportunities.	Varied based on system type, for a single generalized system ranges from 0.01 - 0.38	Varied based on system type, for a single generalized system ranges from 0.25 - 0.84
Transportation	Provide and promote new and expanded opportunities to reduce VMT through public transportation, non-motorized travel, micromobility, shared travel options, and development.	0.72	5.22
Transportation	Accelerate the deployment of low- and zero- emission transportation, fuels, and vehicles.	2.80	135.50
Transportation	Accelerate the deployment of off-road/non-road electric equipment.	3.40	17.74
Waste	Reduce GHG emissions from waste and wastewater treatment.	5.47	30.23
Land Use	Accelerate the expansion of the regional tree canopy and reduce tree canopy loss.	0.47	3.94

The GHG reduction measures described in the PCAP may provide more than just GHG emission reductions; they will result in additional co-benefits including improved air quality, quality job opportunities, cost savings, and enhanced community well-being across the MSA. From increasing energy efficiency in the buildings sector and developing clean energy generation to improving public transportation to planting more trees, the co-benefits these measures will provide to MSA communities, particularly to LIDACs, can be accelerated through additional funding and coordination action.

COG will develop a comprehensive CAP (CCAP) by 2025. In the meantime, COG will continue to meaningfully engage with stakeholders, including local governments, state governments, industry, community organizations, tribes, a matrix of stakeholders (e.g., Commissions, Committees, academic and research resources, CBOs, foundations and institutions), and the public to inform the development of the CCAP and in the implementation of climate actions, throughout the MSA.

1 INTRODUCTION

The Metropolitan Washington Council of Governments (COG) developed this Priority Climate Action Plan (PCAP) for the Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statistical Area (MSA) to meet the requirements of the U.S. Environmental Protection Agency's (EPA) Climate Pollution Reduction Grants (CPRG) program. The CPRG program provides funding to states, local governments, tribes, and territories to develop and implement plans for reducing greenhouse gas (GHG) emissions and other harmful air pollution.

The Washington, D.C. Department of Energy and Environment (DOEE) awarded COG a subgrant to lead the development of this PCAP and the other required CPRG planning deliverables for the MSA, including a Comprehensive Climate Action Plan (CCAP, due mid-2025) and a Status Report (due 2027) for the MSA.

1.1 CPRG Program Overview

The Inflation Reduction Act (IRA), signed into law on August 16, 2022, directs funds to lower healthcare costs, increase America's energy security, improve the tax code, create good-paying jobs here in America, and address the existential threat of climate change by funding climate solutions. The IRA contains provisions that directly or indirectly address climate change, including reduction of U.S. GHG emissions and promotion of adaptation and resilience to climate change impacts.[1]

The CPRG program, authorized under Section 60114 of IRA, provides $5 billion in grants to states, local governments, tribes, and territories to develop and implement plans for reducing GHG emissions and other harmful air pollution. The program consists of two phases: planning and implementation. The planning phase provides $250 million in noncompetitive planning grants for state and local agencies, tribes, and territories to develop a PCAP, CCAP, and Status Report. The second phase provides $4.6 billion in competitive grants for eligible applicants to implement GHG reduction measures identified in their applicable PCAP(s).

Definitions

GHGs: GHGs include the air pollutants carbon dioxide (CO_2), hydrofluorocarbons (HFCs), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

GHG Inventory: A list of emission sources and sinks and the associated emissions quantified using standard methods.

GHG Reduction Measure: Implementable actions that reduce GHG emissions or enhance carbon removal. Measures that enhance "carbon removal" are those that increase the removal of carbon dioxide from the atmosphere through, for example, the uptake of carbon and storage in soils, vegetation, and forests (i.e., sequestration).

Benefits: Direct changes in air pollution (e.g., $PM_{2.5}$) that result from a GHG reduction measure.

Co-Benefits: Positive effects beyond the stated goal of a GHG reduction measure (e.g., improved public health outcomes, economic benefits, increased climate resilience).

Low Income Disadvantaged Community (LIDAC): Communities with residents that have low incomes, limited access to resources, and disproportionate exposure to environmental or climate burdens.

1.2 PCAP Overview and Definitions

This PCAP identifies high priority, ready-to-implement GHG reduction measures that will provide significant GHG reductions and other benefits to the metropolitan Washington region. The PCAP

[1] CRS. "Inflation Reduction Act of 2022 (IRA): Provisions Related to Climate Change," October 3, 2022. https://crsreports.congress.gov/product/pdf/R/R47262.

measures were developed based on significant stakeholder engagement and input about potential concepts for which CPRG implementation funding may be sought. Table 2 outlines the information included in this PCAP.[2]

Table 2. Crosswalk of CPRG PCAP requirements to Metropolitan Washington Region PCAP Section

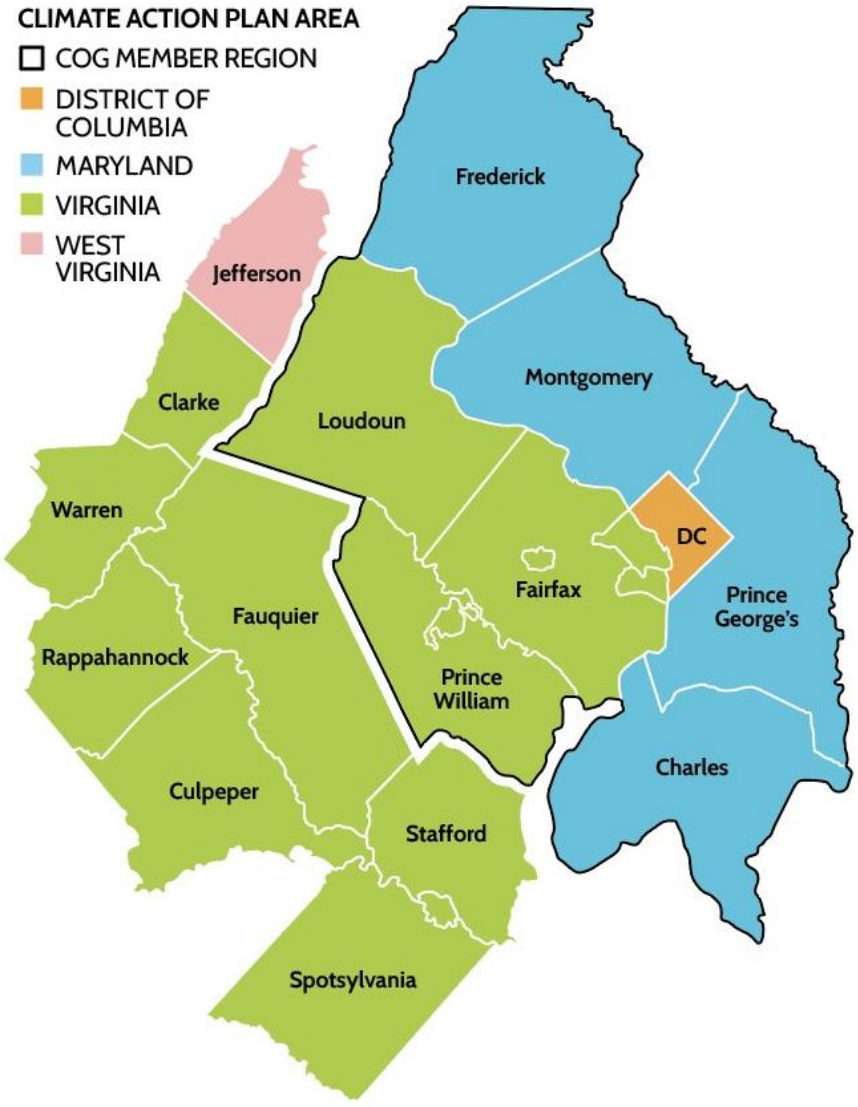
PCAP Required Elements	Metropolitan Washington Region PCAP Section
GHG Inventory	Section 2.1
Quantified GHG Reduction Measures	Section 4
Low-Income, Disadvantaged Community (LIDAC) Benefits Analysis	Sections 1.4 and 3, Section 4 within each measure
Review of Authority to Implement	Section 4 within each measure
PCAP Encouraged/Not Required Elements	
GHG Emissions Projections	Section 2.2
GHG Reduction Targets	Section 2.3
Benefits Analysis for Full Geographic Scope and Population	Will be assessed in the CCAP
Intersection with Other Funding Availability	Section 4 within each measure
Workforce Planning Analysis	Will be assessed in the CCAP

[2] US EPA. "Climate Pollution Reduction Grants Program: Formula Grants for Planning," March 1, 2023. https://www.epa.gov/system/files/documents/2023-02/EPA%20CPRG%20Planning%20Grants%20Program%20Guidance%20for%20States-Municipalities-Air%20Agencies%2003-01-2023.pdf

1.3 Scope of the PCAP

This PCAP covers the Washington-Arlington-Alexandria, DC-VA-MD-WV MSA, the geographic area outlined in Figure 1.[3] The MSA crosses three states (Maryland, Virginia, West Virginia) and the District of Columbia and extends beyond COG's usual geography. Each of these states has developed its own PCAP. COG and the local governments within the MSA are coordinating with state CPRG leads to align GHG reduction priorities.

Figure 1. Jurisdictions included in the Washington-Arlington-Alexandria, DC-VA-MD-WV MSA. Not listed but mapped jurisdictions include Arlington County (VA), City of Alexandria (VA), City of Fairfax (VA), City of Falls Church (VA), City of Fredericksburg (VA), City of Manassas (VA), and City of Manassas Park (VA).



[3] COG is comprised of 24 jurisdictions: The District of Columbia, Town of Bladensburg, City of Bowie, City of College Park, Charles County, City of Frederick, Frederick County, City of Gaithersburg, City of Greenbelt, City of Hyattsville, City of Laurel, Montgomery County, Prince George's County, City of Rockville, City of Takoma Park, City of Alexandria, Arlington County, City of Fairfax, Fairfax County, City of Falls Church, Loudoun County, City of Manassas, City of Manassas Park, and Prince William County. For more information, see https://www.mwcog.org/about-us/cog-and-our-region/local-governments/.

1.4 Approach to Developing the PCAP

1.4.1 GHG INVENTORY AND GHG REDUCTION TARGETS

COG regularly prepares a GHG inventory using the ICLEI (Local Governments for Sustainability) ClearPath tool.[4] COG leveraged and expanded its existing GHG inventory and projections to cover the entire MSA. COG used the existing 2020 GHG inventory for portions of the MSA that fall within COG's geographic scope. For counties and cities outside of this area, COG sought other data sources and approaches to prepare a 2020 GHG inventory for the MSA. Additional information on the GHG inventory may be found in Section 2.1 and Appendix A.

COG and many of the communities within the MSA already have established GHG reduction targets. These are described in Section 2.3 and Appendix B. During the CCAP development process, COG will work with jurisdictions across the MSA to establish an MSA-wide GHG reduction target(s).

1.4.2 PRIORITY GHG REDUCTION MEASURES AND THE PCAP

Many cities and counties within the MSA and the states that the MSA crosses have already engaged in significant climate planning efforts and action. Plans such as the *Metropolitan Washington 2030 Climate and Energy Action Plan,*[5] the *Tree Canopy Management Strategy,*[6] and climate and energy action plans from local governments across the region, and the 2022 TPB GHG Reductions Goals and Strategies Resolution (Resolution R18-2022), provided a solid foundation of planned and ongoing actions to reduce GHG emissions for the PCAP. Appendix B lists existing local, regional, and state plans.

To identify, prioritize, and analyze GHG reduction measures, COG used the process outlined in Figure 2. Stakeholder engagement activities were done continuously across all the steps discussed below.

Figure 2. COG's Process to Develop and Assess Priority GHG Reduction Measures

1. Collect priority project and program ideas. COG used multiple mechanisms to collect ideas for GHG reduction priorities across the MSA. COG reviewed existing plans and climate actions across the region. COG developed and distributed a project survey to CPRG Steering and Technical Committee members to complete or share with other stakeholders (see responses in Appendix D). A public survey was conducted via COG's CPRG website and other virtual channels to collect ideas on community climate priorities (see above and Appendix E).[7] Lastly, COG presented to and held discussions with many stakeholders on existing COG committees and with other external stakeholders.

[4] https://icleiusa.org/clearpath/
[5] https://www.mwcog.org/documents/2020/11/18/metropolitan-washington-2030-climate-and-energy-action-plan/
[6] https://www.mwcog.org/committees/regional-tree-canopy-workgroup/
[7] https://www.mwcog.org/environment/programs/climate-pollution-reduction-grants-cprg-program/

2. Compile ideas and develop GHG reduction measures. COG compiled existing plans and actions, along with responses to both the project and community climate priorities surveys. COG then reviewed these ideas to categorize them by relevant GHG inventory sector, identify themes, and group similar ideas to form broader GHG reduction measures. COG prepared an annotated draft list of measures. To be as inclusive as possible, COG did not explicitly cut any ideas from the initial draft measures list.

3. Prioritize GHG reduction measures. The annotated draft list of measures was shared with the CPRG Steering and Technical Committees and with other stakeholders for review through smaller discussions, webinars, and email. Specifically, COG asked for a review and feedback to identify any potential gaps reviewers saw in line with their priorities for funding, and to identify any potential measures to deprioritize. Using this feedback, COG finalized the list of GHG reduction measures presented in this PCAP.

4. Assess GHG reduction measures. As a next step, COG began to assess GHG reduction measures in line with PCAP requirements, such as quantified GHG reductions, authority to implement, LIDAC benefits, and other information (e.g., available funding, key implementors). COG sought input on many of these analysis elements in the initial project survey. Using the survey results, combined with other relevant information already in existing plans, and based on continued discussions with stakeholders and committees, COG assessed GHG reduction measures. Additional information on quantification of GHG reductions may be found in Appendix A.

5. Draft PCAP. COG drafted the PCAP using information from the previous steps and shared a version with the CPRG Steering and Technical Committees for review. A version of the draft PCAP was also posted publicly online to collect other stakeholder comments and feedback.

6. Finalize PCAP. COG reviewed comments and feedback on the PCAP, addressed many of these, filled in any remaining required information, and completed the PCAP.

1.4.3 IDENTIFYING AND ENGAGING STAKEHOLDERS

Throughout the process outlined above, COG engaged with stakeholders and community representatives throughout the MSA. Engagement consisted of meetings, communications, and coordination between COG, local, and regional climate change and community leaders to ensure that both regional perspectives and local needs are reflected in the plan. Committee members, stakeholders, and community representatives engaged during PCAP development can be found in Appendix F.

CPRG Committees

COG formed CPRG Steering and Technical Committees to advise on GHG emission reduction priority projects, programs, and measures. The committees are comprised of local and state government staff. Priority projects suggested by these groups informed the measures included in this PCAP.

Steering Committee meetings and Technical Committee meetings were held from November 2023 through February 2024, focused on PCAP development, implementation grant evaluation criteria and to discuss prioritizing projects, programs, and measures. The committees emphasized the best ways to collaborate among local governments and communities, and they will continue to advise on the CPRG program through 2027 when the program concludes.

Other COG Committees

In addition to the CPRG Steering and Technical Committees, COG holds regular meetings with local and regional committees representing climate and environmental concerns and with industries that significantly impact GHG emissions. The CPRG was a topic of discussion at recent and ongoing meetings of these committees.

Industry, Utilities, Other Government Partners, and Stakeholders

COG also conducted a succession of meetings, conversations, and emails with stakeholders to gather information, identify priorities, and make connections to inform the PCAP and implementation grant. Groups engaged include utilities, regional stakeholder groups, higher education institutions' sustainability directors, environmentally focused CBOs, and others.

LIDACs

LIDAC benefits and impacts are a primary consideration for selection of priority regional climate pollution reduction projects, programs, and measures. Recognizing that developing authentic and meaningful engagement with LIDACs relies upon dedicated outreach and time to develop relationships, COG targeted its PCAP LIDAC engagement efforts toward gathering and understanding existing priorities and issues identified through local initiatives, established engagement methods, and successful approaches. These efforts have laid the groundwork for deeper and sustained engagement during the development of the CCAP.

PCAP engagement included contributions representing LIDAC interests from both non-governmental organizations and government representatives. Community engagement webinars, individual engagement meetings, and a Community Climate Priorities survey (described below) were offered during the development of the PCAP.

In addition to the Community Climate Priorities survey, COG distributed a questionnaire to local governments, state governments, and COG committees, including the Chief Equity Officers Committee, to gather information about existing outreach activities with LIDAC representatives and organizations. The questionnaire focused on understanding recent and ongoing LIDAC engagement activities at the local level over the past two years and how such engagement informs climate action plans and priority projects, as well as community climate and energy goals. Additionally, the questionnaire sought input on the needs and priorities identified by LIDAC community members related to GHG reduction projects and activities connected to experienced impacts of climate change. This questionnaire is being used to inform future community engagement. COG continues to coordinate with its Chief Equity Officers Committee to provide input on engagement strategies for the CCAP.

Tribes

Tribal engagement is another distinct effort with a relationship building focus within COG's CPRG outreach efforts. COG aims to foster relationships with tribes and tribal communities, ensuring inclusivity throughout the CCAP development and, if awarded, CPRG implementation grant(s). During PCAP development, COG conducted tribal engagement with several tribal communities including the regional Accokeek Foundation and the Patawomeck Indian Tribe in Virginia. As of 2024, there are four state recognized tribes in the MSA including the Maryland Accohannock Indian Tribe, Maryland Piscataway Conoy Tribe, Maryland Piscataway Indian Nation, and the Virginia Patawomeck Indian Tribe. COG acknowledges that there are many indigenous people and communities living throughout the region and will work closely with tribal representatives and organizations to ensure inclusive and equitable contributions to the CCAP.

In meetings with tribal representatives from community and state tribes, several key themes emerged. Partnering on youth education was highlighted as a priority, recognizing the importance of passing down wisdom teachings and embracing the value of conservation for future generations. There was also a strong emphasis on healing the land from the impacts of urbanization and climate change, with a particular need for clean rivers and addressing invasive species. Energy and building retrofits were discussed as essential for environmental sustainability, with a desire to integrate traditional wisdom with modern technology. Concerns were raised about the potential impacts of data centers on the environment, emphasizing the need for careful planning and consideration of ecological restoration efforts. Discussions underscored the importance of a holistic approach, centering indigenous knowledge and values.

Community Members

To incorporate the perspective of community members across the MSA, COG disseminated the CPRG Community Climate Priorities survey to assess community-wide climate priorities. The survey was shared through multiple online channels, extending beyond formal committees to include distribution through social media, the COG CPRG and main COG websites, local representatives, and community-based/non-governmental organizations. The survey gained responses from 86 participants from 13 jurisdictions within the MSA, encompassing a diverse range of individuals, organizations, coalitions, and agencies. Participants were asked to prioritize strategies for mitigating climate change by ranking mitigation strategies. The eight strategies included in the PCAP were ranked by the community in the following order of importance:

1. Land Use
2. Energy Efficient and Clean Energy Buildings
3. Increasing Supply of On-site Clean Energy
4. Transit Options
5. Increasing Off-site Clean Energy
6. Transportation Technology
7. Waste Reduction, Composting, and Recycling
8. Carbon Removal and Sequestration

Participants were requested to reflect on specific equity priorities, barriers to action, and project ideas within the above eight strategies. Summary results are described in Appendix E.

1.4.4 CONTINUED ENGAGEMENT

During the PCAP development, COG strived for inclusivity and relationship building with sister agencies, jurisdictions throughout the MSA, tribes, industry partners, and CBOs representing LIDACs through stakeholder engagement sessions, surveys, and meetings. COG remains committed to broad public engagement during the CCAP development, with a focus on addressing environmental justice and equity concerns and supporting historically underrepresented and overburdened communities.

During development of the CCAP, a thorough Community Engagement Plan (CEP) will focus on diversity, equity, inclusion, and meaningful engagement of tribes and LIDACs in the MSA. Outreach to community stakeholders through ongoing and future engagements will include people and organizations that represent populations that have historically been marginalized, underserved, or left out of climate planning conversations. Through partnering with tribes, CBOs, and COG's

committee of Chief Equity Officers, a conduit for input and engagement across localities and sectors, particularly among underserved community members, is being established.

COG will work to ensure inclusive and equitable contributions to the CCAP and will focus on engagement that meets people where they are. COG aims to engage community members through various channels and will integrate survey responses, feedback from listening sessions, and insights from numerous meetings to further develop the CCAP Community Engagement Plan. Moreover, COG will actively seek input from a diverse audience throughout climate mitigation planning. For example, using insights from separate meetings with members of the Accokeek Foundation and the Patawomeck Indian Tribe, COG is coordinating with state partners experienced in working with state tribes and tribal communities to develop a comprehensive tribal outreach plan. By communicating closely with tribe representatives and organizations, COG will seek to understand initiatives underway and opportunities for future collaboration on projects, programs, and measures.

2 METROPOLITAN WASHINGTON'S CLIMATE CONTEXT

2.1 GHG Inventory

COG developed a GHG inventory of priority sources of GHG emissions within the MSA for the year 2020 (Table 3). A detailed methodology including data resources for the preparation of this inventory are contained in Appendix A. Gross GHG emissions for the MSA were 61.4 million metric tons of carbon dioxide equivalent ($MMTCO_2e$) in 2020. Net GHG emissions amounted to 54.2 $MMTCO_2e$ after accounting for the sequestration of GHG emissions attributed to the MSA's forests and trees.

Table 3. MSA GHG Emissions Inventory

Emissions Type	Emissions Activity or Source	Sub-Activity Source	2020 MSA Total Emissions ($MTCO_2e$)
BUILDINGS			**33,079,836**
Residential Energy	Emissions from Grid Electricity	Residential Electricity	6,887,936
	Emissions from Stationary Fuel	Residential Natural Gas	4,656,374
		Residential Fuel Oil	248,908
		Residential LPG	104,879
Commercial Energy	Emissions from Grid Electricity	Commercial Electricity	13,491,249
	Emissions from Stationary Fuel Combustion	Commercial Natural Gas	3,968,236
		Commercial Fuel Oil	62,663
		Commercial LPG	30,194
Process and Fugitive Emissions	Fugitive Emissions from Natural Gas Distribution	Natural Gas Fugitive Emissions	251,260
	Other Process and Fugitive	Hydrofluorocarbon (HFCs)	3,378,137
TRANSPORTATION			**23,994,733**
	On-Road Transportation (National Emissions Inventory [NEI])	On-Road Mobile Emissions	19,946,011

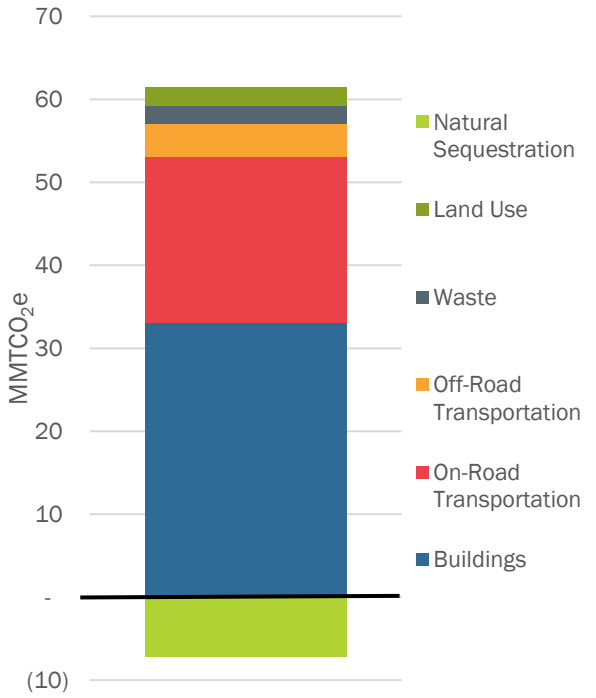
Emissions Type	Emissions Activity or Source	Sub-Activity Source	2020 MSA Total Emissions ($MTCO_2e$)
Transportation and Mobile Emissions	Emissions from Off-Road Vehicles (NEI)	Off-Road Mobile Emissions	2,194,931
	Aviation Travel	Passenger Air Travel	1,814,955
	Rail Transportation	Rail Transportation	38,836
WASTE			**2,090,407**
Solid Waste	Waste Generation	Landfill Waste Generation	1,390,042
	Combustion of Solid Waste Generated by the Community	Combustion of Solid Waste	618,679
Water and Wastewater	Fugitive Emissions from Septic Systems	Septic System Emissions	60,427
	Nitrification/Denitrification Process N_2O Emissions from Wastewater Treatment	Sewer System Emissions	14,873
	Process N_2O from Effluent Discharge to Rivers and Estuaries	N_2O Effluent Discharge Emissions	6,386
LAND USE			**(4,921,268)**
Agriculture	Emissions from Agricultural Activities	Enteric Fermentation	493,279
		Manure Management	139,287
		Ag Soils	539,978
Forests and Trees Outside of Forests	Average Annual Emissions	Forests Converted to Non-Forests	500,205
		Disturbances in Forests Remaining Forests	253,207
		Loss of Trees Outside Forests	307,305
	Average Annual Sequestration	Forests Remaining Forests	(5,018,124)
		Non-Forests Converted to Forests	(104,368)
		Trees Outside Forests	(2,032,037)
GROSS GHG EMISSIONS (ALL SECTORS)			**61,398,238***
NET GHG EMISSIONS (ALL SECTORS)			**54,243,709***

* Totals may differ due to rounding.

The GHG inventory represents GHG-emitting activities undertaken by residents, businesses, industry, visitors, and government located in the MSA. Approximately 54% of the MSA's gross GHG emissions come from residential and commercial building energy consumption and 39% from transportation (32% is on-road). The remainder of GHG emissions comes from other activities including solid waste, wastewater treatment, agriculture, and fugitive emissions (Figure 3).

Note that 2020 represents an atypical year of GHG emission levels due to the impacts of the COVID-19 pandemic. In many places, as in the metropolitan Washington region, this led to reduced GHG emissions from on-road transportation and changes in patterns in building energy use, along with other anomalies that may not be prevalent in future year inventories.

Figure 3. 2020 MSA GHG Emissions by Activity



2.1.1 GHG INVENTORY METHODOLOGY

The MSA inventory and previous COG inventories have been developed to be compliant with the U.S. Communities Protocol for Accounting and Reporting Greenhouse Gas Emissions (USCP), Global Protocol for Community Scale Greenhouse Gas Inventories (GPC), and Global Covenant of Mayors (GCoM) reporting framework. COG mainly follows the calculation guidance from USCP as the USCP identifies sources of data widely available to communities in the US. COG uses ICLEI's ClearPath tool Community Scale Inventory Module for preparing GHG inventories, which is consistent with both US and global accounting protocols.

COG made every effort to capture a complete and accurate picture of GHG trends across the MSA, while also providing for a consistent methodology that is replicable across communities and inventory years. The GHG inventories follow an activities-based approach, meaning emissions are calculated based on the result of activities happening in the local communities. Local results are totaled to create a picture for the region. See Appendix A for the full methodology.

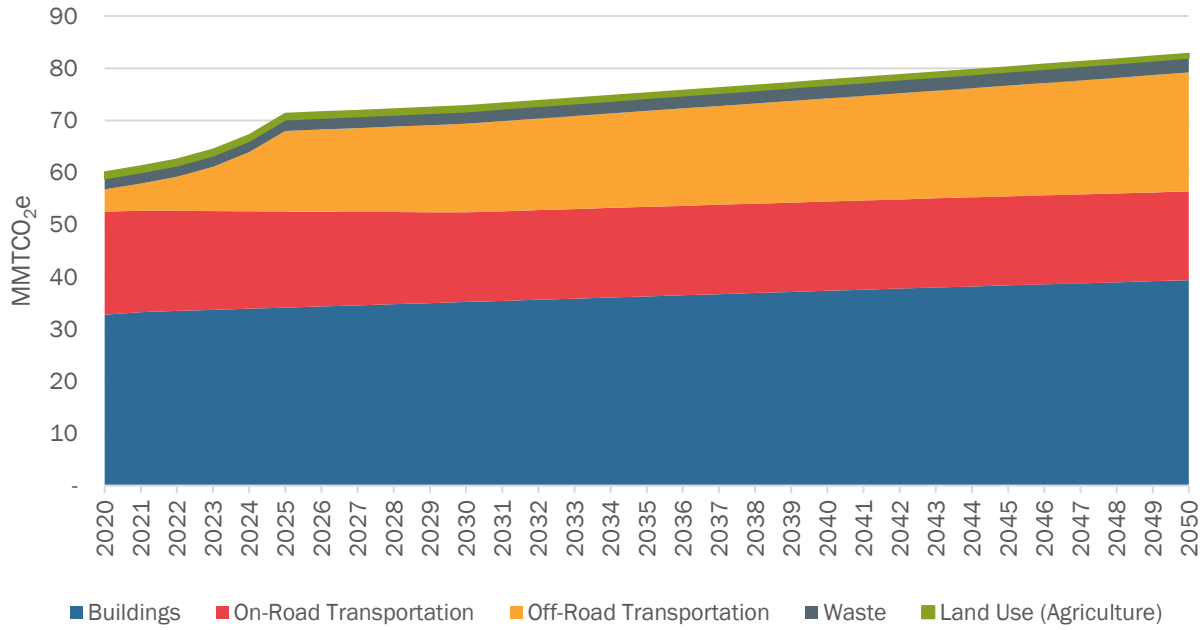
2.2 Business-As-Usual Projections

Business-as-usual (BAU) projections provide a baseline scenario for future GHG emissions. BAU projections account for driving factors such as growth in population, housing and commercial development, and transportation patterns, and estimate the impact they will have on future GHG emissions. BAU projections reflect policies and practices that are currently in place and implemented to-date to reduce GHG emissions, but do not incorporate any additional GHG emission reductions from anticipated future action.

The MSA BAU scenario for this PCAP projected gross GHG emissions out to 2050. Based on the assumptions used, gross emissions increased by 38% between 2020-2050 (not including Land Use - Forests and Trees Outside of Forests).

Figure 4 shows the region's projected BAU emissions to 2050.

Figure 4. MSA Business-As-Usual Projections



See Appendix A for a summary of BAU assumptions. Significant increases were seen in the buildings sector (31% and 10% for residential and commercial energy, respectively) because of continued development and increased population growth. Similarly, population growth is driving waste sector emissions. A decline in GHG emissions from on-road transportation (14%) is seen as a result of continued trends in alternative and electric vehicles, increased efficiency, and other related policies and programs.

2.3 GHG Reduction Targets

The COG Board previously established specific GHG emission reduction goals of 10% below BAU projections by 2012 (bringing regional emission back down to 2005 levels), 20% by 2020 and 80% by 2050 (below the 2005 baseline). In 2019, COG became a Signatory to GCoM. Based on review of the GCoM framework of global best practices for climate planning, updated Intergovernmental Panel on Climate Change (IPCC) recommendations, and a recommendation from the COG CEEPC, the Board approved new 2030 climate goals including:

- The climate mitigation goal of 50% GHG emission reductions below 2005 levels by 2030.
- The climate resilience goal of becoming a Climate Ready Region and making significant progress toward becoming a Climate Resilient Region by 2030.

To be climate ready by 2030, all local governments must assess current and future climate risks, and be actively integrating climate planning across government plans, operations, and communications. To fully be a Climate Resilient Region, the region must have the ability to adapt to

disturbances caused by current and future, acute and chronic climate impacts and successfully maintain essential functions.

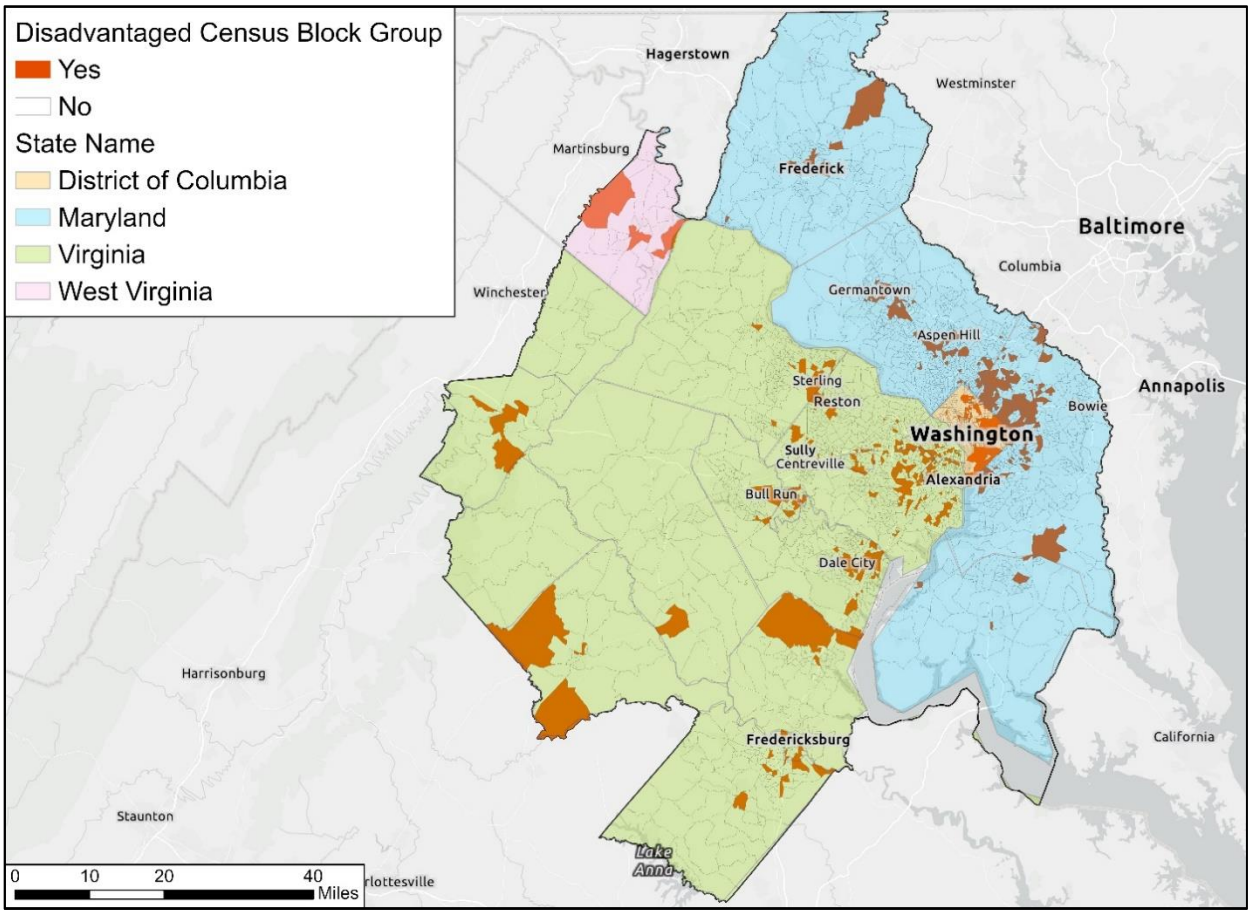
Along with the COG goals, local governments across the MSA and the states the MSA crosses have established goals. Appendix B lists existing local, regional, and state climate and energy goals and plans. During the CCAP development, COG will work with MSA jurisdictions and regional partners to establish an MSA-wide GHG reduction goal(s).

3 METROPOLITAN WASHINGTON LIDACS

3.1 Metropolitan Washington's LIDACs

To identify communities meeting the CPRG LIDAC definition, COG used EPA's Environmental Justice Screening and Mapping Tool (EJScreen) and supplementary data. EJScreen is a tool that uses demographic, social, and environmental datasets to assess the risks and burdens that different communities face. Communities identified as disadvantaged under the EJScreen tool for the MSA include any Census block group at or above the 90th percentile for any of EJScreen's Supplemental Indexes when compared to the nation. COG used EJScreen to visualize and identify Census block groups that EPA designates as disadvantaged in the state (see Figure 5).

Figure 5. LIDACs in the Metropolitan Washington Region as Identified Using EJScreen



In the metropolitan Washington region, 25% of the population is disadvantaged. The percentage of disadvantaged population varies across different states: 47% of the population in D.C., 28% in West Virginia, 23% in Maryland, and 21% in Virginia. A full list of the Census Block IDs that are identified as LIDACs in the MSA is included in Appendix C.

The metropolitan Washington region comprises diverse cities and counties with varying demographics such as education levels, income, and unemployment.

- Education levels vary across the MSA, with 4% of the overall population lacking a high school diploma. However, in LIDACs, this percentage is double the average at 8%.[8]
- Economic diversity is evident in the region's median household incomes. The average median household income across the MSA counties is approximately $125,000. However, within LIDACs, the median household income for the MSA is about 30% less on average at approximately $85,000. Warren County (VA), the City of Fredericksburg (VA), and Jefferson County (WV) reported the lowest household median incomes at $85,096, $89,612, and $94,897, respectively.[9]
- Overall, the unemployment rate in the MSA is 5%, although unemployment rates vary across the region. The District of Columbia experiences the highest overall unemployment rate in the region at 5%; this rises to 10% in LIDAC communities within the District. Maryland experiences the lowest unemployment rate, at about 5% (7% in Prince George's County, 5% in Montgomery County, and 4% in Frederick County). In Virginia, unemployment is 4% (3% in Loudoun County, 5% in Prince William County, 4% in Fairfax County, and 3% in Arlington County). The unemployment rate in Jefferson County, WV is 5%.[10]

The area that is comprised of the largest cluster of connected LIDACs is in Prince George's County (MD). According to the U.S. Census data, Prince George's County is 64.1% Black, 27.0% White, and 4.4% Asian, and 20.9% Hispanic. The racial makeup of the County shows the intersectionality of socio-economic disparities and race, emphasizing the need for targeted and equitable interventions to address systemic inequalities. Prince George's County also reported the highest number of persons who have not attained a high school diploma with 13,997 persons, followed by Montgomery County (MD) with 12,957 persons, and Fairfax County (VA) with 11,256 persons. A similar pattern exists for English proficiency—Prince George's County (16,842 persons), followed by Montgomery County (9,886 persons) and Fairfax County (8,835 persons) reported the highest number of persons experiencing limited English proficiency.[11]

Additionally, as a part of its regular planning and programming, COG's Transportation Planning Board (TPB) developed Equity Emphasis Areas (EEAs)[12] throughout the COG region to elevate equity and inform future growth and investment decisions (see Figure 6 for EEAs). Analysis of the EEAs show significant overlap with LIDACs.[13]

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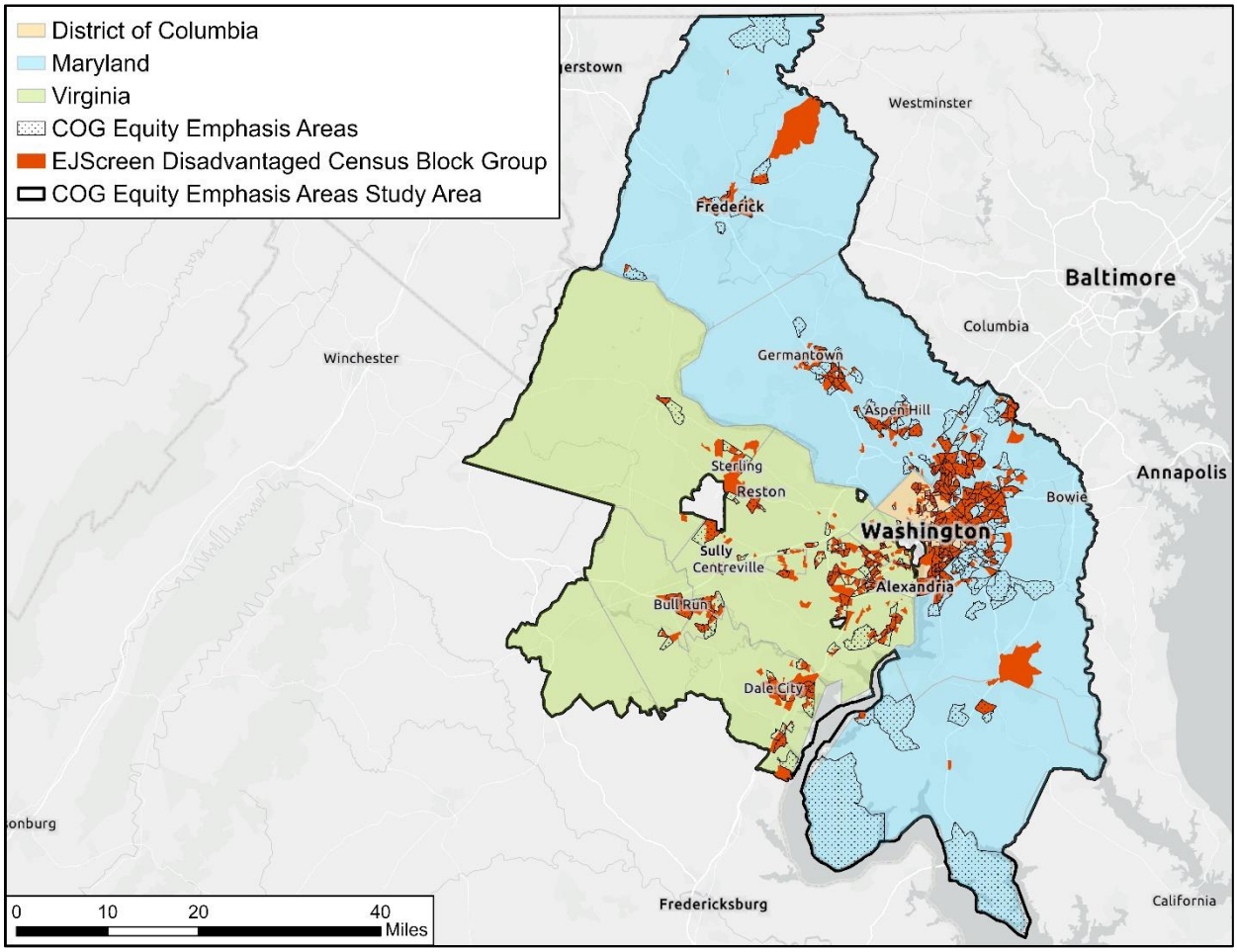
[8] Census Bureau. American Community Survey. 2022. https://www.census.gov/data/developers/data-sets/acs-5year.html
[9] Census Bureau. American Community Survey. 2022. https://www.census.gov/data/developers/data-sets/acs-5year.html
[10] Census Bureau. American Community Survey. 2022. https://www.census.gov/data/developers/data-sets/acs-5year.html
[11] https://www.census.gov/quickfacts/fact/table/princegeorgescountymaryland/PST045223
[12] For more information, see https://www.mwcog.org/newsroom/2021/09/24/equity-emphasis-areas-a-tool-to-prioritize-and-invest-in-communities--equity/.
[13] EEAs have high concentrations of low-income individuals and/or traditionally disadvantaged racial and ethnic population groups. For more information, see here: https://www.mwcog.org/transportation/planning-areas/fairness-and-accessibility/environmental-justice/equity-emphasis-areas.

Figure 6. Overlay of COG EEAs and MSA LIDACs Identified with EJScreen



Recognizing the disparities highlighted in the demographic information across the MSA, particularly within LIDACs and EEAs, COG emphasizes the importance of targeting climate investments in LIDAC (and EEA) community priorities. While the range of low-income, unemployed, low educational attainment, and limited English proficiency varies throughout the region, there are opportunities to positively impact many LIDACs through concentrated and focused efforts in the areas of workforce development, training, and an overall focus of green job creation and sustainable yet affordable housing. COG's LIDAC analysis provides valuable insight to support the implementation of outreach programs to meaningfully engage LIDACs using languages spoken at home, diverse imagery, plain language, and other tools that meet the needs of historically underserved populations.

Consideration of LIDACs is a priority focus for COG when selecting climate pollution reduction projects, programs, and measures. Organizations representing LIDACs and local representatives who frequently work with LIDACs were engaged in the creation of this PCAP. A summary of the engagement efforts conducted with LIDACs is presented in Section 1.4. Furthermore, COG plans to conduct direct and comprehensive engagement with LIDACs throughout the development of the CCAP.

3.2 Climate Impacts and Risks to Metropolitan Washington's LIDACs

Social systems amplify negative impacts from climate risks on Black, Indigenous, and People of Color (BIPOC) individuals and communities, income-eligible households, unhoused individuals, rural communities, and outdoor and agricultural workers.[14] Not only do these communities experience the most severe impacts of climate change, but they are also the least able to prepare for and respond to these impacts due to a lack of resources and socio-political power. According to a 2021 EPA analysis, racial and ethnic minorities are particularly vulnerable to climate change impacts, especially Black and African American individuals.[15]

Minority and low-income communities are more likely to suffer the consequences of climate change due to heightened exposure to climate risks and inaccessibility to resources, such as adequate infrastructure and insurance coverage. Many factors contribute to this inequality, including historical discriminatory practices in housing, education, and employment. Pre-existing health status and living conditions are two key components of climate vulnerability, which are often determined by economic power, social policies, political influence, and structural racism.[16]

Within the Washington MSA, the most prevalent climate risks are extreme heat, extreme precipitation events, sea level rise, and storm surge. These climate risks were evaluated as part of *Climate Ready DC: the District of Columbia's 2016 Plan to Adapt to a Changing Climate* (which applies specifically to D.C.), the Metropolitan Washington *2030 Climate and Energy Action Plan* published in 2020, and other local climate plans. Further, COG and TPB's evaluation of climate risks to the EEAs determined that communities within EEAs are particularly vulnerable to climate risks, including extreme heat, extreme weather and flooding, and sea level rise.

In D.C, average annual temperatures have risen 2°F over the last 50 years and are projected to continue rising in the future. Historically, the average summer high was 87°F. By 2080, this number is projected to increase to 93°F (in a low emissions scenario) or 97°F (in a high emissions scenario). In addition to rising average temperatures, climate change is leading to more intense and frequent heat waves. In 2012, a record-breaking heatwave hit the region and temperatures exceeded 95°F for 11 days. Currently, D.C. experiences 30 "dangerously hot days" (days exceeding 95°F) a year; by 2080, projections indicate that there will be 40-75 of these days. The number of extreme heat days and heat waves is projected to increase across the whole MSA as well; the number of days per year with temperatures above 95°F could reach around 40 days by 2080 under a low emissions scenario, and around 60 days by 2080 under a high emissions scenario.[17]

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[14] Marino, E.K., K. Maxwell, E. Eisenhauer, A. Zycherman, C. Callison, E. Fussell, M.D. Hendricks, F.H. Jacobs, A. Jerolleman, A.K. Jorgenson, E.M. Markowitz, S.T. Marquart-Pyatt, M. Schutten, R.L. Shwom, and K. Whyte, 2023: Ch. 20. Social systems and justice. In: Fifth National Climate Assessment. Crimmins, A.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. U.S. Global Change Research Program, Washington, DC, USA. https://doi.org/10.7930/NCA5.2023.CH20

[15] EPA. 2021. Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. U.S. Environmental Protection Agency, EPA 430-R-21-003. www.epa.gov/cira/social-vulnerability-report

[16] Patnaik, A., Son, J., Feng, A., Ade, C., 2020. Racial Disparities and Climate Change. Princeton Climate Action. https://psci.princeton.edu/tips/2020/8/15/racial-disparities-and-climate-change

[17] A high emissions scenario refers to a Shared Socio-economic Pathway (SSP) that represents the upper boundary of radiative forcing (for example, SSP5-8.5 represents a pathway with an additional radiative forcing of 8.5 W/m^2 by 2100). Under a high emissions scenario, there is intensified exploitation of fossil fuel resources and a more energy-intensive global lifestyle (Böttinger, M. and Kasang, D. The SSP Scenarios. Deutsches Klimarechenzentrum. https://www.dkrz.de/en/communication/climate-simulations/cmip6-en/the-ssp-

The median number of extreme heat days a year in the MSA is 8.61 days; the median in LIDACs is 8.75 days, demonstrating disparities between communities. Urban heat island effects will put populations residing in urban areas at even greater risk of the health effects of extreme heat. Montgomery County mapped urban heat islands across the county to determine the communities that will be most affected.[18] More frequent and severe droughts will also impact the Potomac River and put vulnerable populations in danger due to agricultural and water system disruptions. Rising temperatures may also increase the occurrence of harmful algal blooms in freshwater and marine ecosystems in the MSA, including in the Potomac River.

Although annual amounts of precipitation have not changed significantly, seasonal precipitation rates have changed; fall and winter rates have increased while summer rates have decreased. Additionally, the frequency and intensity of extreme precipitation events is increasing. Today's 1-in-100-year precipitation event could become a 1-in15-year event by late-century for the MSA.

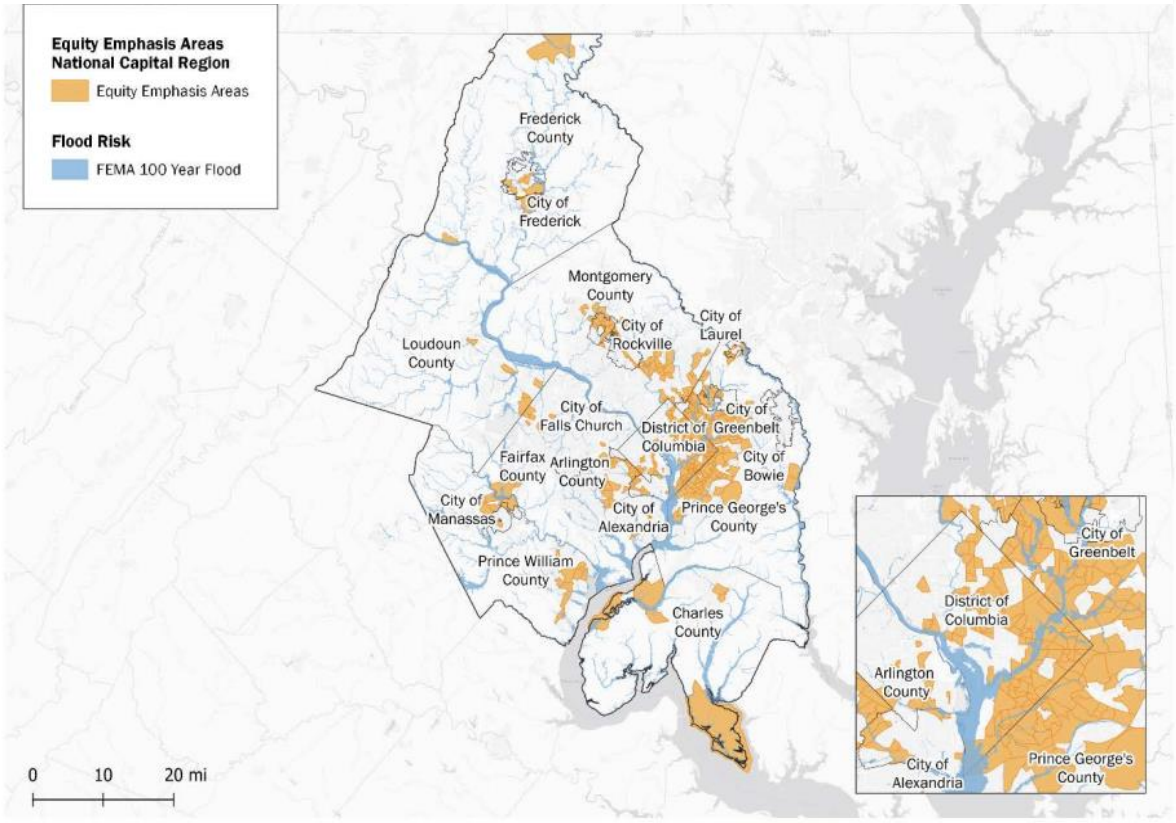
Sea level rise is a problem for low-lying areas in the MSA, particularly in LIDACs. Water levels for the Potomac and Anacostia Rivers (which are both tidal and border LIDACs) have risen 11 inches in the past 90 years. This has resulted in a 300% increase in nuisance flooding along the riverfront. By 2080, there could be up to 3 feet and 5 inches of additional sea level rise. Coastal storms such as hurricanes also create flooding events, and climate model projections indicate that hurricanes will become more intense in the future. The threat of stronger hurricanes combined with rising sea levels puts the region at very high risk of flooding.

EEAs will be more impacted by inland and coastal flooding as well. About 60% of EEAs lie in FEMA 100-year floodplains (about 1 million people total) (see Figure 7), and more than 10% of EEAs will be impacted by a 6-foot sea level rise.

scenarios#:~:text=SSP585%3A%20With%20an%20additional%20radiative%20forcing%20of%208.5,CMIP5%20scenario%20RCP8.5%2C%20now%20combined%20with%20socioeconomic%20reasons.)

[18] https://storymaps.arcgis.com/stories/389babe7ce654fdd87701488ae72e8b6

Figure 7. Equity Emphasis Areas and Inland Flooding Zones for the COG region (orange areas indicate EEAs and blue areas indicate FEMA 100-year floodplains).



Source: FEMA and COG Equity Emphasis Areas

3.3 Benefits and Co-Benefits of GHG Reduction Measures to Metropolitan Washington's LIDACs

Reducing GHG emissions presents a large opportunity to advance equity, environmental justice, health, and economic outcomes in LIDACs. Through strategic interventions in sectors such as buildings, clean energy, transportation, land use, and waste management, communities can experience tangible benefits, including improved air quality, enhanced energy efficiency, increased resilience, and increased access to affordable housing and transportation. Notably, within the eight priority GHG reduction measures, there are significant opportunities to reduce household costs, improve quality of life through better air quality, enhanced green spaces, transit accessibility, and reduced health risks.

Substantial opportunity also exists to enhance the clean energy workforce through tailored trainings, internships, and job placements by both leveraging existing programs and developing new ones. By prioritizing outreach, education, and workforce development initiatives tailored to the needs of LIDACs, climate action programs can effectively mitigate emissions while promoting social equity and building more sustainable and resilient communities.

Additional information on the benefits of each GHG reduction measure for LIDACs in the MSA are presented as a part of each measure below in Section 4.

3.4 Equity, Environmental Justice, and LIDAC Priorities

Through the engagement efforts described in Section 1.4, notable emphasis was placed on equity and environmental justice, particularly concerning the needs of LIDACs. Concerns included air and water quality, greenspace availability, the overall quality of life, and the importance of ensuring that climate initiatives benefit people who have historically faced disproportionate environmental burdens.

Community engagement and empowerment emerged as significant aspects of equity impacts. Responses highlighted the community's call for public support, ensuring investment returns to communities, and involving communities in decision-making during project planning. Priorities also include a focus on addressing food security, creating employment opportunities, and supporting local environmental initiatives in historically underserved neighborhoods.

When asked what emissions reduction projects would have the most positive impact on LIDACs and historically underrepresented communities, responses outlined initiatives and supported priority GHG reduction measures that align with and can be tailored to the unique needs of LIDAC communities. Specifically, communities that include people who use English as a second language, people impacted by environmental impacts on food security, communities overburdened by climate change, air quality, and transportation GHG emissions and pollution, and communities impacted by waste infrastructure such as landfills, incineration sites and trash/recycling collection facilities.

Representatives encouraged the creation or enhancement of programs for climate-related workforce development, increasing access to electric vehicles (EVs), charging infrastructure, and public transit, decreasing vehicle miles traveled (VMT), and clean, efficient, and renewable energy such as solar and weatherization programs. Identified key strategies include:

- Promoting non-car travel, featuring expanded bike lanes, improved bus availability, and pedestrianized streets aimed at enhancing safety and accessibility;
- Locating affordable housing near transit, with an emphasis on the importance of funding for such initiatives;
- Implementing energy efficiency and electrification projects in multifamily and commercial buildings as a crucial step toward reducing energy consumption and emissions;
- Supporting local agricultural and food security initiatives such as community composting and neighborhood farming; and
- Accelerating reuse and repair initiatives, emphasizing waste reduction and promoting local employment.

4 PRIORITY GHG REDUCTION MEASURES

Eight high priority GHG reduction measures were identified for this PCAP, as presented in Table 4. These measures were developed through a collaborative and iterative process with the many government offices and committees within the MSA and the states it crosses, as well as other stakeholders like community-based organizations, private sector actors, utilities, planning boards and committees, and more. These are practical and achievable strategies spanning buildings and clean energy, transportation, waste, and land use sectors.

Table 4. Summary of PCAP Measures

Sector	Measure	2025-2030 GHG reductions ($MMTCO_2e$)	2025-2050 GHG reductions ($MMTCO_2e$)
Buildings and Clean Energy	Accelerate the deployment of energy efficiency solutions and decarbonization of residential, institutional, municipal, and commercial buildings.	5.00	66.67
Buildings and Clean Energy	Accelerate the deployment of clean and renewable energy.	2.66	11.24
Buildings and Clean Energy	Study, plan for, and deploy district energy and microgrid opportunities.	Varied based on system type, for a single generalized system ranges from 0.01 - 0.38	Varied based on system type, for a single generalized system ranges from 0.25 - 0.84
Transportation	Provide and promote new and expanded opportunities to reduce VMT through public transportation, non-motorized travel, micromobility, shared travel options, and development.	0.72	5.22
Transportation	Accelerate the deployment of low- and zero-emission transportation, fuels, and vehicles.	2.80	135.50
Transportation	Accelerate the deployment of off-road/non-road electric equipment.	3.40	17.74
Waste	Reduce GHG emissions from waste and wastewater treatment.	5.47	30.23
Land Use	Accelerate the expansion of the regional tree canopy and reduce tree canopy loss.	0.47	3.94

The GHG reduction measures described in the PCAP may provide more than just GHG emission reductions; they will result in additional co-benefits including improved air quality, quality job opportunities, cost savings, and enhanced community well-being across the MSA. From increasing energy efficiency in the buildings sector and developing clean energy generation to improving public transportation to planting more trees, the co-benefits these measures will provide to MSA communities, particularly to LIDACs, can be accelerated through additional funding and coordination action.

Implementing these measures will depend on available funding, other resources (e.g., staff time), evolving and diverse policy and regulatory landscapes across multiple states, supply chain availability, among other factors. However, COG has outlined a general timeline for PCAP implementation, milestones, and next steps below in Table 5.

Table 5. PCAP Proposed Timeline and Next Planning and Implementation Steps

Milestone	Timeframe
2024	
Deliver final PCAP to EPA	March 1, 2024
Submit CPRG implementation grant	April 1, 2024
Continued engagement, planning, and analysis for the CCAP	May 2024 – December 2024
Expand, accelerate, and develop pilots and programs with CPRG funding, pending award decisions	Late 2024
Continued regional climate action, funding applications, and building on ongoing activities, and aligning/emphasizing PCAP measures	Throughout 2024
2025 - 2026	
Continued engagement, planning, and analysis for the CCAP	Early 2025
Deliver final CCAP to EPA	Mid-2025
Establish approaches for ongoing metrics tracking and track metrics	Late 2025 and on
Continued regional climate action, funding applications, and building on ongoing activities, and aligning/emphasizing PCAP and CCAP measures	Throughout 2025 and 2026
Expand, accelerate, and develop pilots and programs with CPRG funding, pending award decisions	Throughout 2025 and 2026
2027	
Deliver Status Report to EPA	Mid-2027
Continue to implement measures and reduce GHGs at the county and municipal level; Track progress across the MSA	2027 onward

4.1 Buildings and Clean Energy

ACCELERATE THE DEPLOYMENT OF ENERGY EFFICIENCY SOLUTIONS AND DECARBONIZATION OF RESIDENTIAL, INSTITUTIONAL, MUNICIPAL, AND COMMERCIAL BUILDINGS.

Decarbonizing buildings through energy efficiency, fuel switching, adaptive reuse, and other actions are a high priority for the MSA. Building energy consumption accounted for approximately 50% of GHG emissions in the metropolitan Washington region in 2020. This measure focuses on increasing opportunities for owners and users of all building types to access and install technologies to decrease overall energy consumption, increase energy efficiency, and reduce GHG emissions from the built environment. It covers both market rate and low/moderate income customers and private and public buildings.

QUANTIFIED GHG REDUCTIONS AND RELEVANT GHG INVENTORY SECTOR(S)

This measure will reduce GHG emissions in the buildings inventory sector. Cumulative estimated GHG emissions reduction potential for this measure are:

GHG reductions ($MMTCO_2e$), 2025-2030	GHG reductions ($MMTCO_2e$), 2025-2050
5.00	66.67

Key assumptions, methods and data sources used to develop these quantified reduction estimates are provided in Appendix A.

KEY IMPLEMENTING AGENCIES AND PARTNERS

- **State governments.** Government organizations such as the D.C. DOEE, Maryland Green Building Council, Maryland Department of the Environment, Maryland Energy Administration, Maryland Clean Energy Center, Virginia Department of Housing and Community Development, and others offer programs to provide funding and technical assistance for energy efficiency and electrification projects. This may include departments of energy, environment, housing, school districts, and others. Government facilities also are opportunities for building efficiency and decarbonization.
- **Local governments, including public schools.** Local departments of energy, environment, housing, school districts, and others may have additional programs and policies to provide funding and technical assistance for energy efficiency and electrification projects. Government and public facilities and sites also provide opportunities to improve regional building efficiency and reduce GHG emissions from the built environment.
- **Energy utilities.** Most utilities in the MSA serve as providers of existing energy efficiency and building decarbonization programs for rate-payers.
- **Businesses, hospitals, private schools, universities, water utilities, airports, data centers, places of worship**. These entities will implement building improvements and design/build decarbonized buildings.
- **Property owners, developers, renters**. As end users, homeowners, property owners, developers, and renters can make behavior changes and decisions that affect building efficiency. While property owners and developers generally have more control over changes to and within buildings, especially at the time of new construction or major renovations, renters can also make behavior and other changes that will result in GHG reductions.

- **Contractors and equipment/energy service providers.** These partners provide the services and equipment to decarbonize buildings, and may include architects, engineers, energy auditors, consultants, and more. Workforce development organizations also play a key role in building the pipeline of skilled workers to serve the building sector's decarbonization needs.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Actions to implement this measure could include, but are not limited to:

- Create voluntary and/or mandatory benchmarking and labeling programs for buildings.
- Strengthen green building policies and energy codes. Implementing strengthened codes, including "stretch codes," can encourage the mitigation of air pollutants from buildings.
- Conduct energy audits and site assessments. By conducting these assessments, implementers can collect information on which areas of the building inventory, if any, need additional support in achieving improved energy efficiency and decarbonization, and have the highest potential to result in energy savings.
- Facilitate net zero building development. Prioritizing low emissions practices across the lifecycle (in construction, maintenance, and end of life) of new buildings and retrofits to existing buildings can yield more integrated emissions savings.
- Expand or create new programs and incentives for retrofits and upgrades to residential, multifamily, and commercial properties (e.g., building efficiency retrofits including window replacements, insulation, more efficient and/or electric appliances, hybrid or all-electric heat pumps or more efficient gas heat pumps).
- Implement energy efficiency and fuel switching in all buildings, particularly data centers and other large energy users (e.g., hospitals, life sciences, wastewater utilities, CHP/District Energy operators), including implementing solutions to make buildings more efficient and decarbonize buildings, including reducing the use of building-code-required back up diesel generators and transition to cleaner alternatives.
- Expand and/or create new programs for retrofits, incentives, and upgrades to municipal and government buildings, including public schools, government buildings, and operations (e.g., building efficiency and electrification retrofits, street lighting and stadium lighting retrofits, microgrids).
- Fund the deployment of microgrids.
- Plan for and address electric panel and electrical transformer upgrades in residential and commercial properties to support electrification.
- Address refrigerant use in buildings (HVAC, chillers, refrigeration) through replacement with lower global warming potential refrigerants/natural refrigerants.

Some of these activities are already underway to varying degrees across the metropolitan Washington region. For example, the Maryland Climate Solutions Now Act of 2022 requires the Maryland Department of the Environment (MDE) to develop building energy performance standards (BEPS).[19] MDE must develop standards for buildings that, among other requirements, achieve a 20% reduction in net direct GHG emissions by January 1, 2030 compared with 2025 levels for average buildings of similar construction and net-zero direct GHG emissions by January 1, 2040.

[19] https://mde.maryland.gov/programs/air/ClimateChange/Pages/BEPS.aspx

Buildings subject to BEPS in Maryland are 35,000 square feet or larger (excluding the parking garage area). Owners of buildings subject to BEPS will need to report data to MDE each year beginning in 2025. Historic properties, public and nonpublic elementary and secondary schools, manufacturing buildings, and agricultural buildings are exempt.

Furthermore, in January 2024, Montgomery County, Maryland issued a transmittal packet of proposed BEPS regulations to the County Council. Buildings subject to BEPS in Montgomery County are 25,000 square feet or greater and will need to meet a long-term energy performance standard based on-site energy use intensity. The regulations will be considered by the County Council in 2024.[20] The D.C. Government also operates a BEPS program that addresses building as small as 10,000 square feet.

Arlington has a voluntary Green Building Bonus Density Incentive Program and a Sustainable Facilities Policy for municipal buildings. Similar programs exist in other counties and cities in Northern Virginia.

Many utilities in the region (e.g., Dominion), through existing statewide programs (e.g., EmPOWER Maryland) offer rate-payer funded energy efficiency and decarbonization buildings programs for residential, commercial, sector-specific, and income- and age-eligible customers.

Other activities may be further behind in implementation due to limited funds, potential authority limitations, and other barriers such as lack of education/awareness and workforce and supply chain limitations. Most of the activities can be implemented or expanded in the near term.

AUTHORITY TO IMPLEMENT

Maryland, Washington D.C., and Montgomery County, Maryland have enacted legislation mandating BEPS, but Virginia law does not currently allow local governments to establish BEPS or related policies such as energy benchmarking. Energy code implementation across the region is governed by state law, which with some variations limits local governments' ability to implement codes different from that adopted at the state level. Notwithstanding the lack of home rule in Virginia to adopt local building codes, cities and counties in the Commonwealth of Virginia have—for as long as 22 years—fashioned and implemented green building incentive programs based on tiers of BEPs and performance certifications. Additionally, state renewable portfolio standards (RPS) requirements drive the cost for RECs in each state. Thus, all activities mentioned above can be implemented or are being implemented through existing voluntary or regulatory programs.

GEOGRAPHIC COVERAGE

This measure will reduce GHG emissions across the entire MSA.

FUNDING SOURCES

Example potential funding sources include:

- U.S. Department of Energy (DOE) Energy Efficiency and Conservation Block Grants
- DOE Home Efficiency Rebates and Home Electrification and Appliance Rebates
- DOE State Energy Program
- U.S. Department of Housing and Urban Development (HUD) Green and Resilient Retrofit Program

[20] https://www.montgomerycountymd.gov/green/energy/beps.html

- DOE and State Weatherization Assistance Programs
- FEMA Building Resilient Infrastructure and Communities (BRIC)
- Washington DC Sustainable Energy Utility (SEU)
- Maryland Clean Energy Center
- DC Green Bank
- Montgomery County Green Bank
- Inflation Reduction Act Tax Credits (Energy Efficient Commercial Buildings Deduction (179D), and New Energy Efficient Home Credit (45L))
- Utility Programs

LIDAC BENEFITS

These actions could contribute to reducing energy expenses for private and public entities. Indirect benefits include the creation and expansion of green energy jobs and training for auditors, construction workers, contractors, and other building trades such as HVAC suppliers and carpenters. Additionally, these measures may encourage infill development, removing blight from LIDACs and improving visual quality, safety, and quality of life. Retrofit programs typically benefit LIDACs in the urban core and in distressed areas. These measures may result in direct benefits including reduced energy costs from the implementation of energy efficiency measures and educational programs that influence user behavior and result in lower utility bills. The incorporation of microgrids may benefit LIDACs by providing alternative network sources for energy during high demand and increasing reliability. This measure will also improve local air quality, leading to a reduction in related health impacts such as asthma. Potential temporary impacts or dis-benefits for business and residential lease holders during construction include construction noise, fugitive dust, utility interruptions, and in some cases early lease termination to complete construction activities. Following construction, increased rents may be a concern.

SAMPLE METRICS FOR TRACKING PROGRESS

Potential metrics to track the progress of this measure include:

- Number of units retrofitted, disaggregated by residential, institutional, municipal, and commercial buildings
- Number of energy conservation measures installed, disaggregated by residential, institutional, municipal, and commercial buildings
- Participation rates in incentives programs, such as EmPOWER Maryland utility offerings or tax credit programs
- Square footage retrofitted, disaggregated by residential, institutional, municipal, and commercial buildings
- Number of units constructed as net zero, high efficiency or electric, disaggregated by residential, institutional, municipal, and commercial buildings
- Square footage of buildings constructed as net zero, high efficiency or electric, disaggregated by residential, institutional, municipal, and commercial buildings
- Energy use intensity (EUI) and GHG improvements (e.g., for local government buildings)
- Local electricity and natural gas consumption by jurisdiction
- Electricity and natural gas consumption by building (if in EPA Portfolio Manager)

ACCELERATE THE DEPLOYMENT OF CLEAN AND RENEWABLE ENERGY.

This measure aims to accelerate the development of on-site solar energy, complemented by battery storage and microgrids (where feasible), by expanding upon successful existing community-based programs (e.g., Solarize NoVA, SUN-Switch, and Capital Area Solar Switch) and introducing new initiatives and technologies, such as agrivoltaics (the co-location of agricultural production and ground-mounted solar photovoltaic systems).[21] It will provide financial and other support to install solar PV systems at single-family residential properties, including LIDAC properties, and install solar systems at public housing and affordable housing properties, and other residential and commercial buildings. Where on-site solar installation and use is not feasible, off-site solar and other renewable power resources through aggregation options such as community solar, retail choice, and community choice aggregation (CCA) could be used. This measure also includes the use of solar energy for local government operations.

COG's Commitment to Renewable Energy
Based on recommendations from the COG CEEPC, in November 2023, the COG Board endorsed a goal of 250,000 solar rooftops in the region by 2030, with additional goals that call on local jurisdictions to pursue solar installations on government facilities, explore renewable energy for 100% of government operations, and support community-wide efforts to deploy solar, including programs for low-income residents, efficient zoning and permitting processes, and incentives. Currently, there are approximately 73,000 solar energy installations in the region.
Note: This does not cover the entire CPRG MSA.
Source: www.mwcog.org/newsroom/2023/11/08/cog-board-adopts-regional-solar-energy-goals-for-2030-/

QUANTIFIED GHG REDUCTIONS AND RELEVANT GHG INVENTORY SECTORS

This measure will reduce GHG emissions in the buildings sector. It may also reduce emissions in the transportation sector if electric vehicles are charged using distributed renewable energy sources. Cumulative estimated GHG emissions reduction potential for this measure are:

GHG reductions ($MMTCO_2e$), 2025-2030	GHG reductions ($MMTCO_2e$), 2025-2050
2.66	11.24

Key assumptions, methods and data sources used to develop these quantified reduction estimates are provided in Appendix A.

KEY IMPLEMENTING AGENCIES AND PARTNERS

- **State and local governments.** Governments can install and procure renewable energy on or for public facilities (including schools, municipal buildings, and other public buildings), create solar ordinances and updated zoning ordinances, and develop policies and incentive programs to support renewable energy.
- **Utilities and Regional Transmission Organizations.** As providers of large-scale renewable energy and as actors in renewable energy credit markets, utilities can work with entities to negotiate for and procure renewable energy. Utilities may also work with partners to plan for integration of distributed generation and grid modernization to serve community needs.

[21] https://www.energy.gov/eere/solar/agrivoltaics-solar-and-agriculture-co-location

- **CBOs.** Engaging with local CBOs can help ensure that on-site solar initiatives address the specific needs and concerns of local communities. These organizations can also play a role in raising awareness and promoting community participation, (e.g., in community solar programs) or build the pipeline of trained workforce to install more distributed energy generation.
- **Private sector partners.** Collaboration with private sector entities — including solar developers, financiers, building owners, installers, and technology providers — is crucial for implementing on-site solar installations. Public-private partnerships can lead to greater funding and heightened expertise for these projects.
- **Non-profit organizations.** Non-profits can conduct community engagement, education and outreach, capacity building, research on environmental and social impacts of clean energy projects, and/or developing and installing community renewable energy projects.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Actions to implement this measure could include, but are not limited to:

- Expand the reach of existing programs, such as Solarize NoVA, SUN-Switch, and Capital Area Solar Switch programs.
- Map solar opportunities across the MSA to determine potential priorities and investments.
- Provide clean energy and microgrid feasibility assessments at key facilities (e.g., university campuses, hospitals).
- Incorporate community energy infrastructure needs, goals, and strategies in master plans, comprehensive plans, and small area plans.
- Adopt new solar-ready construction ordinances, building codes, and/or incentive programs.
- Provide or promote incentives to encourage installation of solar in the community and for battery storage.
- Install renewable energy systems on schools and municipal infrastructure.
- Implement battery storage pilot initiatives at public facilities.
- Provide technical assistance and support for negotiating and navigating power purchase agreements, CCA, and community solar.
- Examine the possibility of regional demand aggregation.
- Initiate cooperative purchasing initiatives or energy purchasing consortia.
- Develop new state or local policies to help overcome barriers to CCA adoption.
- Leverage existing cooperative purchasing programs, such as the Mid-Atlantic Purchasing Team and COG Cooperative Procurement Program, to fast-track local implementation.
- Establish PPA(s) to provide clean electricity to local government facilities, potentially aggregating demand with other local jurisdictions or large local businesses to reduce cost.
- Implement and share best practices from CCA and retail choice aggregation pilot programs, where applicable.
- Advocate for increased percentages of clean energy in state Renewable Portfolio Standards (RPS) programs.
- Coordinate with utilities to speed up interconnection agreement processing time and ensure equitable costs for transmission upgrades for residents installing solar.
- Provide financial and other support to install solar PV systems at single-family residential properties, including LIDAC properties, public housing and affordable housing properties, and other residential and commercial buildings.

- Implement large off-site solar procurement projects supplying the wholesale PJM electricity market.

Many of these activities are ongoing and will continue to be implemented throughout the region but need to be scaled. Other activities, such as developing new policies to overcome CCA adoption barriers, still need to be implemented and depend on existing authorities. Some of these planned activities can commence in a shorter timeframe, contingent upon available resources (e.g., regional solar opportunity mapping), whereas others may take more time (e.g. adopting solar-ready ordinances) and may be location-dependent.

AUTHORITY TO IMPLEMENT

The authority to implement on-site renewable energy falls on state and local governments in partnership with utilities and the private sector. Programs like Solarize NoVA, SUN-Switch, and Capital Area Solar Switch operate at the building scale, and the implementation authority for voluntary participation rests with individual building owners. On-site solar development is pursued where feasible, but off-site options, such as community solar, retail choice, and CCA, come into play when on-site solutions are not viable. The authority for off-site renewables, particularly community solar, is governed by state law. Utilities in the metropolitan Washington region can offer voluntary renewable energy certificate (REC) purchases (the cost of which is driven by different state RPS requirements), while community solar, retail choice, and CCA require specific state legal authorizations, each addressed by Maryland, D.C., and Virginia laws in their respective domains. Retail choice, allowing customers to choose alternative energy suppliers, is currently authorized in Maryland and D.C. but not in Virginia, except for large electricity users. CCA, allowing local governments to seek energy supplies independently, is legally authorized in Maryland and Virginia, and is subject to state legal provisions similar to those for community solar.

GEOGRAPHIC COVERAGE

This measure will reduce GHG emissions across the entire MSA.

FUNDING SOURCES

Example funding sources include:

- DOE State Energy Program
- HUD Green and Resilient Retrofit Program
- EPA Greenhouse Gas Reduction Fund (including Solar for All)
- FEMA BRIC
- Washington DC SEU
- Montgomery County Green Bank

LIDAC BENEFITS

Transitioning from fossil fuels to renewable energy would provide benefits such as improved indoor air quality and local air quality as well reduced energy bills. Secondary benefits may include site remediation to create spaces for off-site solar development and a competitive market for users who have expanded choices for energy suppliers. In addition, potential health benefits include reduced cases of asthma and upper respiratory disease, and associated effects from diseases such as obesity, diabetes, and chronic infections related to reduced outdoor activities. Job creation and training in the renewable energy space could benefit LIDAC members.

SAMPLE METRICS FOR TRACKING PROGRESS

- Number of solar rooftops
- Amount of distributed solar capacity installed
- Amount of distributed solar capacity installed in LIDACs
- Size of the current solar workforce

STUDY, PLAN FOR, AND DEPLOY DISTRICT ENERGY AND MICROGRID OPPORTUNITIES.

This measure focuses on targeted and strategic uses of district energy systems, with the opportunity to deploy clean energy sources (e.g., renewable gas generated from a landfill or solid waste operations, solar, waste heat recovery, combined heat and power), and potentially pair with microgrids. District energy systems deliver hot water, steam or chilled water from a central plant(s) to multiple buildings via a network of pipes to meet thermal end uses: space heating, domestic hot water, air conditioning or industrial process heating or cooling.

For large energy users (e.g., data centers, water utilities) and campuses (e.g., hospitals, higher education facilities), district energy offers an opportunity for energy efficiency, GHG reductions, and resiliency. Microgrids can provide a form of energy resilience and independence due to their ability to "island" from the larger grid. This is especially important for critical infrastructure, post-disaster community needs, or near 24/7 large energy users when energy is needed during blackouts or other interruptions in service. These opportunities could be targeted in LIDAC areas and form the basis of community resilience hubs and provide needed community facility investment.

QUANTIFIED GHG REDUCTIONS AND RELEVANT GHG INVENTORY SECTOR

This measure reduces GHG emissions from the buildings sector. The potential GHG reduction benefits of district energy systems and microgrids in the metropolitan Washington region is highly dependent on the specific application of the system(s). In 2011, COG worked with FVB Energy Inc to study potential benefits and costs of generalized example district energy systems in the region. The GHG reductions presented below in Table 6 represent the application of various generalized example district energy system types to a comparison building. Calculations based on the FVB study are presented in Appendix A, along with key study assumptions and data sources.

Table 6. Cumulative GHG Reductions for Example Generalized District Energy System Types ($MMTCO_2e$)

System Type	2025-2030	2025-2050
Boilers And Chillers	0.03	0.25
Engine CHP	0.33	0.72
Turbine CHP	0.18	0.38
Combined Cycle CHP	0.38	0.84
Biomass Boiler	0.13	0.70
GSHP	0.01	0.30
Waste Heat	0.09	0.51

KEY IMPLEMENTING AGENCIES AND PARTNERS

- State and local government agencies. Government public buildings are community-focused buildings that can serve as microgrid or resilience hub host sights. State and local governments play a role in planning, development, permitting, and other phases of implementation. They may also be the beneficiaries of investments such as resilience hubs

and critical sheltering. Local governments may need to plan for capital budgeting and procurement.

- **Public Service Commissions, Utilities, Energy Suppliers**. Participation and/or approval by energy utilities (e.g., Pepco) and their regulators, is critical for microgrid owners and operators. Further, utilities and energy suppliers will need to fuel district systems running on clean or renewable gases.
- **Private sector**. Support from the private sector, including key implementers and partners mentioned above, will be required for feasibility assessments, construction planning and development, and potential operations and maintenance. Key industry stakeholders will be important to supplying new sources of zero-emission fuels, such as renewable gas or hydrogen. Financing partners are also important.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Actions to implement this measure could include, but are not limited to:

- Support the identification and selection of high energy users and critical infrastructure for combined heat power (CHP), district energy and/or microgrid implementation.
- Decarbonize existing CHP systems.
- Explore or transition to renewable natural gas (RNG), hydrogen, or other low-carbon fuel solutions for energy sourcing and generation.
- Engage with private sector partners interested in solar, biofuel, CHP, district energy and microgrid implementation solutions.
- Engage with LIDACs where resilience hubs are most needed, and engage with the community on what resources they need.
- Conduct site feasibility assessment and pre-construction planning.
- Partner on grant applications or provide contract support for project planning, feasibility, and implementation support.
- Support state incentives and opportunities to help facilitate district energy and microgrid development.
- Support the development of microgrids.
- Coordinate with state and local governments to reduce barriers to deployment.
- Work closely with regulators and utilities to deploy solutions.
- Conduct pilot programs to demonstrate the viability and utility of resilience hubs.

The accomplishments of CEEPC and its members have also earned the region recognition as a White House Climate Action Champion. This designation made its members eligible for targeted federal technical assistance and grant funding from 2014–2016. One way COG leveraged this opportunity was to conduct local clean energy infrastructure assessments at six sites across the region to determine the feasibility of microgrids, CHP, geothermal, or net zero energy development. Two examples of progress at these sites include the Falls Church School Campus (geothermal energy) and the Washington Hospital Center (microgrid deployment).

Montgomery County has installed a microgrid project at the County's Public Safety Headquarters as part of a comprehensive effort to ensure the resiliency of critical public services during major electric distribution system outages. The project installed a microgrid featuring 2 MW of solar PV canopies mounted over a parking lot and an 800-kW CHP system and reduces GHG emissions of 5,900 metric

tons annually.[22] Montgomery County has also installed a microgrid at the County's Correctional Facility, which will reduce GHG emissions by more than 950 tons annually.[23] In addition, Montgomery County has created Brookville Smart Energy Bus Depot, an integrated microgrid and electric bus charging infrastructure project. Montgomery County also developed a microgrid-powered resilience hub at the Montgomery County Animal Services and Adoption Center.[24] Montgomery County Green Bank created a privately-owned resilience hub in an EEA by electrifying an affordable high-rise apartment building and installing a 159kW solar PV system.[25]

Arlington County's CEP includes a goal to ensure Arlington's energy resilience and includes policy actions that focus on developing resilient energy infrastructure, enhancing energy assurance, and assessing microgrid opportunities for critical services. Under the CEP, in 2023, Arlington County completed its Energy Assurance Plan, which advanced a microgrid and resiliency hub feasibility study and implementation as priority actions, with a focus on primary needs of LIDACs. Maryland has been extending programs to incorporate resiliency projects, e.g., MEA introduced in 2020 the Resilient Maryland Program to provide funding for projects to increase microgrids and other distributed energy resources to improve energy resiliency.

NVRC commissioned a study on the legal viability of district energy systems in 2011, and many of these conclusions and opportunities still stand.[26] The study concluded that: there are clear existing paths for public and/or private establishment, ownership and operation of district energy systems; district energy systems will likely be subject to complex legal frameworks; depending on the ownership arrangements and system characteristics, the operation may be subject to limitations of powers of localities under the "Dillon Rule", to State Corporation Commission Regulation, and land use and environmental regulations; the Code of Virginia provides paths to development of district energy systems, but could be amended to provide more clarity about how district energy systems can be developed and operated.

AUTHORITY TO IMPLEMENT

Where microgrids or district energy systems interconnect with and/or displace infrastructure owned by energy utilities franchised under state law, utility participation and/or permission is typically required, which will also involve state regulatory commissions. It may be necessary to amend some state laws to implement this measure. Where municipally owned utilities are involved, the authority typically resides within the local government. In certain situations, such as greenfield development, microgrid/district energy projects could be developed without utility involvement, though it is more likely that interconnection agreements would be encouraged if not required.

GEOGRAPHIC COVERAGE

The actions within this measure are focused on the entire MSA area, but particular opportunities are focused in areas of high energy use, such as in high density data center populations (e.g., Loudoun and Prince William counties), schools and universities (e.g., University of Maryland), and hospitals.

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[22] Microgrids Public Safety Headquarters (montgomerycountymd.gov)
[23] Microgrids Montgomery County Correctional Facility (montgomerycountymd.gov)
[24] https://www.mymcmedia.org/elrich-announces-new-resiliency-hub-at-animal-shelter/
[25] Montgomery County Green Bank. https://mcgreenbank.org/first-privately-owned-resilience-hub-and-electrification-project-at-hampshire-towers-apartments/
[26] NVRC. https://www.novaregion.org/DocumentCenter/View/3050/NVRC-McGuire-Woods-District-Energy-White-Paper-Au?bidId=

FUNDING SOURCES

Example potential funding sources include:

- Energy Efficiency and Conservation Block Grants
- EPA Greenhouse Gas Reduction Fund
- MEA Resilient Maryland Program
- FEMA BRIC
- DOE Grid Innovation Program
- DOE Smart Grid Grants
- Private sector energy performance contracts

LIDAC BENEFITS

This measure directly benefits D.C. and ancillary service networks within the system as the improvements are focused on large system users such as public and private hospitals, schools, institutions and other large facilities. Secondary or co-beneficiaries include LIDACs due to the reduction of GHG emissions and other air toxins surrounding the fossil fuel facilities, expanded job opportunities and training in the areas of maintenance and system network upgrades, and overall system reliability through the introduction of microgrid components.

SAMPLE METRICS FOR TRACKING PROGRESS

- Number of approved/installed projects
- Capacity of microgrid capacity installed

4.2 Transportation

The transportation sector contributed 39% of the GHG emissions in the metropolitan Washington region in 2020, of which 83% is from on-road transportation and the remaining 17% is from off-road transportation (including construction vehicles, rail, and passenger air travel). The COG region is expected to add about 1.3 million people (an 18% increase) and 900,000 jobs by 2045. At the same time there is expected to be a 12.3% increase in VMT by residents in the region.[27] Population growth and increased VMT are even greater for the whole of the MSA, and vehicle trips are expected to continue to be the predominate mode of transportation in a BAU scenario. As such, it is key to expand access to transit options beyond single occupancy vehicles to increase the mode share for public and active transportation of all trips.

As the federally mandated MPO for the National Capital Region, the TPB is responsible for producing the region's Metropolitan Transportation Plan and Transportation Improvement Program. In June 2022, the TPB adopted a Resolution on the Adoption of On-Road Transportation Greenhouse Gas Reduction Goals and Strategies (TPB Resolution R18-2022). As part of that resolution, the TPB adopted a set of priority strategies to reduce GHG emissions from on-road transportation including:

- Improve walk/bike access to all high-capacity transit stations.
- Increase walk/bike modes of travel, e.g., complete the National Capital Trail Network by 2030.

[27] TPB. Visualize 2045. 2022. https://visualize2045.org/wp-content/uploads/2022/09/Viz2045Final-Report-6-15-22_hyperlinked_.pdf

- Add additional housing near high-capacity transit stations and in COG's Regional Activity Centers.
- Reduce travel times on all public transportation bus services.
- Implement transportation system management and operations improvement measures at all eligible locations by 2030.
- Convert private and public sector light-, medium-, and heavy-duty vehicles, and public transit buses to clean fuels, by 2030.
- Deploy a robust region-wide EV charging network (or refueling stations for alternative fuels) for light, medium, and heavy-duty vehicles.

The resolution also included a set of strategies to be explored in coordination with local and state levels:

- Take action to shift growth in jobs and housing from locations currently forecast to locations near high-capacity transit stations and in COG's Regional Activity Centers to improve the jobs-housing balance locally.
- Make all public bus transportation in the region fare-free by 2030.
- Make all public rail transportation in the region fare-free by 2030.
- Price workplace parking for employees – only in Activity Centers by 2030 and everywhere by 2050.
- Convert a higher proportion of daily work trips to telework by 2030 and beyond.
- Charge a new fee per VMT by motorized, private, passenger vehicles in addition to the prevailing transportation fees and fuel taxes.
- Charge a "cordon fee" (i.e., commuter tax) per motorized vehicle trip for all vehicles entering Activity Centers by 2030.

The TPB's action to adopt GHG goals and strategies specific to the on-road transportation sector were informed by the TPB's Climate Change Mitigation Study of 2021 (CCMS) and a questionnaire of TPB members that was conducted in February and March 2022. The strategies that were studied in the CCMS and later considered by the TPB for adoption are not an exhaustive list of all possible GHG reduction strategies for the on-road transportation sector. As noted previously, documents such as the Metropolitan Washington 2030 Climate and Energy Action Plan and climate action and energy plans from local governments were consulted to identify planned and ongoing actions to reduce GHG emissions. Additionally, strategies that were designated "for further study" by the TPB were designated as such because they were not supported by a majority of members at that time; however, that would not preclude a jurisdiction with implementation authority from implementing one or more of those strategies. A study on those strategies is expected to be completed in June 2024.

The priority GHG reduction measures included below for the transportation sector reflect these already established goals and strategies.

PROVIDE AND PROMOTE NEW AND EXPANDED OPPORTUNITIES TO REDUCE VMT THROUGH PUBLIC TRANSPORTATION, NON-MOTORIZED TRAVEL, MICROMOBILITY, SHARED TRAVEL OPTIONS, AND DEVELOPMENT.

This measure aims to reduce VMT by offering robust, reliable, and safe travel options. It will provide and promote new and expanded opportunities to reduce VMT through public transportation, non-

motorized travel, micromobility, shared travel options, and transit-oriented development. These options include active transportation methods (e.g., bicycling, walking), public transportation (e.g., trains, buses), shared transportation (e.g., carpools, vanpools), and micromobility (e.g., shared bicycles and scooters). Other opportunities for telework and telehealth will also reduce VMT. Land use and transit-oriented development changes also are a part of this measure to help reduce the length of trips and create more opportunities for alternatives to driving.

Public transportation not only reduces GHG emissions, but also improves air quality and makes communities more livable, sustainable, and economically competitive. By attracting businesses, residents, and visitors, well-developed transit systems spur economic growth and development. Public transportation also increases the connectedness of communities, increasing quality of life and economic opportunity by increasing property values and access to jobs, public facilities, and resources.

QUANTIFIED GHG REDUCTIONS AND RELEVANT GHG INVENTORY SECTOR

This measure will reduce GHG emissions in the transportation sector. Emissions from the land use sector may also be impacted because of changes in development. Cumulative estimated GHG emissions reduction potential for this measure are:

GHG reductions ($MMTCO_2e$), 2025-2030	GHG reductions ($MMTCO_2e$), 2025-2050
0.72	5.22

Key assumptions, methods and data sources used to develop these quantified reduction estimates are provided in Appendix A.

KEY IMPLEMENTING AGENCIES AND PARTNERS

- **Local governments and municipalities.** Responsible for land use planning and comprehensive planning; transportation planning, development, and operations, including local transit; program development and administration (e.g., travel demand management programs), and local policies. Will support infrastructure investment and implementation, including pedestrian and cyclist infrastructure.
- **State Departments of Transportation.** Will be key partners in transportation infrastructure planning, development, and operations, such as rail and changes to roads to prioritize bus transportation along state routes, as well as policies related to toll roads and interstate corridor charging and fueling infrastructure.
- **Regional planning organizations and commissions.** Plan for, evaluate, and in some cases fund transportation infrastructure investments and programs. This includes COG, TPB, Northern Virginia Transportation Authority (NVTA), National Capital Planning Commission (NCPC), and other regional planning agencies across the MSA.
- **Regional and local transit agencies.** Transit agencies like WMATA, Maryland Transit Administration (MTA), and Northern Virginia Transportation Commission (NVTC) will be critical to implementing programs and policies.
- **Transit advocates and NGOs**. NGOs and advocates can play a supporting role in education and outreach related to this measure and can also help connect and engage with grassroots organizations and LIDACs.

- **Private sector partners.** Private sector partners, such as landowners, developers, and businesses play a key role in development decisions and design that affect the viability of using alternatives to driving. Business can also implement telecommute and other policies that help manage travel demand. Public-private partnerships can lead to greater funding and heightened expertise for these projects.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Actions to implement this measure could include, but are not limited to:[28]

- Implement infrastructure improvements to support non-motorized travel (e.g., roadway designs that make walking and biking safer, adding bicycle and pedestrian pathways, adding, and expanding sidewalks, improving crosswalks, completion of the National Capital Trail Network and other paved and unpaved trails for bicycle use).*
- Enhance micromobility options, including expanding shared bike, e-bike, and scooters.*
- Improve first mile and last mile connections to transit (e.g., shuttles, bicycle storage, bicycle and pedestrian connections to transit, on-demand transit).*
- Provide improvements and enhancements in public transit service (e.g., operational and service enhancements, bus and rail maintenance and investments to improve reliability and quality of service, low-income/free fare products, and bus rapid transit).*
- Support land use policies that encourage development near high-capacity transit stations and within activity centers, including design that supports walking, biking, and transit.*
- Provide transit capital investments to enhance and expand public transit service (e.g., expansion of bus, rail, and bus rapid transit infrastructure; bus stop improvements such as benches and bus shelters, mobility hubs that bring together transit, bike sharing, transit station improvements for operational efficiency, and other options).*
- Implement or expand policies that promote car/ride sharing and reducing vehicle travel, such as through reduced parking minimums, parking pricing, and congestion pricing, as well as HOV-3 free and other policies to encourage ride sharing.
- Implement incentives that encourage use of sustainable modes, such as incentives for purchasing e-bikes, or incentives for ridesharing and using transit, reduced or fare-free transit.
- Implement policies and incentives to manage travel demand, such as those that promote or require telework policies, employer-based trip reduction, ride matching, and vanpool formation.

AUTHORITY TO IMPLEMENT

The actions associated with making changes to increase pedestrian and bicycle infrastructure can be administered by local and state jurisdictions. Policies that impact land use can similarly be administered by local jurisdictions though zoning codes and potential changes and developers can act on where to build based on these policies. Actions related to public transportation may need approvals from regional or state transportation agencies to be implemented and will need higher levels of authority depending on the scope and scale of changes to public infrastructure. Additional agencies and approvals will be needed for any actions related to charges such as congestion pricing and VMT pricing. Employers also play a key role in providing company policies to allow for

[28] Note: Strategies with an * generally fall within the priority GHG reduction strategies that were adopted by the TPB in June 2022 and are included in the quantified GHG reductions.

teleworking. Of note, for this region there is a relatively high number of federal workers, so changes in employee telework policies will be tied in part to federal agency employee policies.

GEOGRAPHIC COVERAGE

This measure will reduce GHG emissions across the entire MSA.

FUNDING SOURCES

Example potential funding sources include:

- Federal Transit Administration (FTA) Grants – Urbanized Area Formula Program
- FTA –Bus and Bus Facility Grants
- FTA – Capital Investment Grants
- Federal Highway Administration (FHWA) Carbon Reduction Program
- FHWA Congestion Mitigation and Air Quality Improvement (CMAQ) Program
- FHWA Highway Safety Improvement Program (HSIP)
- FHWA Surface Transportation Block Grant (STBG) Program
- Virginia Department of Rail and Public Transportation

LIDAC BENEFITS

The actions in this measure aim to improve public transit service through enhanced and increased service along with prioritizing designated service types within LIDACs. Improving public transit service in the urban core and along commuter routes could encourage increased transit use because of reduced commute times from home to workplace and last mile service. Priorities include the enhancement of bus and rail service that could better serve LIDACs using VRE and Maryland Area Rail Commuter (MARC) regional rail service, and commuter bus and local WMATA bus and rail service in addition to other regional transit service such as Montgomery County's RideOn bus service. Expanding and improving bus transportation will benefit LIDACs as many transit-dependent and low-income transit riders use bus systems.[29]

LIDAC members located in the urban core or near congested highways across the MSA experience significant traffic, noise, pollution, and safety related effects. Suburban and rural areas face another set of barriers that increase pollution due to increased commute times and congestion, resulting in increased transportation GHG emissions. Increasing the use of public transportation and accessible and safe transportation options such as walking and biking can positively impact LIDACs by reducing transportation costs and improving health through active transportation alternatives.

This measure also includes transit-oriented development (TOD) considerations. However, TOD development historically leads to gentrification when supportive policies are not implemented to protect underserved homeowners and renters. This measure will require partnership among municipalities, transit agencies, and the development community to truly benefit LIDACs.

SAMPLE METRICS FOR TRACKING PROGRESS

- VMT and VMT per capita

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[29] Shuling Wu & Jennifer D. Roberts (2023) Transit justice: community perceptions and anticipations of a new light rail transit line in Prince George's County, Maryland, United States, Cities & Health, 7:6, 1012-1028, DOI: 10.1080/23748834.2022.2133573

- Mode share for public and active transportation (e.g., percent of workers commuting by single occupant vehicle, rideshare, transit, bike, walk, telework)
- Transit ridership for bus and rail transit
- Active transportation and micromobility uptake
- Percent of businesses that adopt hybrid or fully remote work policies
- Mode share for public and active transportation of all trips

ACCELERATE THE DEPLOYMENT OF LOW- AND ZERO- EMISSION TRANSPORTATION, FUELS, AND VEHICLES.

This measure aims to accelerate the deployment of low emission and zero-emission transportation, fuels, and vehicles across all on-road sectors including light-, medium-, and heavy-duty vehicles. This includes both personal vehicles and private and public fleets, including school and municipal bus fleets, and support for the deployment of charging and fueling infrastructure. To support the deployment of EVs, a robust network of EV charging must be widely available, reliable, and easy to use for residents and businesses, especially in public community and multifamily settings. Beyond EVs, this measure also allows for flexibility in the use of green hydrogen, biodiesel, and other renewable or low-carbon fuels where options are not available or feasible, particularly for medium- and heavy-duty vehicles and buses.

QUANTIFIED GHG REDUCTIONS AND RELEVANT GHG INVENTORY SECTORS

This measure reduces GHG emissions from the transportation sector. The increase in EV adoption may also impact GHG emissions in the buildings sector depending on how chargers are tied to the built environment. Cumulative estimated GHG emissions reduction potential for this measure are:

GHG reductions ($MMTCO_2e$), 2025-2030	GHG reductions ($MMTCO_2e$), 2025-2050
2.80	135.50

Key assumptions, methods and data sources used to develop these quantified reduction estimates are provided in Appendix A.

KEY IMPLEMENTING AGENCIES AND PARTNERS

- **COG** can support the aggregation of demand via the COG Cooperative Purchasing Program and local EV buying co-ops. This effort can also be supported by **Clean Cities Coalitions and Washington Area New Dealers Association (WANADA).**
- **TPB** can coordinate efforts in the region and has set priority actions that are reflected in this measure.
- **Local and regional transit agencies** are also key implementors in the transition of public transit fleets and clean fuel and EVs. They also coordinate on implementing charging/fueling infrastructure.
- **State and local governments (including public schools)** can transition municipal fleets to EVs or low-carbon fuel vehicles supported by the adoption of green fleet policies and plans and provide incentives or policies to support EV adoption. State agencies, with federal funding, are building out EV charging networks. Local governments can also implement community-wide buying co-ops for EVs for public and private fleets as well as personal

vehicles and provide education to residents and businesses about EVs and EV charging. Governments can also install charging equipment on municipal properties, including through partnerships with utilities and the private sector.

- **Utilities** can provide incentives for transitioning to clean fuel vehicles and installing EV charging (e.g., both Pepco and Dominion Energy offer support for rideshare and electric bus charging infrastructure in the region). Public Utility Commissions (PUC)/ Public Service Commissions (PSC) will coordinate on the relevant regulations for implementation. Water utilities can transition their fleets to low emission vehicles.
- **Private sector actors**, for-hire vehicle operators such as Uber and Lyft or ridesharing companies such as ZipCar, can procure and offer alternative fuel vehicles and provide EV charging infrastructure. Other private sector actors, such as developers, can include EV charging and EV-ready parking in the construction projects to expand the charging network.
- **Vehicle manufacturers.** Auto manufacturers can add new low emissions vehicles to their product offerings.
- **Grocery stores, shopping plazas, and gas/charging and fueling stations**. These entities can work with state and local governments to bring publicly accessible charging and biofuel or hydrogen fueling stations to the region.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Actions to implement this measure could include, but are not limited to:

- Implement systems to manage and use data on vehicle registrations and charging infrastructure (e.g., uptime) and fueling stations.
- Support cooperative purchasing and community buyer co-ops, as well as ride share and car share that accelerate the use of low- or zero-emissions vehicles.
- Pass and implement ordinances that mandate or incentivize clean fuel infrastructure into development.
- Create and implement clean vehicle and clean fuel procurement policies.
- Plan for, develop, and procure EV charging networks, such as along Alternative Fuel Highway Corridors. Also, develop biofuels infrastructure and markets.
- Develop incentive programs for EV chargers in multifamily, public, commercial, and rental properties.
- Create incentives and programs for EV and low emissions vehicles. Incentives can include direct financial incentives or exemptions to certain restrictions (such as D.C.'s driving restriction exemption, HOV lane exemptions in Maryland and Virginia, or emissions testing exemption in Virginia).
- Develop corridor and local hydrogen fueling stations, including focused on serving medium and heavy-duty vehicles. Work with fleet owners and truck dealers to accelerate the adoption of hydrogen vehicles.
- Provide funding to support the conversion of private and public sector light-, medium-, and heavy-duty vehicles, and public transit buses to clean fuels, and for the necessary supportive infrastructure.
- Provide workforce training (e.g., through the Electric Vehicle Infrastructure Training Program) and upskilling of current trades for installation and maintenance of EV charging and fueling infrastructure.
- Conduct regular analysis of the state of clean fuel infrastructure to address any gaps in charging/refueling needs that may hamper the rate of transition.

- Explore innovations in charging such as vehicle-to-grid regenerative power and solar tie-in to EV infrastructure.
- Provide funding to improve the development of battery-operated equipment.
- Properly dispose batteries through creating end of battery life management systems.
- Provide funding to support the conversion of private and public sector light-, medium-, and heavy-duty vehicles, and public transit buses to clean fuels and for the necessary supportive infrastructure.
- Support grid connection upgrades and infrastructure improvements that support affordable, adequate, reliable, and resilient power supply for private and public sector light medium, and heavy-duty vehicles, and public transit buses using clean fuels.

All these implementation activities and milestones support the TPB's adopted priority strategies (June 2022) to convert private and public sector, light-, medium-, and heavy-duty vehicles, and public transit buses to clean fuels and to deploy a region-wide robust EV charging network (or refueling stations for alternative fuels) for light-, medium-, and heavy-duty vehicles.[30] COG is already taking action to support these priorities. In the summer of 2023, a new Electric Vehicle Deployment Clearinghouse was unveiled.[31] A REVD Working Group was also established and is developing a Regional Electric Vehicle Infrastructure Implementation Strategy.[32]

AUTHORITY TO IMPLEMENT

Local jurisdictions have the authority to purchase vehicles for their fleets; such purchases have already been started across the MSA. In some instances, purchasing or procurement policies may need to be adjusted to prioritize low and no emissions vehicles. Private and personal purchasing of low and no emissions vehicles does not have any statutory limitations. Local zoning or code changes may need to be made for charging and fueling infrastructure, and authority to implement varies across the MSA. States are also using transportation funds to support the planning for and development of EV charging infrastructure. Municipalities and residents may need to coordinate with PUCs and PSCs on regulations regarding the siting of public charging infrastructure, charging resale statues, and other issues as appropriate.

GEOGRAPHIC COVERAGE

This measure will reduce GHG emissions across the entire MSA.

FUNDING SOURCES

Example potential funding sources include:

- IRA – Clean Vehicle Tax Credit
- IRA – Previously Owned Vehicle Tax Credit
- IRA – Clean Commercial Vehicle Tax Credit
- IRA – Alternative Fuel Vehicle Refueling Property Tax Credit
- FHWA National Electric Vehicle Infrastructure Formula Program (NEVI)
- FHWA Charging and Fueling Infrastructure Discretionary Grants

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[30] June 2022 TPB meeting recap: Plan update, new climate goals approved - TPB News - News | Metropolitan Washington Council of Governments (mwcog.org)
[31] COG unveils Electric Vehicle Deployment Clearinghouse - News Highlight - News | Metropolitan Washington Council of Governments (mwcog.org)
[32] Regional Electric Vehicle Deployment Working Group | Metropolitan Washington Council of Governments (mwcog.org)

- EPA Clean School Bus Program
- EPA Diesel Emissions Reduction Program (DERA)
- EPA Clean Heavy-Duty Vehicle Program
- FTA Low or No Emission Grant Program
- Maryland EV Excise Tax Credit Program
- Utility incentive programs, such as EmPOWER Maryland

LIDAC BENEFITS

This measure includes considerations for incentivizing the sale of EV and low emission vehicles and creating EV infrastructure such as charging stations. Possible direct benefits to LIDACs include reduction in $PM_{2.5}$ and ozone and related health impacts such as asthma. The inclusion of incentives for EV infrastructure at multifamily, public, commercial, and rental properties will expand the presence of EV vehicle use beyond suburban or more wealthy urban neighborhoods. These measures would benefit LIDACs throughout the MSA region by reducing overall transportation costs. EV network design and thoughtful consideration of charging station placement are key to ensuring that communities are not left out of the EV network.

Members of LIDACs have historically benefited little from EV programs due to the high capital costs to purchase them. However, programs and incentives that expand the use of EV ride sharing or car sharing can bring benefits to LIDACs. Cooperative purchases for heavy-duty and school bus fleet conversions would also reduce local GHG emissions in LIDACs. Indirect benefits to LIDACs include workforce development and training, but existing jobs for internal combustion engine maintenance may start to dissipate.

SAMPLE METRICS FOR TRACKING PROGRESS

- Number of EVs, and low-carbon fuel vehicles registered (or purchased for local government or public fleets)
- Number of publicly accessible installed charging stations by type (e.g., Level 2 or DC Fast Chargers)
- Uptime hours for public charging stations
- Number of alternative fuel stations
- Quantity of biofuels consumed annually
- Number of maintenance/repair workers trained

ACCELERATE THE DEPLOYMENT OF OFF-ROAD/NON-ROAD ELECTRIC EQUIPMENT.

This measure focuses on accelerating the widespread adoption of electric and/or battery-operated off-road/non-road electric and other low emission equipment through education and awareness campaigns and by implementing a comprehensive framework of incentives and assistance programs to make purchase of new equipment or retrofit of existing equipment more accessible and appealing. This equipment includes lawn and landscaping equipment, construction equipment, recreational vehicles like all-terrain vehicles (ATVs), marine vessels, locomotives, and more. It also includes transitioning government owned and operated equipment to electric.

QUANTIFIED GHG REDUCTIONS AND RELEVANT GHG INVENTORY SECTOR

This measure reduces GHG emissions from the transportation sector. Cumulative estimated GHG emissions reduction potential for this measure are:

GHG reductions ($MMTCO_2e$), 2025-2030	GHG reductions ($MMTCO_2e$), 2025-2050
3.40	17.74

Key assumptions, methods and data sources used to develop these quantified reduction estimates are provided in Appendix A.

KEY IMPLEMENTING AGENCY(IES) AND PARTNERS

- State and local government agencies. Local governments can create financial incentives for residents to purchase electric lawn care equipment and for construction companies to purchase electric or retrofit existing construction equipment. They can also work with the private sector to educate consumers. Government agencies can put in place procurement policies for, or contract for, electric-powered off-road equipment and partner with the private sector on upstream programs.
- Private sector (including retailers, landscaping companies, etc.). Share information on equipment, join roadshows to demonstrate and give consumers access to equipment and information about retrofit programs. Also procure and use electric or battery-operated equipment.
- Businesses and residents. Buy and use electric and other low emission equipment.
- Local and regional transit agencies. Key implementors in transitioning equipment to electric.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Actions to implement this measure could include, but are not limited to:

- Provide education and outreach campaigns to introduce new products or technologies to consumers and users (e.g., conduct a "roadshow").
- Expand or create new incentives and technical assistance programs to promote and spread the use of electric equipment.
- Fund the improvement of battery-operated equipment, e.g., increasing the lifespan of battery powered equipment can enable commercial and public entities to adopt battery powered equipment.

There are already examples of available incentives for this measure that could be expanded upon. For example, the City of Bowie, Maryland has implemented a rebate for electric lawn care equipment for residents. Furthermore, the D.C. SEU has implemented a rebate for electric lawn mowers. Because this technology is readily available and programs already exist, this measure could be implemented in the near term.

AUTHORITY TO IMPLEMENT

Because these actions are typically incentive based rather than regulatory, the authority of state and local agencies to mount voluntary programs is typically within their charters. Actions such as regulating criteria air pollution emissions from off-road equipment for the purposes of complying with

ambient air quality standards under state implementation plans or similar regulatory actions are not anticipated in this measure.

GEOGRAPHIC COVERAGE
The actions within this measure are focused on the entire MSA.

FUNDING SOURCES
Example potential funding sources include:

- U.S. EPA Clean Diesel Grant Program/Diesel Emissions Reduction Act

LIDAC BENEFITS
In the short term, benefits may be isolated to business owners and program participants who can afford the upfront costs of transitioning to electric and/or battery-operated equipment. However, as programs gain traction and awareness spreads, LIDACs may become more engaged in the process. Benefits for LIDACs may include reduced operational expenses in the long term for business owners and localized health benefits resulting from reduced GHG emissions and toxins and reduced noise pollution.

SAMPLE METRICS FOR TRACKING PROGRESS

- Dollars of incentives used
- Number of pieces of electric equipment or electric off-road vehicles procured by local government or the private sector
- Number of engines repowered or replaced
- Annual quantity of diesel fuel reduced

4.3 Waste

REDUCE GHG EMISSIONS FROM WASTE AND WASTEWATER TREATMENT.
The waste sector, which includes waste landfills, waste incineration, and wastewater treatment facilities, generates high potency GHG emissions. To address emissions from the waste sector within the metropolitan Washington region, this measure aims to prevent, reduce, and divert waste and to reduce emissions at landfills, solid waste incinerators, drinking water treatment plants, drinking water distribution facilities, and wastewater treatment plants. It also includes harnessing landfill gas (LFG) to generate electricity and heat. This measure covers both inorganic and organic waste.

QUANTIFIED GHG REDUCTIONS AND RELEVANT GHG INVENTORY SECTOR(S)
This measure reduces GHG emissions from the waste sector. GHG emissions from buildings and transportation may also decrease if LFG can be collected and used to generate electricity and heat. Cumulative estimated GHG emissions reduction potential for this measure are:

GHG reductions ($MMTCO_2e$), 2025-2030	GHG reductions ($MMTCO_2e$), 2025-2050
5.47	30.23

Additional indirect GHG emissions reductions may be realized, including reduced energy consumption to process and transport waste and reduced maintenance and operations activities

and inputs (e.g., chemicals). Key assumptions, methods and data sources used to develop these quantified reduction estimates are provided in Appendix A.

KEY IMPLEMENTING AGENCY(IES) AND PARTNERS

- **Local government departments of public works, resource recovery, and/or water.** Oversees landfills, solid waste management and recycling, wastewater treatment operations and facilities.
- **VA Department of Professional and Occupational Regulation (DPOR)**. Oversees the Board for Waterworks and Wastewater Works Operators and On-site Sewage System Professionals, which licenses wastewater treatment facilities.
- **MD Department of the Environment**. Handles solid waste management and recycling in the state. MDE also oversees the Board of Waterworks and Waste System Operators, which sets standards for wastewater treatment plant operators.
- **Washington Suburban Sanitary District (WSSC Water)**. Provides water and wastewater treatment services for Prince George's and Montgomery County in Maryland.
- **WV Solid Waste Management Board (WVSWMB)**. The state agency is charged with helping local Solid Waste Authorities achieve their recycling goals through technical assistance and grants.
- **WV Department of Environmental Protection**. Oversees the Division of Water and Waste Management, which permits wastewater treatment facilities.
- **Additional state government agencies.** The Virginia Department of Environmental Quality, DC Water, and other agencies, where appropriate, will provide guidance and resources for implementation of this measure.
- **Local governments**. General oversight and policy implementation.
- **Private sector**. Including Solid Waste Authorities and privately-owned sanitation centers and wastewater treatment plants, and waste-related businesses support local and state governments in waste and wastewater treatment collection and management.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Proposed actions within this measure focus on increased access to composting, waste diversion practices, waste-to-energy facilities (such as water pollution treatment plants for biowaste), methane capture technology, and food waste reduction programs. These actions and programs will reduce waste sector emissions and provide multiple benefits to communities, including reduced air pollution and improved waste management in LIDACs. Actions to implement this measure could include, but are not limited to:

- Expand and offer new programs to implement waste prevention, recovery and recycling for food waste and other organics. This will include promoting the source reduction of food scraps, edible food recovery and increased recycling of food scraps, along with other organics, through composting, anaerobic digestion, and animal feed operations.
- Expand existing programs or establish new ones to enable using organic waste for compost, including yard trimmings and food waste, for curbside pickup. Collected organic waste will then be brought to a composting site, such as the Prince George's County's Organic Composting Facility in Maryland or Prince William County Balls Ford Road Composting Facility in Virginia, instead of being sent to landfills or waste-to-energy facilities such as the Covanta Fairfax incinerator. The Prince William Landfill is being developed into an Eco-park to capture methane and conduct anaerobic digestion of organic waste. Compost can then

be used to produce soil additives for growing foods and plants. Compost can be collected curbside in city or County-provided composting bins, as proposed below.

- Provide residential compost bins**.** Provide free compost bins to residents, similar to how many cities and counties provide residents with recycling bins. Residents can pick up a compost bin at a city or County sanitation center. They can use the bins at their home to participate in a city or County-run curbside composting program, as described above, or to start their own home composting operation.
- Encourage commercial composting. Establish an educational program to encourage businesses, including restaurants, universities, multi-resident buildings, and other entities to compost organics and food waste. Training and educational materials could highlight incentives such as GHG emissions reductions and cost savings on waste hauling costs. Cities and Counties could provide training materials for businesses, and potentially subsidize the cost of on-site composting vessels. Pairing this with additional investment in industrial composting facilities and an expanded compost collection program would further incentivize commercial composting.
- Provide commercial composting facilities with necessary. For example, de-packaging equipment to handle expired processed foods and Receiving Buildings with bio-filters to reduce volatile organic compounds.
- Invest in industrial composting facilities. Invest in organics and food composting operations at existing and new solid waste facilities, including composting, mulching, and landfill facilities. Current composting facilities in the metropolitan Washington region include the Prince George's County's Organic Composting Facility in Maryland and the Prince William County Eco-Park in Virginia. Enhancing composting operations across the region would build capacity for a residential curbside composting program, as well as composting from commercial stakeholders with larger quantities of organic waste.
- Support new infrastructure and transportation options for moving compost and organic waste to treatment or processing facilities.
- Support recycling activities including feeding animals and anaerobic digestion (AD) with beneficial use of digestate/biosolids.
- Obtain and use new cold storage systems to reduce food waste.
- Conduct waste education and public service campaigns. Educate the public to promote behavioral changes that encourage waste diversion at the source. Establish a public service campaign and disperse educational materials that encourage households to reuse and buy in bulk. Include education that focuses specifically on limiting single-use materials and food waste. Additionally, educate businesses on how they can reduce waste in their operations or implement composting systems, as described in the above action.
- Improve practices and technologies to increase waste reduction, reuse/recovery, and recycling for all waste streams.
- Support product innovation and policy. Enact policies to ban or tax wasteful single-use packaging (e.g., plastic bags, plastic straws, polystyrene). Additionally, establish a program, potentially a grant, to promote research and develop new product designs to replace wasteful products sold and used in industrial processes in the region.
- Establish landfill waste transfer stations and convenience centers. Establish government owned waste transfer stations that will service homeowners, small haulers, and large haulers. Waste collected at this facility will be transferred to other jurisdictions for processing, recovery, and disposal. The facility will incorporate a public convenience center,

which will assist with reuse and waste diversion initiatives. This action is being explored especially in Charles County, Maryland as their landfill nears capacity.

- Monitor, manage, and capture methane from landfills, food scrap/aerobic compost digester systems, and wastewater treatment plants for beneficial use.
- Use methane capture technology. Introduce methane capture technologies, such as anaerobic digesters or LFG collection systems, via regional pilot or demonstration projects. Ensure project data can be easily tracked and monitored, and that projects can be scaled up if deemed effective.
- Develop LFG-to-energy projects. Expand LFG treatment centers at landfills so that captured LFG can be converted into fuel for vehicles, electricity, and heating systems, rather than burned off.
- Develop wastewater heat exchange projects.
- Promote the electrification of the transportation sector to move food waste. Implement waste-to-energy equipment at regional wastewater treatment plants through available anaerobic digestion technology.
- Produce power for renewable fuel production, enhance power reliability for wastewater treatment plants, reduce biosolids production and prevent sanitary sewer overflows to improve water quality and protect public health.

There are limited barriers to implementing this measure, and with proper funding and support, many actions could be implemented in the near future.

AUTHORITY TO IMPLEMENT

The implementing authorities for this measure are state and county government agencies (e.g., Public Works, Department of the Environment, etc.) in partnership, where applicable, with private utilities, landfills, and composting facilities. Public waste management, demonstration projects, waste-related policies, and public education campaigns can all be carried out under the existing powers of local governments. Support from the private sector, including key implementers and partners mentioned above, will be required for projects that expand to private landfills and wastewater treatment centers.

GEOGRAPHIC COVERAGE

The actions within this measure are focused on the entire MSA.

FUNDING SOURCES

- EPA Solid Waste Infrastructure Recycling Grant Program
- EPA Consumer Recycling Education and Outreach Grant Program
- U.S. Department of Agriculture Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Guaranteed Loans and Grants

Benefits of Addressing Food Waste

Reducing, rescuing, and repurposing food waste can provide broader benefits to the region beyond GHG reductions. Addressing food challenges can bring health and nutritional benefits to LIDACs and reduce GHG emissions associated with food production and transportation, among many other benefits. Within the metropolitan Washington region, some jurisdictions have implemented the first stage of food waste prevention education campaigns (e.g., Montgomery County's Food Is Too Good To Waste campaign).

LIDAC BENEFITS

Using new and innovative technologies to manage longstanding community facilities such as landfills and treatment plants, which are often sited near low-income and overburdened areas, may result in not just a reduction of GHG emissions but also of odor, eye irritants, fugitive dust, sewer overflows, sewage backups, and other nuisance incidents that directly impact homes and businesses surrounding these locations. Exposure to hazardous materials may also be reduced. Expanding composting and other food waste reduction programs at the neighborhood and commercial level may spur the implementation of urban farming, community gardening, food distribution, farmers markets, and other programs which support farm to table programs, reduced organic waste, and other activities which may benefit LIDACs. Local farming, gardening, and composting programs also reduce the amount of organic waste from food in landfills, therefore reducing methane gas emissions, improving air quality in surrounding neighborhoods, and reducing overall GHG emissions.

SAMPLE METRICS FOR TRACKING PROGRESS

- Weight of waste diverted from landfills or waste-to-energy facilities
- Weight of waste composted
- Number of people reached via waste diversion education programs and public service campaigns (e.g., clicks, views, webinar attendees, flier passed out)
- Weight of biosolids diverted from land application
- GHG reductions and equivalencies

4.4 Land Use

ACCELERATE THE EXPANSION OF THE REGIONAL TREE CANOPY AND REDUCE TREE CANOPY LOSS.

Trees and the canopy they create provide numerous environmental, economic, and social benefits. For example, the tree canopy is important for mitigating the urban heat island effect and protecting communities from the increased temperatures that are a result of climate change and can reduce the cost of energy because of reduced need for air conditioning. Trees and other plants are also carbon sinks, removing CO_2 from the atmosphere and sequestering it in their structures. Trees also provide adaptation benefits by storing stormwater and surface water runoff in the surrounding soil, particularly in upstream areas. Trees reduce the occurrence and severity of flood events and prevent erosion.[33] This measure focuses on increasing tree canopies in urban and rural settings and preventing additional tree canopy losses. It involves planning, implementation, and management efforts on both private and public lands and working with community organizations and property owners to identify and implement strategies to increase tree canopy. Expanding green spaces in addition to tree canopy has the potential to increase sequestration potential of the land use sector.

QUANTIFIED GHG SEQUESTRATION AND RELEVANT GHG INVENTORY SECTOR

This measure reduces GHG emissions from the land use sector. Cumulative estimated GHG sequestration potential for this measure is:

GHG sequestration ($MMTCO_2e$), 2025-2030	GHG sequestration ($MMTCO_2e$), 2025-2050

[33] World Resources Institute. 5 Reasons Cities Should Include Trees in Climate Action. 2022. https://www.wri.org/insights/urban-trees-city-climate-action

0.47	3.94

Key assumptions, methods and data sources used to develop these quantified reduction estimates are provided in Appendix A.

KEY IMPLEMENTING AGENCIES AND PARTNERS

- **State department or divisions of natural resources or forestry.** Maintain and provide technical expertise and services for the maintenance and care of trees and other natural lands.
- **Chesapeake Tree Canopy Network.** Provides a platform for partners to share knowledge and best practices.
- **COG Regional Tree Canopy Subcommittee (RTCS).** A subcommittee dedicated to the management of both the tree and forest canopy. COG and its municipal partners are currently working to determine an implementation path for its integrated urban tree canopy management approach.
- **Local governments.** Local governments operate various programs that enhance tree canopy by planting, maintaining, and monitoring the health of trees on public land and operating programs to incentivize private landowners to plant trees.
- **Community organizations.** Local organizations can help inform the strategic placement of trees to benefit LIDACs.
- **Private landowners.** Can choose to voluntarily increase tree canopy on their land.

IMPLEMENTATION ACTIVITIES AND MILESTONES

Actions to implement this measure could include, but are not limited to:

- Use data and mapping tools to identify priority planting areas and track local and regional tree canopy coverage. Implement programs and tools to assist in care and maintenance of trees.
- Implement and expand partnerships with educational organizations to enable students to plant, monitor, and maintain trees. Teaching students how to manage trees (especially in LIDACs) can increase the public awareness of the benefits of tree canopy and expand capacity to plant and monitor trees.
- Support community gardens and small-scale urban agriculture.
- Review and strengthen local tree canopy-related policies and ordinances. Ensure that local policies are aligned to enable implementers to accelerate the expansion of tree canopy.
- Expand existing programs (e.g., the West Virginia Forestry Stewardship Program) or create new incentivizes for planting trees and forestry management on private land, communities, and developments.
- Fund investments on private land. Provide plans and funds to increase tree canopy in public lands such as in parks and forests, as well as on and around public schools, libraries, and government owned buildings and on publicly owned sidewalks that support safe access to transit and active transportation (e.g. walking, biking and micromobility).
- Adopt and implement policies that stimulate use of green infrastructure such as green roofs, green walls, green common areas.
- Design and install green infrastructure to supplement urban canopy in heat-intensive or vulnerable areas.

- Apply green infrastructure to trails, walkways, streets, and roads, integrating green with built infrastructure.

Many of these activities are ongoing but could be expanded or started in the coming years. COG has taken actions to promote increased tree canopy across the MSA. COG's *Tree Canopy Management Strategy*[34] describes the state of urban forest programs in the COG region as of 2018. COG's RTCS is recommending a tree canopy goal of 50% for the COG region as well as goals by land use type.

Programs such as Arlington County's Land Disturbance Activity Ordinance and Programs have resulted in nearly 170 Green Roofs, and the Green Streets Program has resulted in 14 completed projects.

Beyond the COG region, states across the MSA have also focused on goals and actions to increase and maintain tree cover. For example, the Virginia Department of Forestry's 2019 strategic plan has six strategic goals, that focus on protecting the forest resources and the community members of the Commonwealth from wildfire and reduce impacts to the forest from other threats and increasing the social, environmental, and economic benefits provided by trees and forests, among other priorities.[35]

AUTHORITY TO IMPLEMENT

Implementation authority for tree canopy expansion, preservation, or development on public land typically falls within the powers of the owning jurisdiction (e.g., a state natural resources or forestry agency). Public space tree planting and tree canopy maintenance falls to the owning jurisdiction. For private-owned land, consent of or actions from the landowner would be needed, and applicable covenants and zoning restrictions would need to be honored. Any applicable environmental regulations would also apply (e.g., managing stormwater and runoff). Smart growth and green development incentive programs are deployed by numerous cities and counties within COG territory, as well as local government programs for green infrastructure.

GEOGRAPHIC COVERAGE

The actions within this measure are focused on the entire MSA area.

FUNDING SOURCES

Example potential funding sources include:

- U.S. Department of Agriculture (USDA)
- U.S. Forest Service Urban and Community Forestry Grant
- Local government capital improvement program funds
- Foundation Grants

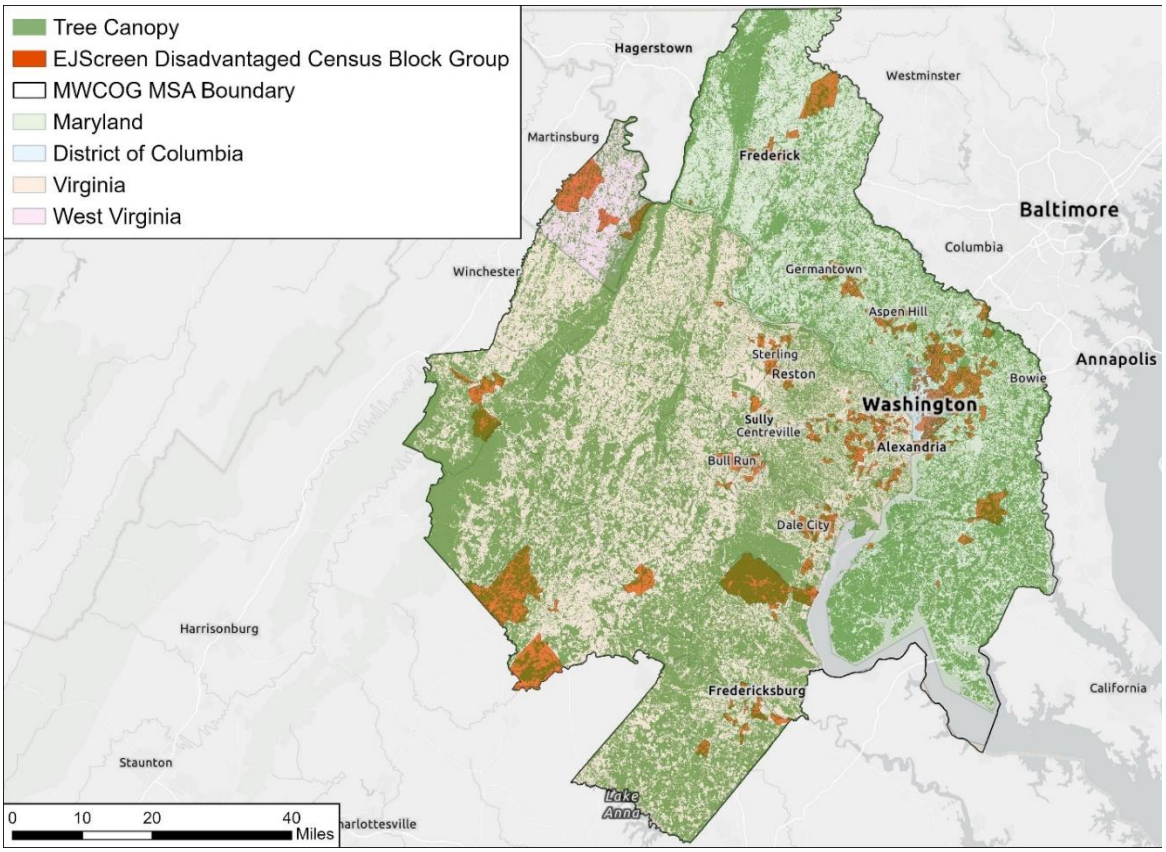
LIDAC BENEFITS

On average, LIDACs have less tree canopy than other areas, particularly urban settings (Figure 8). Increasing the tree canopy can provide cooling and stability benefits in areas within the urban core that are subjected to heat island effects. The regional tree canopy also provides health and aesthetic benefits to LIDAC communities. This measure will have a positive impact for LIDACs in the urban core where parks and green spaces have been preserved, and in rural and suburban settings where growth boundaries have been implemented to protect green space and the tree canopy. Educational

[34] https://www.mwcog.org/documents/tree-canopy-management-strategy/
[35] https://dof.virginia.gov/strategic-plan/

programs and participation opportunities for adults, teens, and children, including environmental stewardship experiences, can lead to greater awareness and further action in the community. Training and employment opportunities for both planting and maintenance of urban forests may benefit LIDAC members in terms of employment, training, and expanded canopy coverage as canopy restoration programs become more prevalent in cities and urban neighborhoods.

Figure 8. Tree Canopy Overlaid with Metropolitan Washington LIDAC Areas



SAMPLE METRICS FOR TRACKING PROGRESS

- Number of priority planting areas identified and addressed
- Tree canopy cover area
- Number of trees planted
- Number of new tree planting programs

4.5 Cross-Cutting Enabling Actions

All the priority GHG reduction measures identified above may be enabled or enhanced through various cross-cutting actions, such as the following.

- **Public education and engagement.** Education, marketing and outreach, and real-time data will accelerate the deployment of GHG reduction technologies, stimulate passive house and/or smart growth standards that incorporate green infrastructure, facilitate behavior changes, and increase participation in climate and energy programs. Targeting education and engagement efforts on LIDACs by partnering with community leaders and CBOs that

represent LIDACs will help bring additional awareness and benefits to these populations. Conducting marketing research to understand barriers and incentives to adoption can help increase program uptake.

- **Build the clean energy workforce.** An expanded and well-trained workforce is critical to implement the breadth and depth of GHG reduction measures in this plan, beginning with education for building owners, architects, designers, and contractors to influence climate-facing development from the design phase. This also includes developing new programs or expanding existing ones to provide training, paid internships, and job opportunities for a clean energy workforce. Some of these opportunities should be focused in LIDACs to bring benefits to these communities.
- **Leverage or establish umbrella organizations to support centralized resources.** Deploying shared resources and funding through a centralized program for implementation-ready projects or pooling resources to accelerate climate action for a set list of climate actions and technologies that benefit multiple jurisdictions can create administrative and other efficiencies. Providing technical assistance can assist stakeholders in completing projects.
- **Clean energy financing.** Clean energy financing and incentives to increase clean energy, energy efficiency, and fuel switching will accelerate the deployment of GHG reduction measures by overcoming capital and funding barriers. Clean energy financing mechanisms may include green banks, green financing, commercial PACE programs, interest rate buy downs, grant or rebate programs, a revolving loan fund (e.g., green bonds, clean energy loans), Energy Savings Performance Contract (ESPC), as well as grants and rebates.

5 NEXT STEPS

COG, state governments (including D.C. DOEE), local governments, and other related entities across the MSA are eligible to participate in the general competition for CPRG implementation grants, competing against other entities nationally for up to $4.6 billion in funding through individual grants ranging from $2 million to $500 million each ($300 million is set aside for tribes and territories). Implementation grant applications are due April 1, 2024, with awards anticipated in 2024.[36]

As the lead organization for CPRG planning deliverables, COG is also responsible for developing a CCAP by mid-2025 and a Status Report on CCAP progress in 2027.

The 2025 CCAP will include:

- An updated GHG inventory for the MSA
- BAU GHG emissions projections and an economy-wide GHG emissions reduction scenario
- GHG reduction targets for the MSA (short- and long-term)
- A comprehensive list of GHG reduction measures that address economy-wide emissions. Building on the PCAP, this will include the following for each measure:
    - Quantified estimates of GHG reduction and costs
    - Key implementing agency or agencies
    - Implementation schedule and milestones
    - Expected geographic location

[36] For more information about the implementation grant applications and competition see: https://www.epa.gov/inflation-reduction-act/about-cprg-implementation-grants.

- Quantified estimates of co-pollutant reductions (e.g., $PM_{2.5}$, NOx, SO_2, VOCs, air toxics)
- A more robust or quantified analysis of benefits for LIDACs
- A review of the statutory or regulatory authority to implement the measure (and a schedule and milestones for key entities to obtain authority if not existing)
- Identification of funding sources that have been secured for implementation
- Metrics for tracking progress
- A workforce planning analysis

The 2027 CPRG Status Report will include:

- The implementation status of the quantified GHG reduction measures from the CCAP
- Relevant updated analyses or projections supporting CCAP implementation
- Next steps and future budget or staffing needs to continue CCAP implementation

COG will continue to meaningfully engage with stakeholders, including local governments, state governments, industry, community organizations, tribes, a matrix of stakeholders (e.g., Commissions, Committees, academic and research resources, CBOs, foundations, and institutions), and the public throughout the development of the CCAP and in the implementation of climate actions throughout the MSA.

APPENDIX A. GHG INVENTORY, BUSINESS-AS-USUAL PROJECTIONS, AND GHG REDUCTION MEASURE QUANTIFICATION

GHG Inventory

For the CPRG, COG produced a 2020 GHG inventory for the MSA. COG leveraged and expanded its existing GHG inventory and projections for the COG region to cover the entire MSA. COG used the existing 2020 GHG inventory for portions of the MSA that fall within COG's geographic scope. To incorporate counties and cities in the broader MSA COG region, COG sought additional data sources and approaches to prepare a 2020 GHG inventory for the full MSA.

COG completes GHG community-scale inventories for all 24 local government members, Northern Virginia, and metropolitan Washington. COG makes every effort to capture an accurate picture of GHG trends for each of its local government members, while also providing for a consistently applied methodology across all its members' communities. Local inventory results are added together to get the total regional GHG emissions. The emissions attributed to the additional MSA jurisdictions that have been incorporated into COG's 2020 inventory have been calculated as a whole for most sectors included in this inventory.

COG GHG inventories are compliant with both the U.S. Communities Protocol for Accounting and Reporting Greenhouse Gas Emissions (USCP) and Global Protocol for Community-Scale Greenhouse Gas Inventories (GPC). COG inventories use public data readily available on a consistent basis. While both accuracy and consistency are important to GHG inventories, consistency is given a higher priority. COG used global warming potential (GWP) factors from the Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC AR4).

The inventory follows an activities-based approach, meaning emissions are calculated based on the result of an activity happening in a community. An example of this is that solid waste emissions are calculated based on the tonnage of trash the community sends to a landfill(s). Simply because they do not have a landfill within their jurisdiction's boundaries, does not mean that they are not contributing to landfill emissions.

The broad categories of emission types covered by COG's GHG inventory work include the built environment (including some process and fugitive emissions), transportation and mobile emissions, waste (solid waste and wastewater), and some land use (agriculture, forests, and trees outside of forests). Most of these sectors, except land use, are required elements to be compliant with the USCP and GPC.

The gases calculated within these inventory records include carbon dioxide (CO2), methane (CH4), Nitrous oxide (N2O), Hydrofluorocarbons (HFCs), and Perfluorocarbons (PFCs).

CLEARPATH

ICLEI's ClearPath tool is an online tool for preparing local GHG inventories, forecasts, climate action plans, and monitoring reports. The tool is consistent with both US and global accounting protocols. COG uses the Community Scale Inventory Module to support completing its GHG inventory work for its members and the region. Some of the tool's calculators are used to calculate emissions as

inventory records are created, while in other instances, emissions are calculated outside the tool and recorded in the inventory record.

COVID-19 IMPACTS

The COVID-19 pandemic has had far-reaching impacts on the global economic and social system. Pandemic impacts on GHG emissions are largely due to reduced economic and travel activity. Globally, the pandemic impacted GHG emissions by 4-5% in 2020. The state of Maryland estimates the pandemic had a 4% impact on GHG emission reduction in 2020. COG estimates the pandemic had a 4-6% impact on metropolitan Washington's 2020 GHG emissions.

The pandemic impacted the anticipated reduction in a few key sectors of metropolitan Washington's 2020 GHG emissions inventory. Emissions from the built environment were lower than projected for 2020, in part due to the pandemic; however, the grid getting cleaner and weather impacts also played a role. Emissions from the transportation sector were lower than previously projected for 2020 because less people were on the roads and flying during the height of the pandemic. Finally, solid waste emissions were overall lower than projected for 2020. However, waste that would have been generated and collected from businesses were generated within individual residences during the height of the pandemic and thus it did not make a significant impact on overall GHG emissions in 2020.

BUILT ENVIRONMENT

Residential and Commercial Electricity

Residential Electricity accounts for emissions resulting in electricity use in residential buildings. Commercial Electricity accounts for emissions resulting in electricity use in commercial, government, industrial, and other non-residential buildings and facilities. The Residential and Commercial Electricity emission calculations for the COG member jurisdictions follow the USCP recommended methodology as outlined in Appendix C, BE.2.1 from Version 1.2 of the Protocol. COG annually collects aggregated account and consumption data from the seven electric utilities that serve metropolitan Washington.

Calculations of Residential and Commercial Electricity emissions for the additional MSA jurisdictions also follow the USCP recommended methodology as outlined in Appendix C, BE.2.1 from Version 1.2 of the Protocol. The residential electricity methodology estimates consumption in kilowatt hours (kWh) by multiplying the estimated number of households using electricity with per household electricity consumption data. The Energy Information Administration (EIA) has readily available electricity energy intensity data for the South Atlantic region and the US Census Bureau American Community Survey (ACS) has readily available data on number of households using electricity. The Commercial Electricity methodology estimates consumption by calculating the percent of commercial square footage using electricity. Values for commercial building square footage using electricity are scaled locally by multiplying the local jurisdictional commercial square footage by the percentage of commercial building square footage using electricity in the broader South Atlantic region. These values, in turn, were multiplied by the electricity energy intensity in kilowatt hours per square foot ($kWh/ft.^2$) to get total electricity consumption in kWh per additional MSA jurisdiction.

Electricity consumption data and EPA eGRID emission rates are used to calculate emissions. EPA eGRID Subregions leveraged to complete the MSA inventory include RFC East (RFCE), RFC West (RFCW), and SERV Virginia/Carolina.

Residential and Commercial Natural Gas

Residential and Commercial Natural Gas consumption accounts for combustion emissions from stationary fuel applications, such as boilers and furnaces. The Residential and Commercial Natural Gas emission calculations for the COG member jurisdictions follow the USCP recommended methodology as outlined in Appendix C, BE.1.1 from Version 1.2 of the Protocol. COG annually collects aggregated account and consumption data from the three natural gas utilities that serve metropolitan Washington, which is used to complete emission calculations using this methodology.

Calculations of Residential Natural Gas emissions for the additional MSA jurisdictions follow the USCP recommended methodology as outlined in Appendix C, BE.1.2 from Version 1.2 of the Protocol. This methodology estimates residential utility natural gas consumption in therms by multiplying the estimated number of households using utility natural gas in each jurisdiction with per household natural gas consumption data for the South Atlantic region. The EIA Residential Energy Consumption Survey (RECS) has readily available utility natural gas energy intensity data for the South Atlantic region and the ACS has readily available data on number of households using utility natural gas.

Calculations of Commercial Natural Gas emissions for the additional MSA jurisdictions follow the USCP recommended methodology as outlined in Appendix C, BE.1.3 from Version 1.2 of the Protocol. The Commercial Natural Gas methodology estimates consumption by calculating the percentage of square footage using natural gas. Values for commercial building square footage using utility natural gas are scaled locally by multiplying the local jurisdictional commercial square footage by the percent of commercial building square footage using utility natural gas in the broader South Atlantic region. These values, in turn, were multiplied by the natural gas energy intensity in therms per square foot (therms/ft.^{2}) to get total natural gas consumption in therms per additional MSA jurisdiction.

Residential Fuel Oil and Liquefied Petroleum Gas (LPG)

Fuel oil accounts for both distillate fuel oils and kerosene used in stationary applications. LPG refers to a group of hydrocarbon gases derived from crude oil refining or natural gas processing. Propane is the most common LPG. The Residential Fuel Oil and LPG emissions calculations follow the USCP recommended methodology as outlined in Appendix C, BE.1.2 from Version 1.2 of the Protocol. This methodology estimates residential fuel oil and LPG consumption in gallons by multiplying the estimated number of households using fuel oil or LPG as a home heating fuel in the region and each jurisdiction with the respective residential fuel oil or LPG energy intensity data for the region. Gallons are used to estimate emissions.

Local data on households and consumption related to fuel oil and LPG is not readily available for all MSA members. However, the EIA Residential Energy Consumption Survey (RECS) has readily available fuel oil and LPG energy intensity data for the South Atlantic region and the ACS has readily available data on number of households using fuel oil and LPG as a home heating fuel.

Commercial Fuel Oil and LPG

The Commercial Fuel Oil and LPG emissions calculations follow the USCP recommended methodology as outlined in Appendix C, BE.1.3 from Version 1.2 of the Protocol. These methodologies calculate percentage of square footage using fuel oil or LPG. Values for commercial building square footage using fuel oil or LPG are scaled locally by multiplying the local jurisdictional commercial square footage by the percentage of commercial building square footage using fuel oil or LPG in the broader South Atlantic region. These values, in turn, are multiplied by the fuel energy intensity in gallons per square foot (gallons/ft.^{2}) to get total fuel oil or LPG consumption in gallons per locality and region. Gallons are used to estimate emissions.

The number of commercial buildings and total square footage for each MSA jurisdiction is readily available from the CoStar Commercial Property Records. There is not data readily available on stationary fuel use for these buildings. The EIA does have data available for larger regions on total commercial buildings and square footage; number and square footage of buildings using fuel oil or LPG; and energy intensity. EIA's South Atlantic region in the Commercial Building Energy Consumption Survey (CBECS) includes DC, MD, VA, DE, WV, NC, SC, GA, and FL.
Process and Fugitive Emissions

Natural Gas Fugitive Emissions

Natural Gas Fugitive Emissions accounts for emissions resulting from local natural gas system losses within the community. The Fugitive Emissions from Natural Gas emission calculations use a ClearPath calculator. The fugitive emissions are calculated based on a leakage rate for total annual natural gas consumption. The ClearPath calculator uses a leakage rate of 0.3 percent. Data from the Metropolitan Washington Annual Utility survey needs to first be collected and analyzed for the inventory year prior to completing these steps.

Hydrofluorocarbon Emissions

Hydrofluorocarbons (HFCs) are a type of GHG and are comprised of several organic compounds composed of hydrogen, fluorine, and carbon. HFCs are produced synthetically and are commonly used in air conditioning and refrigerants. HFC emissions in this inventory represent GHG emissions from substitutions for ozone depleting substances. The U.S. EPA annual inventory reports on GHG emissions calculates nationwide emissions for substitutes for ozone depleting substances. Total U.S emissions from substitutes for ozone depleting substances are scaled locally by population to estimate regional values. Local data on substitutes for ozone depleting substances is not available. It would take extensive research and local surveys to develop this data.

TRANSPORTATION AND MOBILE EMISSIONS

On-Road and Off-Road Mobile Emissions

On-Road Mobile Emissions represent exhaust and evaporative emissions of carbon dioxide (CO2), nitrous oxide (N2O), and methane (CH4) from on-road passenger and freight motor vehicles. The mobile off-road equipment data category includes all mobile source emissions that do not operate on roads, excluding commercial marine vehicles, railways, and aircraft. The MSA inventory uses EPA's National Emissions Inventory (NEI) data for on-road mobile emissions and Off-road mobile emissions estimates. COG region inventories typically use EPA MOVES model for these calculations; however, data and modeling are not available for the full MSA.

Passenger Air Travel

Passenger air travel emissions account for commercial aircraft emissions from major commercial airports serving the MSA. The Passenger Air Travel emission calculations generally follow the USCP recommended methodology as outlined in Appendix D, TR.6.D from Version 1.2 of the Protocol. COG's approach uses the best available data to estimate air travel passenger emissions by airport and includes personal travel and business travel by people who live, work, or were visiting an MSA jurisdiction. This includes all air passengers leaving from Ronald Reagan Washington National Airport (DCA) and Washington Dulles International Airport (IAD). COG estimates air travel passenger emissions for air passengers leaving from Baltimore-Washington International Thurgood Marshall Airport (BWI) by allocating emissions by the percent of passengers traveling from COG member jurisdictions to the airport.

To estimate emissions per airport, national aircraft emissions are downscaled based on the local to national ratio of revenue passenger miles for BWI, DCA, and IAD. This approach does not account for aircraft emissions and air passengers that are, for instance, flying into IAD and taking a connecting flight elsewhere. For all originating air passengers departing from the region's three commercial airports – BWI, DCA, IAD – the biennial Washington-Baltimore Regional Air Passenger Survey provides readily available origin-destination data for base and forecast years. There is also readily available data on commercial aircraft emissions and passenger miles traveled for the airports serving the region through EPA and the Bureau of Transportation Statistics, respectively.

Commuter Rail

Commuter Rail Transportation calculates emissions resulting from Maryland Transit Administration (MTA) MARC and Virginia Railway Express (VRE) trains carrying commuters from Maryland and Virginia. The Commuter Rail Transportation emission calculations generally follow the USCP recommended methodology as outlined in Appendix D, TR.4 from Version 1.2 of the Protocol. In this approach, emissions are calculated from annual diesel consumption of commuter rail operators.

Diesel consumption of commuter rail systems (code CR) is readily available via the Federal Transit Administration's (FTA) National Transit Database. MTA reports diesel consumption for their full commuter rail operations, some of which occur outside the MSA. MTA annual diesel consumption is attributed to the MSA by the percent of stations located in the MSA – 63 percent of MTA's MARC stations are in the MSA.

WASTE

Solid Waste

Landfill Waste Generation accounts for the emissions resulting from waste generated by the community in a year and disposed of at a landfill. The Landfill Waste Generation emission calculations follow the USCP recommended methodology as outlined in Appendix E, SW.4 from Version 1.2 of the Protocol. The calculations are based on tons of municipal solid waste (MSW) from local jurisdictions going to a landfill and whether the receiving landfills have methane capture. The EPA FLIGHT Tool was used to identify whether a landfill that regularly receives MSW from the region has methane collection. COG also gathered information on landfill methane collection efficiency from jurisdictions or landfill operators.

The Combustion of Solid Waste accounts for the emissions resulting from the tons of MSW generated by the community in a year and disposed of at a waste-to-energy (WTE) facility. The Combustion of Solid Waste Generated by the Community emission calculations follow the USCP recommended methodology as outlined in Appendix E, SW.2.2 from Version 1.2 of the Protocol.

The best available MSW data from local and regional sources was used to calculate these emissions. Unlike other activities in this inventory, there is no regional, state, or federal source of MSW data that comprehensively reports data in the way needed for GHG inventory calculations.

Wastewater

Septic Systems Emissions account for the fugitive emissions resulting from the physical settling and biologic activity during the treatment process in septic tanks. The Fugitive Emissions from Septic Systems calculations follow the USCP recommended methodology as outlined in Appendix F.WW.11 from Version 1.2 of the Protocol. The methodology estimates GHG emissions based on the population served by septic.

Sewer System Emissions accounts for N2O emissions during the treatment process at wastewater treatment plants (WWTPs). The Nitrification/Denitrification Process N2O Emissions from Wastewater Treatment calculations follow the USCP recommended methodology as outlined in Appendix F.WW.7 from Version 1.2 of the Protocol. The methodology estimates GHG emissions based on the population served by sewer.

N2O Effluent Discharge Emissions account for the emissions resulting from treated wastewater that flows out of a treatment facility and is discharged into waterways. The Process N2O from Effluent Discharge to Rivers and Estuaries calculations follow the USCP recommended methodology as outlined in Appendix F.WW.12 from Version 1.2 of the Protocol. The methodology estimates GHG emissions based on the population served by sewer and daily Nitrogen loads. Data inputs on Nitrogen loads are downloaded from EPA Chesapeake Bay Program's Chesapeake Assessment Scenario Tool (CAST). This data represents a simple average of the annual loads recorded by the Bay Program.

The Regional Wastewater Flow Forecast Model (RWFFM) and COG Cooperative Forecasts are leveraged to estimate populations served by sewer and septic. For jurisdictions not included in COG's Cooperative Forecast, population data are acquired from the ACS.

LAND USE

Agriculture

Emissions from agricultural activities include enteric fermentation, manure management, and ag soils. Enteric fermentation accounts for the methane produced from animal digestion in cows, sheep, goats, swine, and horses. Manure management accounts for emissions from management systems that stabilize or store livestock manure. Ag soils account for nitrous oxide (N2O) emissions from animals, crop production, and fertilizer application.

Agricultural sources and activities relevant to the MSA were calculated using EPA's State GHG Inventory Tool. MSA data inputs into the EPA's State GHG Inventory Tool are pulled at the county-scale from CAST. CAST is a web-based nitrogen, phosphorus, and sediment load estimator tool that streamlines environmental planning in the Chesapeake Bay watershed.

Forests and Trees Outside Forests

Forests and trees outside of forests sequester CO2 during photosynthesis and act as a carbon sink. If removed, they can be a source of emissions. ICLEI's Land Emissions And Removals Navigator (LEARN) tool estimates the local GHG impacts of forests and trees outside of forests. This tool provides information on land cover, including forest cover and change. Forested areas are defined as greater than 1-acre while trees outside forests are individual trees or trees in small patches less than 1-acre. LEARN combines methods outlined in the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions Appendix J with national and regional data sources to derive a first-order approximation of annual GHG impacts over a given time period. The time period analyzed for forests is 2013-2019 and is applied to the 2020 GHG inventory.

Business-as-Usual Projections

BAU projections account for driving factors such as growth in population, housing and commercial development, and transportation patterns, and estimate the impact they will have on future GHG emissions. BAU projections reflect policies and practices that are currently in place and implemented to-date to reduce GHG emissions, but do not incorporate any additional GHG emission reductions

from anticipated future action. The BAU projections for Residential and Commercial Electricity do not reflect the Renewable Portfolio Standard (RPS) policies that have been adopted in the District of Columbia, the state of Maryland, and the Commonwealth of Virginia. Instead, EPA's 2020 eGRID emission factors have been kept constant out to 2050. The impacts of policies that accelerate the deployment of clean energy, such as RPS policies, are reflected in this PCAP's priority GHG reduction measures. Table 7 provides a summary of BAU assumptions used in the development of BAU projections for this PCAP.

Table 7. BAU Assumptions

Emissions Activity	BAU Assumptions
Residential Energy	COG Cooperative Forecasts Round 10.0 household growth by COG member jurisdiction
	Applied to typical housing mix in each community (Single Family Detached, Attached, Apartments 2-4 Units, Apartments 5+ Units)
	Typical energy use intensity by housing type
Commercial Energy	10.0 Cooperative Forecasts employment growth by COG member jurisdiction
	Historic job growth & commercial construction -> SQFT new construction / job
	New building mix by Core, Inner, Outer areas from COG Commercial Construction Report
	Typical energy use intensity by building type (office, retail, flex/other)
On-Road Mobile Emissions	Adopted Transportation Planning Board projections from Vision 2045
	Transportation Demand Model 2.3.75
	Uses Visualize 2045 Transportation Networks & 9.1a Cooperative Forecasts as inputs
	EPA MOVES2014b
	Incorporates incremental improvements in average fuel economy
Air and Rail Travel	Passenger growth based on COG Regional Air Passenger Origin/Destination Forecast
	Percent increase derived from Transportation Planning Board projections of future ridership
Off-Road Mobile Emissions	Held constant
Agriculture	All sources (soils, livestock, manure) decreased at annual rate of recent loss in farmland (2007-2012) from COG What our Region Grows Report, 2017 (Note: the COG region rate was applied to the full

	MSA in the absence of more specific data for additional MSA jurisdictions)
Waste (Solid Waste and Wastewater), HFCs	Proportional increase with population
Fugitive Natural Gas	Driven by increases in natural gas consumption

GHG Reduction Measure Quantification

The following is a summary of methods used for calculating GHG emission reductions in the COG PCAP. In developing these values, modeling assumptions were made to determine reasonable GHG emissions reductions from the deployment of specific measures. In some instances, already existing modeling efforts were used, these situations are noted below. Additionally, in some cases, there may be areas of overlap between emissions reduction values between measures. For example, electricity emissions factors associated with a progressively cleaner grid were used to determine emissions reduction potential for a range of measures (such as efficiency and electrification). This might result in double counting when comparing it to the clean and renewable energy measure, which also accounts for emissions reductions from cleaner electricity.

ACCELERATE THE DEPLOYMENT OF ENERGY EFFICIENCY SOLUTIONS AND DECARBONIZATION OF RESIDENTIAL, INSTITUTIONAL, MUNICIPAL, AND COMMERCIAL BUILDINGS.

This measure calculated emissions reductions from electrification and energy efficiency in the building sector. Building energy use and building emission projections are based on energy consumption from electricity, natural gas, fuel oil, and propane in existing residential (single-family, multifamily, and mobile homes) and commercial buildings (office, food service, school, hotel, healthcare, retail, and warehouse).

CO_2Sight™ utilizes ICF's Distributed Energy Resources (DER) Planner model for modeling existing buildings. DER Planner is a bottom-up model that is built upon the best practice principles for potential modeling outlined by the National Action Plan for Energy Efficiency in their Guide for Conducting Energy Efficiency Potential Studies. The model can be used to calculate technical, economic, and achievable potential estimates. Together, the CO_2Sight platform and DER Planner estimate energy and emissions changes from a range of decarbonization strategies, including electrification retrofits and energy efficiency.

DER Planner, informed by stock CO_2Sight measures data, has the capabilities to model various energy efficiency, electrification, and building envelope measures in selected building types. This tool allows the analysis of over 80 residential and commercial measures in selected regions applied to the Pennsylvania building characteristics. The model uses key inputs such as equipment stock, participation rate curves, and energy change per measure and estimates potential savings from applying efficient measures available for each building type and end-use. Given the efficient technologies available, this quantifies how much energy could be reduced. To compute total savings potential, the model runs all permutations combining savings per energy efficiency measure unit,

expected measure penetration, and total number of measure units (or total eligible stock) by all adoption types.

By integrating DER Planner and comprehensive datasets such as ResStock and ComStock, CO_2Sight aggregates energy and emissions changes to estimate changes in energy use. The base year and projections for energy consumption in existing buildings are built from the 2022 Annual Energy Outlook (AEO), which represented projected energy user prior to the passage of the IRA, from the U.S. EIA. AEO data are scaled to cover the MSA by scaling AEO Census level data with the ResStock and ComStock building models of North American building stock with county-level resolution. The model calibrates ComStock and ResStock energy consumption to AEO energy consumption on a Census division level. Then the modeling proportionally adjusts county-level energy consumption to the scaled Census division level. Energy use values have been integrated with emissions factors for primary fuels (electricity, gas, propane and fuel oil) to provide total emissions. Results are provided every five years from 2020 to 2050 and interpolated for years in between.

For the MSA, modeling assumed an accelerated electrification scenarios for HVAC as well as Water Heating and Cooking, and a high scenario for building envelope implementation, in alignment with sources outlined below.

As an input into DER Planner, each measure has participation (or technology adoption curves) connected to them. A range of factors can impact whether new electric or efficiency technologies are adopted. This approach builds from NREL's Electrification Future Study,[37] from which many of the adoption curves are provided. It accounts for costs, supporting infrastructure, ownership and availability, health and sustainability (including policies) and other factors that could influence technology change. Adoption curves are also provided from the implementation energy efficiency programs and informed by ICF expertise. For ease of use, users can select prepopulated groupings of participation curves to match the types of energy change they want to model. The groupings are outlined below:

HVAC, Water Heating, and Cooking Pathways

- Business-as-Usual: Small amount of energy efficiency, no specific electrification strategy or fuel switching
- Gas Efficiency: Significant amount of energy efficiency, no electrification, specific emphasis on efficiency for gas equipment. Gas heat pumps in future years.
- Beneficial Electrification: Significant amount of energy efficiency, small amount of electrification for those projects that are presently cost-effective.
- End of Life Electrification: Significant amount of energy efficiency, large amount of electrification when equipment reaches the end of its useful life.
- Accelerated Electrification: Signification amount of energy efficiency, large amount of electrification prior to equipment reaching the end of its useful life.

Water Heating and Cooking Pathways

- Business-as-Usual: Small amount of energy efficiency, no specific electrification strategy or fuel switching

[37] https://www.nrel.gov/analysis/electrification-futures.html

- Gas Efficiency: Significant amount of energy efficiency, no electrification, specific emphasis on efficiency for gas equipment. Gas heat pumps in future years.
- Beneficial Electrification: Significant amount of energy efficiency, small amount of electrification for those projects that are presently cost-effective
- End of Life Electrification: Significant amount of energy efficiency, large amount of electrification when equipment reaches the end of its useful life
- Accelerated Electrification: Signification amount of energy efficiency, large amount of electrification prior to equipment reaching the end of its useful life

Building Envelope Pathways

- Business-as-Usual: Small amount of energy efficiency on building envelope
- Low: Moderate building envelope work, some deep energy retrofits
- High: Significant building envelope work, Significant deep energy retrofits

In addition to HVAC; Water Heating and Cooking Pathway selection being chosen, there are opportunities to influence core energy efficiency work occurring in each pathway including:

- Full lighting retrofits and lighting controls
- Smart Thermostats and Building Automation Systems
- New energy efficient appliances
- New energy efficient HVAC equipment

CO_2Sight uses ICF's Integrated Planning Model (IPM) to generate a trajectory of grid emissions factors associated with the electricity grid. Emissions factors for this measure were derived from the Net Zero Electricity Grid measure. Values from EPA's Center for Corporate Climate Leadership GHG Emission Factors Hub were used for natural gas and propane reductions.[38]

ACCELERATE THE DEPLOYMENT OF CLEAN AND RENEWABLE ENERGY.

The potential GHG emission reductions from increased distributed solar adoption were estimated using a combination of NREL datasets, information on existing distributed solar systems in the region, and regional goals for increased adoption of distributed solar. The data are representative of the COG region, rather than the CPRG MSA territory, but is used as a proxy for rooftop solar potential for this measure.

From NREL's dataset on rooftop solar potential in the U.S., an average kW potential for solar per building was derived using data for zip codes in the region. The average system size metric was applied to the 2030 COG goal of 250,000 solar rooftops in the region to estimate the kW solar potential by 2030. The region's population growth rate was used to continue growing the number of rooftop solar systems in the region through 2050. To calculate the kWh of solar output, the capacity factor for residential solar from NREL's annual technology baseline was used. The incremental growth in solar output from current levels, multiplied by the grid emissions factor from the 2023 AEO Reference Case, resulted in the potential avoided emissions from rooftop solar. The grid emissions factor used was the average of the PJMD and PJME AEO regions for CO_2 emissions factors. The CO_2 emissions factors were combined with the CH_4 and N_2O eGRID emission factor data from the SRVC

[38] https://www.epa.gov/climateleadership/ghg-emission-factors-hub

and RFCE regions to estimate a CO_2e emission factor representing the MSA. The results are summarized in Table 8 and Table 9.

Table 8. Summary Results

Summary Outputs	2022 (Existing)	2030	2050
Buildings with Rooftop Solar	72,701	250,000	287,372
Rooftop Solar Capacity (kW)	807,339	2,797,242	3,215,394
Rooftop Solar Output (MWh)	1,050,235	3,638,820	4,182,777

Table 9. Cumulative GHG Reductions Over Time

Cumulative GHG Reductions (MTCO2e)	2025-2030	2025-2050
Distributed Renewables Measure	2,658,847	11,244,812

Data sources used include:

- Rooftop Solar Photovoltaic Technical Potential in the United States: A Detailed Assessment (2016), NREL Technical Report and dataset
- 2023 Electricity Annual Technology Baseline, NREL
- AEO 2023 Reference Case, electric grid emissions factor data
- EPA eGRID, electric grid emissions factor data, 2020
- COG data collection for existing distributed solar systems in the region
- COG community cooperative forecast, population growth projections

STUDY, PLAN FOR, AND DEPLOY DISTRICT ENERGY AND MICROGRID OPPORTUNITIES.

In 2011 COG worked with FVB Energy Inc to study potential benefits and costs of generalized example district energy systems in the region. This report, "Development of Cost Benefit Information and Business Case for Integrated Community Energy Solutions, Final Report" analyzed the benefits of the application of various generalized example district energy system types to a comparison building. Table 10 presents information from this study in terms of energy consumption differences between applied district systems and the comparison building, emission factors used for the year 2025, and conversion factors used to arrive at annual GHG emissions and GHG reductions for different system types.

To calculate the cumulative GHG reductions over time, varying emission factors for the grid were applied, consistent with other measures analyzed. For the comparison building, grid emission factors were held constant over time.

Table 10. DE System Types

Annual DE System Energy Consumption	Boilers and chillers	Engine CHP	Turbine CHP	Combined cycle CHP	Biomass Boiler	GSHP	Waste Heat	Solar
Gas (mmbtu)	339,845	1,335,623	1,118,251	1,442,068	49,319	94,763	150,313	261,856
Grid power (mmbtu)	256,223	(1,266,944)	(737,520)	(1,493,840)	215,443	489,447	256,223	256,223
Annual Comparison Building Energy Consumption								
Gas (mmbtu)	335,616	335,616	335,616	335,616	335,616	335,616	335,616	335,616
Grid power (mmbtu)	254,853	254,853	254,853	254,853	254,853	254,853	254,853	254,853
% Change in Annual Energy Consumption with DE System	1%	-88%	-36%	-109%	-55%	-1%	-31%	-12%
Conversion and Emission Factors								
kwh/mmbtu	293.071070							
mtCO2e/mmbtu (gas)	0.053115							
mtco2e/kwh (grid power, 2025)	0.00027							
mtco2e/kwh (grid power, BAU, 2025)	0.00029							
Annual DE System GHG Emissions								
Gas ($mtCO_2e$)	18,051	70,941	59,395	76,595	2,620	5,033	7,984	13,908
Grid power ($mtCO_2e$)	20,130	(99,535)	(57,942)	(117,361)	16,926	38,453	20,130	20,130
Annual Comparison BAU Building GHG Emissions								
Gas ($mtCO_2e$)	17,826	17,826	17,826	17,826	17,826	17,826	17,826	17,826
Grid power ($mtCO_2e$)	21,711	21,711	21,711	21,711	21,711	21,711	21,711	21,711
% Reduction in Annual GHG Emissions with DE System	-3%	-172%	-96%	-203%	-51%	10%	-29%	-14%

PROVIDE AND PROMOTE NEW AND EXPANDED OPPORTUNITIES TO REDUCE VMT THROUGH PUBLIC TRANSPORTATION, NON-MOTORIZED TRAVEL, MICROMOBILITY, SHARED TRAVEL OPTIONS, AND DEVELOPMENT.

The measure models the resulting GHG emissions reduced if the MSA achieves the VMT reductions modeled for scenario MS.4 of the *TPB Climate Change Mitigation Study of 2021: Additional Transportation Scenarios Analysis*. This scenario models a variety of strategies to reduce VMT, including land use changes, reduction in transit travel times, telework, and increased walk and bike access, and uptake of micromobility. These strategies result in VMT reduction for passenger vehicles only. The same baseline VMT, vehicle population, energy consumption, and emissions by fuel type and vehicle source type from EPA MOVES4 used for the low- and zero- emissions measures were used for this measure as well. This analysis sourced data from EPA MOVES4, the TPB Climate Change Mitigation Study of 2021 Additional Transportation Scenarios Analysis (June 2022),[39] and eGRID.

ACCELERATE THE DEPLOYMENT OF LOW- AND ZERO-EMISSIONS TRANSPORTATION, FUELS, AND VEHICLES.

The measure models the resulting GHG emissions reduced if the MSA meets the ZEV targets outlined in scenario VT.1 of the TPB Climate Change Mitigation Study of 2021:

- 50% of new light-duty vehicle (LDV) sales are ZEVs in 2030, with 100% by 2040,
- 30% of new medium/heavy-duty (MHD) truck sales ZEVs in 2030, with 100% by 2050, and
- 50% of buses on the road are ZEVs in 2030, with 100% in 2050.

The model uses outputs from the EPA Motor Vehicle Emissions Simulator (MOVES4) to project baseline VMT, vehicle population, energy consumption, and Scope 1 emissions for on-road transportation in the MSA by fuel type (gasoline, diesel, ethanol (E-85), compressed natural gas, and electricity), vehicle source type, and model year. Default input values were used. Scope 2 emissions from electricity consumption by EVs were found using the following equation:

$$Scope\ 2\ Emissions = Electricity\ Consumption\ \times\ Electricity\ Emission\ Factor$$

The electricity emission factor was held at 2020 eGRID levels through 2050 for the baseline.

To model GHG emission reductions in the policy scenario, for each model year, a fraction of VMT was designated as fuel type “electricity” or “hydrogen” based on the ZEV sales curve. The resulting energy consumption was found using the following equation:

$$Energy\ Consumption = VMT\ \times Energy\ Efficiency$$

where energy efficiency was in units of kJ/mi for battery-electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs). Implied BEV energy efficiencies from the MOVES4 baseline results were used. FCEV energy efficiencies were sourced from the California Advanced Clean Fleets (ACF) rule. Scope 1 emissions were found by reducing baseline internal combustion engine vehicle (ICEV) emissions by

[39] ICF, Fehr and Peers, and Gallop Corporation. “TPB Climate Change Mitigation Study of 2021, Additional Transportation Scenarios Analysis: TPB Survey Identified Scenarios.” June 2022. file:///C:/Users/18745/Downloads/CCMS_2021_Additional_Transportation_Scenarios_Analysis__-_TPB_Survey_Identified_Scenarios_v5.pdf

the ZEV sales fraction. Scope 2 emissions were found using Equation (1). Electricity emission factor projections were sourced from EIA's AEO for the MSA region.

The following additional key assumptions were made throughout the analysis:

- ZEVs exist in the vehicle fleet for the same length of time as ICEVs.
- ZEV activity/use is identical to an ICEV.
- The annual ZEV sales fraction applies to every fuel type.
- Long-haul medium and heavy-duty vehicles (MHDVs) ZEVs are modeled as FCEV and all other MHDVs ZEVs are modeled as BEV.
- All LDVs ZEVs are modeled as BEVs.
- All BEV populations 2021 and earlier are EPA MOVES4 default.
- The methodology in some cases required re-allocating MOVES4 baseline projected electric vehicle back to internal combustion engine vehicles. Where this was necessary, LDVs were designated as gasoline, and MHDVs were designated as diesel.
- The hydrogen supply is assumed to be 50% green hydrogen and 50% blue hydrogen.

This analysis sourced data from EPA MOVES4, eGRID, and EIA AEO, and electricity emission factors used were consistent with the factors from IPM used in other measures.

ACCELERATE THE DEPLOYMENT OF OFF-ROAD/NON-ROAD ELECTRIC EQUIPMENT.

To estimate GHG emission reductions from this measure, off-road GHG emissions were assumed to remain constant, as presented in the MSA BAU. To estimate cumulative reductions, in each year, a percent reduction from BAU was then applied. This percent reduction was derived from the modeling from the COG 2030 CEAP, by calculating the 2030 CEAP COG region BAU off-road emissions in a given year to the 2030 CEAP COG region GHG reduction scenario off-road emissions in that same year. The annual percent reduction was held constant from 2030 through 2050.

REDUCE GHG EMISSIONS FROM WASTE AND WASTEWATER TREATMENT.

For the waste sector, the same method was applied as was used for off-road emissions, building off an approach that scales COG 2030 CEAP GHG reductions to the larger MSA region. For the wastewater treatment sector, GHG emission reductions were estimated calculating an average annual percent GHG emission reduction across from wastewater treatment across the MSA states (MD, VA, WV) from EPA's state-level non-CO_2 GHG projections and mitigation assessments[40] and then applying those annual percent reductions to the MSA BAU for wastewater treatment.

ACCELERATE THE EXPANSION OF THE REGIONAL TREE CANOPY AND REDUCE TREE CANOPY LOSS.

For this measure the main tools used were:

- i-Tree MyTree (Accessed through https://www.itreetools.org/. This tool is used for assessing the carbon sequestration potential of trees, specifically in Maryland.

[40] EPA. "Non CO_2 Greenhouse Gas Data Tool." https://cfpub.epa.gov/ghgdata/nonco2/

- ICLEI LEARN: Utilized via https://icleiusa.org/LEARN/. This tool is used for estimating tree canopy cover percentage in the MSA, employing 1-meter resolution data from the University of Vermont and the Chesapeake Conservatory land cover data.

The main assumptions are derived from legislative goals set forth by Washington, D.C. and Maryland.

- In Washington, D.C., the goal is to increase tree canopy coverage from 35% to 40%. The goal was within Sustainable DC—a planning effort to make the District of Columbia the greenest, healthiest, and most livable city in the nation. https://doee.dc.gov/sites/default/files/dc/sites/ddoe/page_content/attachments/Draft_Urban_Tree_Canopy_Plan_Final.pdf
- The 5 Million Trees Initiative was mandated by Maryland legislation through the Tree Solutions Now Act of 2021. Part of this legislation included a historic directive to plant 5 million native trees on public and private land by 2031. https://news.maryland.gov/dnr/2023/06/01/five-million-trees-please-maryland-rolls-out-5-million-trees-initiative/

Tree canopy cover percentage for the MSA is estimated using the ICLEI LEARN tool, using 1-meter resolution data from the University of Vermont and the Chesapeake Conservatory land cover data to assess tree cover in "settlement" areas.

Carbon sequestration potential of native trees in Maryland is determined using i-Tree MyTree, which utilizes county coordinates within each MSA Maryland County and designates the trees as "new planting" and in "partial sun" with a 1-inch diameter.

Data used included:

- Urban and Rural Areas Census data for 2010 and 2020: Obtained from the U.S. Census Bureau's website at https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural.html
- Native Tree Species in Maryland: https://msa.maryland.gov/msa/mdmanual/01glance/html/trees.html

APPENDIX B. METROPOLITAN WASHINGTON CLIMATE AND ENERGY PLANS AND TARGETS

REGIONAL

- Transportation Planning Board Visualize 2045, 2022 update, goals are specific to the on-road transportation sector:
  - 50% below 2005 levels by 2030
  - 80% by 2050
- Metropolitan Washington 2030 Climate and Energy Action Plan, 2020
  - 50% below 2005 levels by 2030
  - 80% by 2050

DISTRICT OF COLUMBIA

- Carbon Free DC, 2023
  - 60% Reduction in emissions by 2030 compared to 2006 baseline
  - 50% Reduction in per capita energy use by 2032 compared to 2006 baseline
  - 50% Energy from renewables by 2032

MARYLAND

City of Bowie

Updated Climate Action Plan, 2020

- 50% by 2030 below 2015 levels

Charles County

- Community climate plan began development in 2023

Frederick County

- Climate Emergency Resolution, 2020
  - 50% from 2010 levels by 2030
  - 100% by 2050
- Sustainable Frederick County, 2017
  - 25% reduction below 2007 levels by 2025

City of Greenbelt

- Sustainability Plan Framework, 2013
  - Meet State of MD and COG goals (COG goals noted above and MD goal of 25% below 2006 levels by 2020)

City of Laurel

- Phase II of developing a Sustainable Community Implementation Framework kicked off in 2023

Montgomery County

- Montgomery County Climate Action Plan, 2021
  - 80% below 2005 levels by 2027
  - 100% below 2005 levels by 2035

Prince George's County

- Climate Action Plan, 2022
  - 80% below 2008 levels by 2050

City of Rockville

- Climate Action Plan, 2022
  - 50% reduction below 2005 levels by 2030
  - Zero GHG emissions on or before 2050

City of Takoma Park

- Sustainability and Climate Action Plan, 2019
  - Does not establish new GHG goals but instead works toward being consistent with state, County, and COG plans.
- Sustainable Energy Action Plan, 2014
  - Does not establish new GHG goals but instead works toward being consistent with state and County plans.

State of Maryland

- Maryland Climate Pollution Reduction Plan, 2023
- The 2030 Greenhouse Gas Reduction Act (GGRA) Plan, 2021
  - The Act established the goals of 40% reduction below 2006 levels by 2030.
  - The Plan calls for achieving the target of 50% reduction below 2006 levels by 2030.
- The Climate Solutions Now Act (CSNA), 2022
  - The CSNA adjusted statewide GHG emission goals to include net zero carbon emissions by 2045.
  - The CSNA also calls for a reduction of statewide GHG emissions by 60% below 2006 levels by 2031.

VIRGINIA

City of Alexandria

- Energy and Climate Change Action Plan, 2023
  - Does not establish new GHG goals but affirms commitment to Paris Climate Agreement goals.
- Eco-City Alexandria Environmental Action Plan, 2019
  - 50% below 2005 levels by 2030
  - 80 – 100% below 2005 levels by 2050

Arlington County

- Community Energy Plan Roadmap, 2022 (years 1-2), updated for years 3-5 in 2024

    - Supports CEP goal of county-wide carbon neutral by 2050
  - Community Energy Plan Update, 2019
    - County-wide carbon neutral by 2050, compared to 2007 levels
- Energy Assurance Plan, 2023 (resilience)
- Carbon Neutral Transportation Master Plan (2024)

City of Falls Church

- Community Energy Action Plan (CEAP), 2023
  - 50% below 2005 levels by 2030
  - 80% below 2005 levels by 2050
  - Net zero emissions by 2050

Fairfax County

- Resilient Fairfax Climate Adaptation and Resilience Plan, 2022
- CECAP Implementation Plan, 2022
  - Does not establish new GHG goals but instead works toward meeting CECAP goals
- Community-wide Energy and Climate Action Plan (CECAP), 2021
  - By 2030, 50% below 2005 levels
  - By 2040, 75% below 2005 levels
  - By 2050, carbon neutral

Loudoun County

- Loudoun County Energy Strategy, 2023
  - Supports state goal to become net zero by 2045 and achieve a carbon-free grid by 2050
- Loudoun County Energy Strategy, 2009
  - County-wide goal to reduce GHGs from 3.85 million metric ton to 3.0 million metric ton by 2040
  - Government operations goal to reduce emissions 15% between 2007 and 2012

City of Manassas

- Draft Climate Action Plan, 2023
  - 50% GHG reduction from 2005 levels by 2030
  - 80% reduction from 2005 levels by 2050

Prince William County

- Community Energy and Sustainability Master Plan, 2023
  - By 2030, 50% below 2005 levels
  - By 2035, use 100% renewable electricity county-wide
  - By 2050, achieve carbon neutrality in government operations

Commonwealth of Virginia

- Virginia Clean Energy Plan, 2022

    - Ensure access to abundant, reliable, affordable, and clean energy so all Virginians can live, work and raise a family in a growing and thriving Commonwealth.
- Virginia Clean Economy Act, 2020
    - Mandates Dominion Energy Virginia and Appalachian Electric Power, produce 100% renewable electricity by 2045 and 2050, respectively.
    - Sets energy efficiency standards.
- Virginia 2018 Energy Plan
    - Plan mentions state commitment to Under2Coalition goal of reducing pollution and keeping global temperature rise under 2°C.

WEST VIRGINIA

- State of West Virginia 2018-2022 State Energy Plan, 2017

APPENDIX C. IDENTIFICATION OF LIDACS IN THE WASHINGTON-ARLINGTON-ALEXANDRIA, DC-VA-MD-WV MSA

Table 11. Census Block IDs for the MSA

City/County	State	Census Block ID	City/County	State	Census Block ID
District of Columbia	DC	11001000501	Prince George's County	MD	24033804001
District of Columbia	DC	11001001002	Prince George's County	MD	24033804002
District of Columbia	DC	11001001803	Prince George's County	MD	24033804002
District of Columbia	DC	11001001803	Prince George's County	MD	24033804102
District of Columbia	DC	11001001803	Prince George's County	MD	24033804102
District of Columbia	DC	11001001804	Prince George's County	MD	24033804300
District of Columbia	DC	11001001804	Prince George's County	MD	24033804300
District of Columbia	DC	11001001804	Prince George's County	MD	24033804400
District of Columbia	DC	11001001901	Prince George's County	MD	24033804400
District of Columbia	DC	11001001901	Prince George's County	MD	24033804600
District of Columbia	DC	11001001901	Prince George's County	MD	24033804801
District of Columbia	DC	11001001902	Prince George's County	MD	24033804801
District of Columbia	DC	11001002001	Prince George's County	MD	24033804801
District of Columbia	DC	11001002001	Prince George's County	MD	24033804802
District of Columbia	DC	11001002002	Prince George's County	MD	24033804802
District of Columbia	DC	11001002101	Prince George's County	MD	24033804900
District of Columbia	DC	11001002101	Prince George's County	MD	24033804900
District of Columbia	DC	11001002102	Prince George's County	MD	24033805000
District of Columbia	DC	11001002102	Prince George's County	MD	24033805000
District of Columbia	DC	11001002201	Prince George's County	MD	24033805000
District of Columbia	DC	11001002201	Prince George's County	MD	24033805101
District of Columbia	DC	11001002202	Prince George's County	MD	24033805101
District of Columbia	DC	11001002400	Prince George's County	MD	24033805201
District of Columbia	DC	11001002501	Prince George's County	MD	24033805201
District of Columbia	DC	11001002501	Prince George's County	MD	24033805202
District of Columbia	DC	11001002503	Prince George's County	MD	24033805202
District of Columbia	DC	11001002504	Prince George's County	MD	24033805202
District of Columbia	DC	11001002702	Prince George's County	MD	24033805500
District of Columbia	DC	11001002702	Prince George's County	MD	24033805500
District of Columbia	DC	11001002704	Prince George's County	MD	24033805601
District of Columbia	DC	11001002801	Prince George's County	MD	24033805601
District of Columbia	DC	11001002801	Prince George's County	MD	24033805601
District of Columbia	DC	11001002802	Prince George's County	MD	24033805602
District of Columbia	DC	11001002802	Prince George's County	MD	24033805602
District of Columbia	DC	11001002802	Prince George's County	MD	24033805602

District of Columbia	DC	11001002900	Prince George's County	MD	24033805700
District of Columbia	DC	11001002900	Prince George's County	MD	24033805700
District of Columbia	DC	11001003000	Prince George's County	MD	24033805700
District of Columbia	DC	11001003000	Prince George's County	MD	24033805801
District of Columbia	DC	11001003200	Prince George's County	MD	24033805801
District of Columbia	DC	11001003200	Prince George's County	MD	24033805802
District of Columbia	DC	11001003200	Prince George's County	MD	24033805802
District of Columbia	DC	11001003200	Prince George's County	MD	24033805904
District of Columbia	DC	11001003400	Prince George's County	MD	24033805904
District of Columbia	DC	11001003400	Prince George's County	MD	24033805906
District of Columbia	DC	11001003500	Prince George's County	MD	24033805906
District of Columbia	DC	11001003500	Prince George's County	MD	24033805907
District of Columbia	DC	11001003600	Prince George's County	MD	24033805907
District of Columbia	DC	11001003702	Prince George's County	MD	24033805908
District of Columbia	DC	11001003802	Prince George's County	MD	24033805909
District of Columbia	DC	11001004100	Prince George's County	MD	24033806000
District of Columbia	DC	11001004300	Prince George's County	MD	24033806000
District of Columbia	DC	11001004702	Prince George's County	MD	24033806000
District of Columbia	DC	11001004703	Prince George's County	MD	24033806100
District of Columbia	DC	11001004703	Prince George's County	MD	24033806501
District of Columbia	DC	11001004703	Prince George's County	MD	24033806501
District of Columbia	DC	11001004703	Prince George's County	MD	24033806501
District of Columbia	DC	11001004704	Prince George's County	MD	24033806601
District of Columbia	DC	11001004704	Prince George's County	MD	24033806601
District of Columbia	DC	11001004801	Prince George's County	MD	24033806601
District of Columbia	DC	11001004801	Prince George's County	MD	24033806602
District of Columbia	DC	11001004802	Prince George's County	MD	24033806602
District of Columbia	DC	11001004802	Prince George's County	MD	24033806602
District of Columbia	DC	11001004901	Prince George's County	MD	24033806711
District of Columbia	DC	11001004902	Prince George's County	MD	24033806712
District of Columbia	DC	11001005004	Prince George's County	MD	24033806713
District of Columbia	DC	11001005004	Prince George's County	MD	24033806713
District of Columbia	DC	11001005203	Prince George's County	MD	24033806713
District of Columbia	DC	11001005501	Prince George's County	MD	24033806714
District of Columbia	DC	11001005503	Prince George's County	MD	24033806714
District of Columbia	DC	11001005601	Prince George's County	MD	24033806800
District of Columbia	DC	11001005601	Prince George's County	MD	24033806900
District of Columbia	DC	11001005801	Prince George's County	MD	24033806900
District of Columbia	DC	11001005900	Prince George's County	MD	24033807000
District of Columbia	DC	11001006400	Prince George's County	MD	24033807000
District of Columbia	DC	11001006400	Prince George's County	MD	24033807000
District of Columbia	DC	11001006804	Prince George's County	MD	24033807000
District of Columbia	DC	11001007100	Prince George's County	MD	24033807000

District of Columbia	DC	11001007100	Prince George's County	MD	24033807301
District of Columbia	DC	11001007100	Prince George's County	MD	24033807305
District of Columbia	DC	11001007203	Prince George's County	MD	24033807305
District of Columbia	DC	11001007301	Prince George's County	MD	24033807404
District of Columbia	DC	11001007304	Prince George's County	MD	24033807405
District of Columbia	DC	11001007304	Prince George's County	MD	24033807407
District of Columbia	DC	11001007304	Prince George's County	MD	24033807409
District of Columbia	DC	11001007304	Prince George's County	MD	24033807410
District of Columbia	DC	11001007401	Prince George's County	MD	24033807500
District of Columbia	DC	11001007401	Prince George's County	MD	24033980000
District of Columbia	DC	11001007403	Arlington County	VA	51013100300
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District of Columbia	DC	11001007404	Arlington County	VA	51013101602
District of Columbia	DC	11001007406	Arlington County	VA	51013101603
District of Columbia	DC	11001007406	Arlington County	VA	51013101603
District of Columbia	DC	11001007407	Arlington County	VA	51013101701
District of Columbia	DC	11001007407	Arlington County	VA	51013101703
District of Columbia	DC	11001007407	Arlington County	VA	51013101704
District of Columbia	DC	11001007408	Arlington County	VA	51013101704
District of Columbia	DC	11001007408	Arlington County	VA	51013101705
District of Columbia	DC	11001007409	Arlington County	VA	51013101705
District of Columbia	DC	11001007409	Arlington County	VA	51013101803
District of Columbia	DC	11001007409	Arlington County	VA	51013101804
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District of Columbia	DC	11001007502	Arlington County	VA	51013102001
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District of Columbia	DC	11001007504	Arlington County	VA	51013102100
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District of Columbia	DC	11001008804	Fairfax County	VA	51059421500
District of Columbia	DC	11001008804	Fairfax County	VA	51059421500

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District of Columbia	DC	11001009000	Fairfax County	VA	51059421800
District of Columbia	DC	11001009000	Fairfax County	VA	51059421900
District of Columbia	DC	11001009000	Fairfax County	VA	51059422101
District of Columbia	DC	11001009102	Fairfax County	VA	51059422102
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Montgomery County	MD	24031700813	Prince William County	VA	51153900201
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Montgomery County	MD	24031704000	Spotsylvania County	VA	51177020313
Montgomery County	MD	24031706012	Stafford County	VA	51179010201
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Prince George's County	MD	24033800109	Stafford County	VA	51179010216
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Prince George's County	MD	24033801405	Alexandria City	VA	51510200102
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Prince George's County	MD	24033803900	Jefferson County	WV	54037972701
Prince George's County	MD	24033804001			

APPENDIX D. PROJECT IDEAS SUBMITTED TO COG

This list of project ideas in Table 12 is from fall of 2023 and may not be exhaustive of projects or programs that COG may be including in a CPRG implementation grant application. The ideas presented here were used as a starting point to develop PCAP measures, and some may be carried into COG's implementation grant application.

Table 12. Submitted Project Ideas

Submitting Organization	Project Concept
Public	Consumer education campaigns for household food waste reduction ("prevention")
Alexandria	Direct installation and ownership of solar energy generation systems on city-owned and managed facilities
Alexandria	Deep energy retrofits for low-income multifamily housing
Alexandria	Healthy Homes improvements, capacity building, and monitoring
Alexandria	VFA facility capital planning software, climate mitigation overlay
Alexandria	Regional collaboration for passive-design and building performance education, training, and certification pathways
Arlington County	Energy performance for LIDAC multifamily & commercial buildings
Arlington County	Energy performance for non-LIDAC multifamily & commercial buildings
Arlington County	MUSH (Municipal, University, Schools & Hospitals) program for energy performance
Arlington County	Regional education and training program on advanced building design and retrofits
Arlington County	Energy efficiency, solar and storage for non-profits and places of worship
Arlington County	Finance mechanisms
Arlington County	Technical assistance and education
Charles County	Mulching facility relocation and composting facility
Charles County	Landfill gas (LFG) to energy
Charles County	Landfill convenience center and waste transfer station
Charles County	County fleet EV transition
Charles County	Urban tree canopy program expansion
City of Frederick	Tree canopy incentive program
D.C. DOEE	Regional composting program
Fairfax County	Technical and financial assistance to property owners implementing energy efficiency updates
Fairfax County	Resilience hubs pilot program
Fairfax County	Clean energy clearinghouse/ "concierge" service
Fairfax County	Boost low-income weatherization and energy efficiency programs
Frederick County	Solar power purchase agreement and community solar
Frederick County	Pilot projects for non-diesel alternatives and data center back up space
Frederick County	Solar and microgrids for county buildings
Frederick County	Reimbursements for energy efficiency upgrades, solar, and EVs
Frederick County	Weatherization and energy efficient retrofits to LIDAC multifamily buildings

Frederick County	Reducing VMT through transit systems
Frederick County	Urban reforestation and green infrastructure
Frederick County	Implementation of biodiesel for fleet that cannot be electrified
Frederick County	EVs for county fleet
Frederick County	BEPS internal
Frederick County	BEPS external
Loudoun County	Electrified and efficient equipment "road show"
Loudoun County	Studies and business plan for district energy for commercial and residential buildings
Montgomery College	Smart grid, ice thermal storage, natural refrigerants, Rockville Campus and Takoma Park Silver Spring Campus
Montgomery County	Urban shade tree planting project
Montgomery County	Installation of enhanced diversion technologies at the Montgomery County Shady Grove Transfer Station to manage approximately 450,000 tons of waste that was not recycled and that otherwise will go to the Regional Residuals Facility or a landfill
Montgomery County	Community health worker climate-based community outreach and engagement, in Spanish
Montgomery County	Reforest open areas and enhance and expand existing forest and forested stream buffers on private properties. The project will work with private property owners to stop mowing and add forest plantings to expand and enhance forest coverage around the county
Montgomery County	133 affordable housing properties and 32 additional multifamily properties in overburdened and underserved neighborhoods to complete modernizing upgrades to save energy and improve quality of life
Montgomery County	Smart meter electrical panel upgrade program for EEAs, water heater loaner program, heat pumps for income-qualified residents with delivered fuel
Montgomery County	Support incentives and turn-key solutions to install EV charging infrastructure at multi-unit dwellings as well as other public and commercial sites needed to support the equitable and rapid adoption of electric vehicles
Montgomery County	Microgrid/resiliency hub and renewable energy "green" power production at four county owned locations
Montgomery County	Increase size of Capital Bikeshare e-bike fleet
Montgomery County	Provide funding to farmers or composting companies for the construction of an on-farm food scrap composting facility.
Montgomery County	Provide funding to farmers for the construction of an accessory solar array that will provide electricity to the agricultural operation.
Montgomery County	Increase the amount of funding in the Office of Agriculture (OAG)'s Soil Amendment Program, which provides county farmers with free deliveries of LeafGro, the compost produced at the County-operated yard trim composting facility in Dickerson
Montgomery County	Leaf blower rebate program
Montgomery County	Yard Trim Composting Program, installation of a dry fermentation anaerobic digester system will produce significant quantities of methane for use as Renewable Natural Gas for fuel or part of the process to produce hydrogen fuel for buses, trucks, and cars
Montgomery County Green Bank (MCGB)	MCGB BEPS Readiness Program - ASHRAE energy audit and guaranteed financing for projects identified in audit as economical

Montgomery County Green Bank	MCGB Energize Multifamily Program - Mezzanine finance loan to owners and developers who are restricted by senior lending.
Montgomery County Green Bank	MCGB Building Decarbonization Bond - Conduit capital markets issuance to support BEPS Readiness (above) and Energize Multifamily (above) by using grant capital for a guarantee.
Montgomery County Green Bank	MCGB Resiliency Hub Accelerator - Financing support from MCGB plus grant support to manage storage economics.
Montgomery County Green Bank	MCGB Resiliency Bond -Conduit capital markets issuance to support Resiliency Hub Accelerator (above) using grant capital for a guarantee.
Montgomery County Public Schools	Retrofit schools in equity areas with energy efficient upgrades and decarbonization measures to improve the indoor learning environment
Montgomery County Public Schools	Install agrivoltaics at Loiderman Reach Hub
Montgomery County Public Schools	Convert 35 additional fleet (non-bus) vehicles to clean energy & add messaging on fleet about Climate Actions
Montgomery County Public Schools	Install additional electric vehicle charging stations for fleet
Montgomery County Public Schools (MCPS)	Completely decarbonize some MCPS schools
Montgomery County Public Schools	Real-time energy/utility (electric, water, gas) monitoring enhancements at all schools so real-time consumption can be viewed and acted upon by students, staff, and other building users. Students have expressed a desire for their real-time data to be available for them to be able to act.
NVRC	Expand Solarize NoVA
Prince George's County	Solar PV grants for Energy Resiliency Communities (ERC)
Prince George's County	Implementation of Solar PV and Solar Thermal Hot Water Systems for public housing properties
Prince George's County	Zero-emission bus and supporting infrastructure (microgrid, battery storage, charging stations)
Prince George's County	Circular tree canopy program
Prince George's County	Accelerate purchase of EVs for gov ops
Prince George's County	Assist affordable housing building owners to comply with BEPS
Prince George's County	BEPS for Government buildings
Prince George's County	Infrastructure and technical monitoring upgrades at Prince George’s County’s municipal landfills
Prince William County	Regional tree canopy grant program
Rockville	Renovation and conversion to efficient electrification of 100 affordable residential units
Rockville	LED streetlight conversion
Rockville	Heavy-Duty fleet electrification - replace three shuttle buses and seven heavy-duty vehicles with electric models (pending market availability)

Rockville	Heavy-Duty fleet EV charging - DC Fast Charging to serve 10 heavy-duty fleet vehicles
Rockville	Rockville Swim and Fitness Center Energy Efficiency and Renewable Energy Upgrades (Lighting, variable frequency pumps, solar hot water, solar panels, electrification, and energy efficiency strategy to meet Montgomery County and Maryland BEPS)
Rockville	Expansion of Montgomery County Residential Electrification Incentives
Rockville	Expansions of solar rooftops and parking lot canopies on City of Rockville facilities
Rockville	Upgraded efficient and electric appliances, solar, and energy efficiency of 100 apartments and town homes owned by Rockville Housing Enterprises (RHE) property at Scarborough Square
Rockville	Upgraded roofs, energy efficiency, insulation, and air sealing, windows, and doors at RHE Scarborough Square town homes and apartments.
Rockville	EV Charging stations at RHE properties (at three multifamily apartment/town home developments and 29 scattered single-family homes)
Rockville	City of Rockville Facility LED Light Retrofits
Rockville	Landscape equipment electrification (public and private)
Rockville	Mobile EV charger for fleet
Rockville	Energy Audits and Electrification Plan for City Facilities to meet County and State BEPS. Only one of about 10 facilities has received a Level 2 energy audit in the last 18 years.
Rockville	Implementing electrification for HVAC and other City appliances, energy efficiency upgrades at 10 facilities.
Rockville	Reforestation at RedGate Park Arboretum to plant 5,000 trees and 2,500 shrubs.
Rockville	Greenspace Master Plan to maximize sequestration of City-owned lands
Rockville	Curbside Food Waste Compost Program. A local transfer and regional commercial compost site would need to be identified.
Rockville	Bikeshare Program Expansion to Twinbrook metro and neighborhood
Rockville	Establish Carshare or E-carshare Program
Rockville	Multiple Bicycle and Pedestrian Safety and facility expansion Projects
Rockville	Transit projects: MD 355 BRT construction serving Rockville (County project currently under design); MD 586 BRT construction serving Rockville (County project currently under design)
Rockville	Outreach, Education, Engagement with diverse communities and messaging materials coordinated by County, State, or COG to advance IRA incentives, energy efficiency, electrification, EVs, bike/ped/transit, waste reduction/compost, and sequestration.
Takoma Park	Solar canopies in city-owned parking lots
Takoma Park	Technical assistance program to help municipalities divest from fossil fuels
Takoma Park	Multifamily Building Improvement Grant (MFBIG) to make electrification/efficiency upgrades
Takoma Park	Commercial Building Improvement Grant to make electrification/ efficiency upgrades
Takoma Park	Clean Building Workforce Development Program
Takoma Park	Capital Area Resiliency Hub creation - retrofit existing buildings like schools or community centers with solar, battery storage, generators, etc.
Takoma Park	Multifamily EV charging station program

Takoma Park	Municipalities Building Performance Support Program - support gov building efficiency upgrades
University of Maryland/Prince George's County	Retrofitted solar microgrid
WMATA	Enhanced bus service i.e., WMATA's Better Bus Network Redesign Visionary Network implementation and other regional transit service improvement projects that will align service with regional development and travel patterns and increase access to frequent service that is easier to use
WMATA	Bus priority infrastructure projects i.e., dedicated bus lanes/clear lanes, transit signal priority and access efforts across the region
WMATA	First/last mile improvements and use that support access to transit and other active transportation modes
WMATA	Zero-emission buses and supporting infrastructure (i.e., battery storage, charging stations)
WSSC Water	The implementation of aeration control improvements across all six Water Resource Recovery Facilities (WRRFs) including integration of blowers and upgrades/replacements of aeration systems.
WSSC Water	Capture and recovery of ammonia product from liquid portion of solids stream at Piscataway Maryland Bio-Energy WRRF to recycle as fertilizer and reducing treatment volume and methanol and electricity use.
WSSC Water	Water and Wastewater Pump Optimization: Develop a process/system to monitor operation of pumps and provide actionable information on performance and operational condition for operating efficiency and reduce minimal energy usage.
WSSC Water	Install sewer thermal exchange equipment and solar array at the Anacostia, Maryland Depot to provide low-carbon heating, cooling, and hot water at this facility.
WSSC Water	Continue fleet electrification plan through acquisition of 60 electric vehicles and 13 electric forklifts as well as charging infrastructure available for both employees and the public at our facilities throughout Prince George's and Montgomery County Maryland.
WSSC Water	Install a microgrid at the Potomac water filtration plant consisting of 9 MW of natural gas engine generation plus 860 kW of solar. Include carbon capture of exhaust gas and removal and sequestration of carbon off-site.

APPENDIX E. COMMUNITY CLIMATE PRIORITIES SURVEY RESULTS

To capture a larger perspective of communities in the MSA, COG disseminated the CPRG Community Climate Priorities survey to assess community-wide climate priorities. The survey was shared through multiple online channels, extending beyond formal committees to include distribution through social media, the COG CPRG and main COG websites, local representatives, and community-based/non-governmental organizations. The survey gained responses from 86 participants from 13 different jurisdictions within the MSA, encompassing a diverse range of individuals, organizations, coalitions, and agencies.

COMMUNITY PRIORITIES

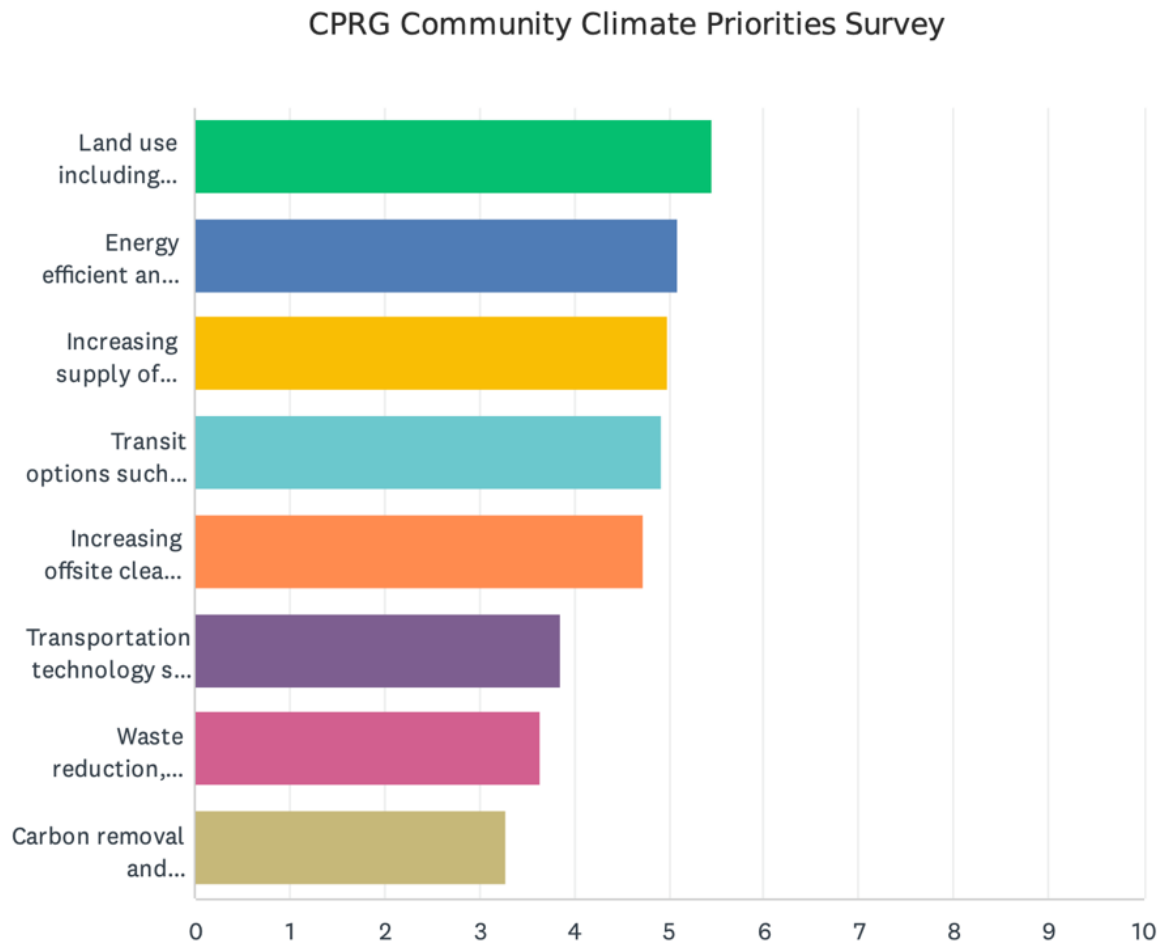
Participants were assigned the task of prioritizing GHG reduction strategies based on their perceived importance in mitigating climate change. The rankings of these strategies were averaged to generate an overall score. The following outlines the ranked strategies based on community input, listed from highest to least priority:

1. **Land Use** (including development planning, land conservation, and environment protection): 23.26% (Score 5.45)
2. **Energy Efficient and Clean Energy Buildings**: 17.44% (Score 5.09)
3. **Increasing Supply of On-site Clean Energy** (e.g., rooftop solar): 10.47% (Score 5.00)
4. **Transit Options** (such as increased use of public transportation, bike and pedestrian travel options, and reduction of travel): 17.44% (Score 4.93)
5. **Increasing Off-site Clean Energy** (e.g., community solar, utility-supplied energy): 9.30% (Score 4.74)
6. **Transportation Technology** (such as clean fuels and Low/Zero-Emission Vehicles): 5.81% (Score 3.86)
7. **Waste Reduction, Composting, and Recycling**: 11.63% (Score 3.64)
8. **Carbon Removal and Sequestration** (including green infrastructure such as trees and wetlands): 4.65% (Score 3.28)

These results are also displayed in Figure 9.

These rankings reflect the community's prioritization of strategies to mitigate climate change. Land use, energy efficient buildings, and on-site clean energy supply ranked as top priorities, with an emphasis on sustainable development and clean energy initiatives.

Figure 9. Results from COG's Community Climate Priorities Survey



EQUITY AND LIDAC PRIORITIES

The community responses outlined two overarching themes in response to questions that polled equity impact priorities. There was a notable emphasis on environmental justice, particularly concerning the needs of LIDACs. Concerns included air and water quality, greenspace availability, and overall quality of life that underscored the importance of ensuring that climate initiatives benefit people who have historically faced disproportionate environmental burdens.

Community engagement and empowerment emerged as significant aspects of equity impacts. The responses highlighted the community's call for public support, ensuring investment returns to communities, and involving communities in project planning and decision-making. This theme also encompassed a focus on creating employment opportunities, supporting local initiatives such as community composting and neighborhood farming, and fostering a sense of ownership and agency within historically underserved populations. Together, these themes conveyed the community's perspective on the most important equity impacts to achieve in the context of climate action. When assessed on what emissions reduction projects would have the most positive impact on communities that are low-income, disadvantaged, and overburdened, or have been historically underrepresented in planning processes, respondents outlined initiatives tailored to the unique needs of these communities. Key strategies identified included the promotion of non-car travel, featuring expanded bike lanes, improved bus availability, and pedestrianized streets aimed at enhancing safety and accessibility. Additionally, there was a strong emphasis on reuse and repair

initiatives, such as community-engaged compost programs and durable materials reuse infrastructure, with the goal of reducing waste and promoting local employment.

Affordable housing near transit emerged as a significant strategy, with respondents emphasizing the importance of funding allocation for such initiatives. Respondents also emphasized the importance of implementing energy efficiency projects in multifamily and commercial buildings as a crucial step toward reducing energy consumption and emissions. In summary, respondents delineated a comprehensive set of emissions reduction projects addressing transportation, waste management, energy efficiency, and community development, reflecting a commitment to sustainability and economic well-being within these communities.

BARRIERS

Respondents identified several barriers hindering their organizations from advancing climate change initiatives and energy efficiency planning. The most prevalent challenges included limited access to program funding, cited by 37.21% of respondents, followed closely by the high cost of alternatives at 36.05%. Time constraints were identified by 34.88% of respondents, while 29.07% specified other barriers not covered in the provided options. Limited knowledge was noted as a challenge by 20.93% of respondents, and 19.77% indicated limited access or inconvenience of programs as a barrier. These findings underscore a range of impediments that individuals and organizations encounter, providing valuable insights into considerations of the multifaceted challenges associated with advancing climate mitigation initiatives and energy efficiency planning.

Some survey respondents highlighted personal challenges such as time constraints and limited knowledge, emphasizing the need for more accessible and user-friendly information and resources. Others mentioned specific barriers related to their expertise or organizational focus, such as the lack of transparency on data center energy use, obstacles in rezoning industrial space, and challenges related to living in an apartment where residents may feel limited control over larger-scale initiatives.

Additionally, respondents underscored financial considerations, including the high capital cost, the need for concierge services to guide individuals through the process, and limited access to utility services and infrastructure. These nuanced insights highlight the diverse array of obstacles faced by organizations, emphasizing the importance of tailored solutions to address their unique circumstances.

PROJECT EMPHASIS

When responding to the question about advancing projects within COG's eight identified areas for climate action strategies, participants provided a diverse range of project ideas aligned with the key focus areas: Planning, Equity, Clean Electricity, Zero Energy Buildings, Zero-Emission Vehicles, Mode Shift and Travel Behavior, Zero Waste, and Sequestration.

Their input reflected emphasizing the need for projects that span urban planning, social equity, renewable energy, sustainable infrastructure, transportation, waste management, and carbon sequestration. The following insights offer valuable perspectives on the types of initiatives respondents believe should be prioritized to address the multifaceted challenges posed by climate change within the COG region.

The community responses reflected several key themes that resonated across the spectrum of climate action strategies within COG's identified areas.

- **Equity and Inclusive Clean Energy Transition:** A recurring priority was the promotion of equitable clean energy transitions, particularly in LIDACs. The responses advocated for green job opportunities, diverse representation, and inclusive decision-making processes to ensure the benefits of clean energy initiatives reached everyone.
- **Renewable Energy:** Another prevalent theme was the commitment to advancing renewable energy. This involved a push for increased use of renewable energy sources, such as solar.
- **Sustainable Transportation:** This recurring theme of sustainable transportation focused on zero-emission vehicle (ZEVs), robust charging infrastructure, and enhanced public transit options.
- **Waste Reduction and Recycling Initiatives:** Respondents expressed a collective commitment to a circular economy, emphasizing waste reduction, recycling initiatives, and legislative support for reuse infrastructure. Additionally, there was a shared focus on climate resilience through community planning, increased green spaces, and stormwater management solutions.

These common themes underscored the community's strong emphasis on inclusivity, environmental sustainability, and climate resilience in shaping climate action strategies.

CONCLUSION

COG values community input and will continue to engage with the public more broadly within the MSA on the development of the CCAP, with a focus on addressing environmental justice concerns and supporting historically underrepresented and overburdened communities. While all input from the Community Climate Priorities survey was carefully considered in developing PCAP measures, not all suggestions could be feasibly included as designated measures. Survey responses were used in conjunction with ongoing and planned project activities from participating jurisdictions, serving as a resource to confirm regional climate priorities. COG will use the responses of this survey to inform the CCAP and its wider Community Engagement Plan for the CCAP and continue to seek engagement from a wider, more diverse audience within its climate mitigation planning processes.

Thank you to all community members who participated in shaping the climate priorities for the metropolitan Washington region.

APPENDIX F. STAKEHOLDER AND COMMUNITY REPRESENTATIVES

Some of the organizations that attended meetings or engaged with COG, or which COG initiated outreach, include those listed in Table 13.

Table 13. COG CPRG Steering and Technical Committees

Committee	Organization	Jurisdiction
Steering Committee Members	Arlington County, Office of Sustainability and Environmental Management and Office of Climate Coordination and Policy	Virginia
	Charles County, Climate Resilience and Sustainability	Maryland
	City of College Park, Department of Planning and Community Development	Maryland
	City of Falls Church, Environmental Sustainability Programs	Virginia
	City of Frederick, Office of Sustainability	Maryland
	City of Gaithersburg	Maryland
	City of Greenbelt, Public Works	Maryland
	City of Manassas, Planning and Development	Virginia
	Clarke County, Environmental and Water Resources	Virginia
	Culpeper County	Virginia
	D.C. Department of Energy & Environment (DOEE)	District of Columbia
	Frederick County, Division of Energy and Environment	Maryland
	Loudoun County, Department of Building & Development	Virginia
	Maryland Department of Environment (MDE)	Maryland
	Maryland Department of Transportation (MDOT)	Maryland
	Montgomery County, Climate Change	Maryland
	Prince George's County, Department of Environment	Maryland
	Prince William County, Environmental and Energy Sustainability	Virginia
	Rappahannock County, Community Development	Virginia
	Town of Bladensburg	Maryland
	Virginia Department of Environmental Quality (DEQ)	Virginia
	Virginia Department of Transportation (VDOT)	Virginia
	Washington Suburban Sanitary Commission (WSSC Water)	Maryland
Technical Committee Members	Arlington County, Energy Program	Virginia
	City of Fairfax, Public Works and Environment	Virginia
	City of Falls Church, Environmental Sustainability Programs	Virginia
	City of Laurel, Environmental Programs	Maryland
	City of Rockville, Environment Commission	Maryland
	City of Takoma Park, Public Works	Maryland

	Connected DMV, Climate and Energy	District of Columbia
	DC Water	District of Columbia
	D.C. DOEE	District of Columbia
	Fairfax County, Environmental and Energy Coordination	Virginia
	Frederick County, Department of Climate and Energy	Maryland
	Loudoun County, Energy Program	Virginia
	MDE	Maryland
	Maryland Department of Transportation (MDOT)	Maryland
	Montgomery County Department of Environmental Protection	Maryland
	Prince George's County, Department of Environment	Maryland
	Virginia Department of Environmental Quality (DEQ)	Virginia
	Virginia Department of Transportation (VDOT)	Virginia
	Northern Virginia Regional Commission (NVRC)	Virginia
	Washington Metropolitan Area Transit Authority (WMATA)	Regional
	Washington Suburban Sanitary Commission (WSSC Water)	Maryland

COG and TPB Committees

- Built Environment and Energy Advisory Committee (BEEAC)
- Chief Equity Officers Committee (CEOC)
- Climate Energy and Environmental Policy Committee (CEEPC)
- Food and Agriculture Regional Member (FARM) Policy Committee
- Metropolitan Washington Air Quality Committee (MWAQC)
- Metropolitan Washington Air Quality Committee Technical Advisory Committee (MWAQC-TAC)
- National Capital Region Transportation Planning Board (TPB)
- Regional Electric Vehicle Deployment (REVD) Working Group
- Transportation Planning Board Community Advisory Committee (TPB-CAC)
- Transportation Planning Board Technical Committee (TPB-Tech)

Industry, Utilities, Other Government Partners, and Stakeholders

- D.C. Sustainable Energy Utility (DCSEU)
- District of Columbia City Council
- Dominion Energy
- Potomac Electric Power Company (Pepco)
- Frederick County Division of Solid Waste and Recycling
- Fredericksburg Planning Commission
- Georgetown, George Mason, George Washington, and Catholic Universities
- Greater Washington Region Clean Cities Coalition (GWRCCC)
- George Washington Regional Commission
- Institute for Local Self-Reliance
- Maryland Clean Energy Center (MCEC)

- Maryland Department of Agriculture
- Maryland Energy Administration (MEA)
- Maryland Energy Innovation Institute
- Maryland Forestry Foundation (MFF)
- Montgomery County Solid Waste Advisory Committee
- Neighborhood Sun
- Northern Shenandoah Valley Regional Commission
- NVRC
- Members of the public
- Prince George's County Solid Waste Advisory Commission
- Prince William County Public Schools (PWCPS)
- Rappahannock Electric Cooperative
- Southern Environmental Law Center (SELC)
- Virginia Clean Cities Coalition
- Virginia Department of Environmental Quality (DEQ)
- Virginia Energy
- Virginia Property Assessed Clean Energy (PACE) Authority
- Washington Gas (WGL)
- Washington Metropolitan Area Transit Authority (WMATA)
- WSSC Water
- Agricultural, Working Lands, Food, and Solid Waste regional stakeholder group

LIDAC-Related and Equity Focused Organizations

- Common Grain Alliance (CGA)
- Faith Alliance for Climate Solutions (FACS)
- GWRCCC
- Hola Cultura
- Institute for Local Self-Reliance (ILSR)
- Montgomery County Food Council (MoCoFC)
- Neighborhood Sun
- Prince George's County Food Equity Council
- Prince George's Soil Conservation District
- Sierra Club, Virginia Chapter
- Southern Environmental Law Center
- University of Maryland (UMD)
- Voters for Animals

Tribal Representatives

- Accokeek Foundation
- Patawomeck Indian Tribe in Virginia