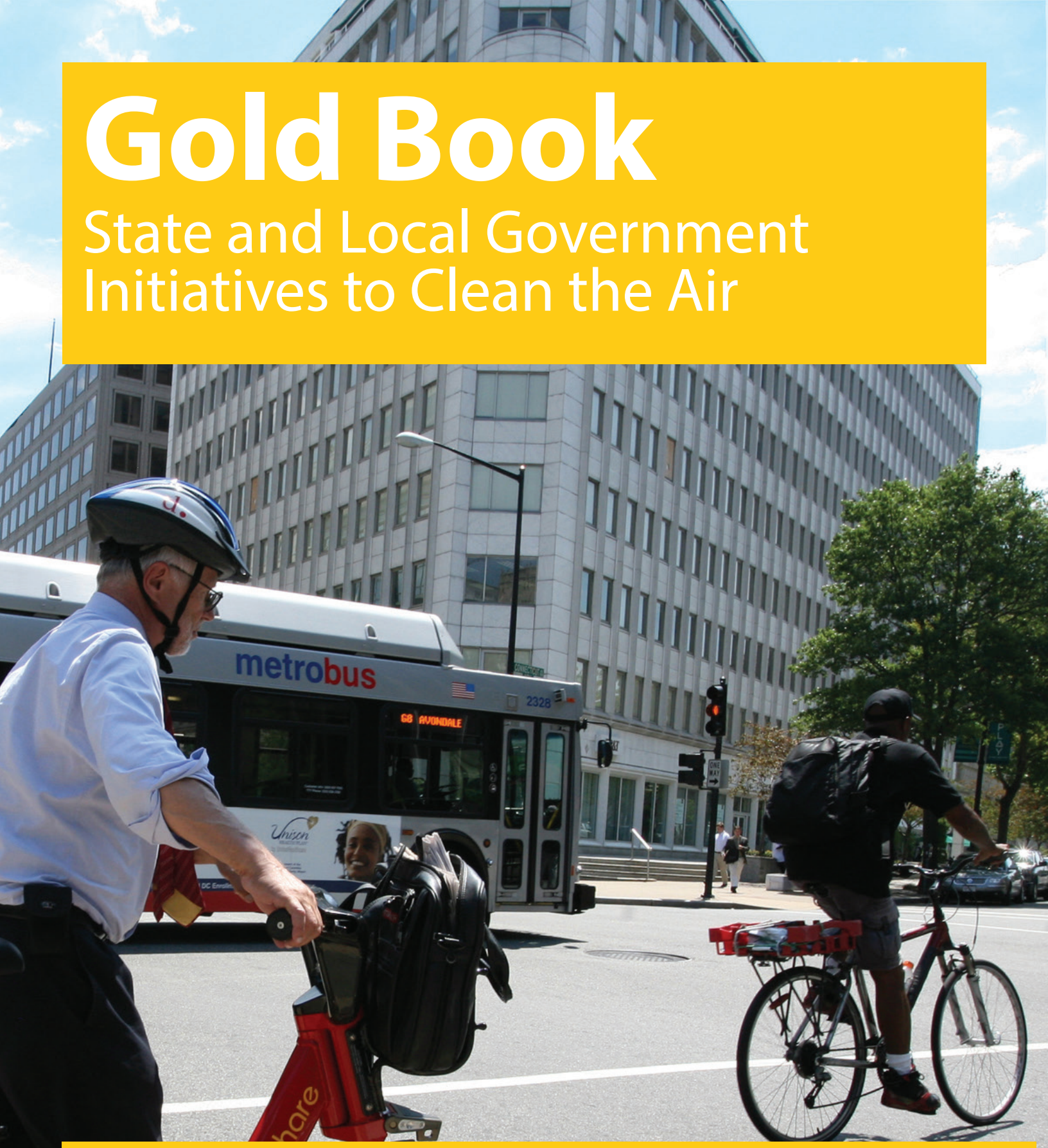
Gold Book

State and Local Government Initiatives to Clean the Air



Prepared by the
Metropolitan Washington Air Quality Committee for the
Metropolitan Washington Council of Governments

METROPOLITAN WASHINGTON
Council of Governments

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The Gold Book reflects the progress local governments in the metropolitan Washington region are making to improve air quality, and helps local governments identify additional measures they can take. It is intended to be a living document, so feedback, suggestions and additions are welcome.

Please direct comments to Isabel Ricker at iricker@mwcog.org.

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State and Local Government Initiatives to Clean the Air

Metropolitan Washington, DC Ozone Nonattainment Area

October 2014

METROPOLITAN WASHINGTON
Council of Governments

Table of Contents

Table of Contents

Status Definitions:
Existing: A measure several jurisdictions in the region are implementing
Existing-Expansion: A measure that has been implemented in the region but which could be greatly expanded or adopted by new jurisdictions
New: A measure of interest to the region which jurisdictions are at the early stages of implementing

Opening Letter

Metropolitan Washington has come a long way in improving air quality. It is easy to forget that as recently as the 1980s, smog and haze blanketed this area in the summer. In 1988, nearly half of summer days exceeded one or more of the Environmental Protection Agency's air pollution standards.

Since that time we've made tremendous progress thanks to the combined efforts at the national, state, local, and regional levels as well as actions by businesses and citizens. We have not had any exceedances of EPA air pollution standards – Code Red air days - during the last two years.

While people may be most familiar with regulations to reduce emissions from power plants and passenger vehicles, it's also important for us to recognize and learn from a variety of other valuable programs implemented by state and local governments. Some are not easily quantifiable but together, they have had a major impact on our region's air quality. Many of these programs – such as green power purchases; new transportation options; Climate, energy, and sustainability plans - are highlighted in this Gold Book.

I am proud that through this publication, the Metropolitan Washington Air Quality Committee is helping inform area officials by spreading best practices around the region and pushing the envelope on how we can better clean the air. Despite our many accomplishments, there is more we can and must do to protect the health of more than five million area residents. I encourage you to learn more about these successful programs in the following pages.

David F. Snyder
Chairman, Metropolitan Washington Air Quality Committee
Vice Mayor, City of Falls Church

Introduction

Government agencies in the Washington, D.C. ozone nonattainment area have a long history of undertaking emission control measures to improve air quality and protect public health. The Clean Air Act requires the US Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) (see 40 CFR part 50) for pollutants considered harmful to public health and the environment. The six criteria pollutants regulated by EPA are: particulate matter (PM), ground-level ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NOx), and lead (Pb). All can have harmful effects but PM and ozone are the most prevalent threats. The chart below shows the metropolitan Washington region's air quality designation, classification and attainment of National Ambient Air Quality Standards for ozone and particulate matter over time.

	NAAQS Date	Effective Designation Date/Classification	SIP Status	Attainment Status
1-Hour Ozone Standard (125 ppb)	1979	January 6, 1992/Serious, March 25, 2003/Severe	Submitted 2004	Attained in 2005
8-hour Ozone Standard (84 ppb)	1997	June 15, 2004/Moderate	Submitted 2007	Attained in 2009
PM2.5 Standard (15 ug/m3)	1997	April 5, 2005/not applicable	Submitted 2008	Redesignation Request Submitted in 2013
8-hour Ozone Standard (75 ppb)	2008	July 20, 2012/Marginal	No SIP required	Attainment Deadline of 2015
Anticipated 8-hour Ozone Standard (60-70 ppb)	2014?	Pending	Pending	Anticipated Attainment Deadline of 2020
ppb = parts per billion				

Air Pollutants

Ozone contributes to reduced visibility (smog or haze), and can cause harmful health effects even at low levels. Ozone exposure can trigger chest pain, coughing, throat irritation, inflame the linings of the lungs and can worsen bronchitis, emphysema, and asthma. Repeated exposure may permanently scar lung tissue. Ground-level ozone is not emitted directly into the air, but created through chemical reactions between nitrogen oxides (NOx) and volatile organic compounds (VOCs). In the metropolitan Washington region, onroad mobile sources are the largest contributor of nitrogen oxides, accounting for approximately 54 percent of regional emissions in 2011. Other sources of NOx include power plants, industrial facilities and nonroad mobile sources.

VOCs are emitted as gases from a huge variety of materials including paints and lacquers, paint strippers, glues and adhesives, permanent markers, cleaning supplies, pesticides, building materials, and office equipment like copiers and printers. While some VOCs pose serious health threats to indoor air quality, VOCs are primarily regulated because they can contribute to ground-level ozone through

reactions with NOx, and carbon monoxide. Mobile sources contributed about half of the region's VOC emissions in 2011.

Particulate matter (PM) includes "coarse particles" like soot, smoke, dirt and dust, with a diameter between 2.5 and 10 micrometers, and "fine particles," which have diameters 2.5 micrometers and smaller. PM can cause serious health problems because they can get deep into the lungs and even into the bloodstream. Particle pollution exposure is linked to a variety of health problems, including: aggravated asthma, decreased lung function, irregular heartbeat, heart attacks, and even premature death in people with heart or lung disease. Some particulates are emitted directly – primarily from construction sites, unpaved roads, fields, smokestacks or fires – while others form through reactions of sulfur dioxides and nitrogen oxides that are emitted by power plants, industries and vehicles. Mobile sources contributed about a quarter of the region's fine particle emissions in 2011.

Air Quality Regulation

The Metropolitan Washington Air Quality Committee (MWAQC) is certified by the Mayor of the District of Columbia and the Governors of Maryland and Virginia to prepare an air quality plan for the DC-MD-VA Metropolitan Statistical Area under Section 174 of the federal Clean Air Act Amendments of 1990. MWAQC coordinates air quality planning activities among the local government members of the Metropolitan Washington Council of Governments (COG), the Transportation Planning Board (TPB) and external stakeholders to develop and adopt an air quality plan for transmittal to the District of Columbia, Maryland, and Virginia.

Despite progress, the metropolitan Washington region remains in nonattainment of the 2008 NAAQS for 8-hour ozone of 75 ppb. The Clean Air Act requires that the region attain the standard as soon as practicable but no later than December 31, 2015. However, because the region's designation classification is "marginal," there is no federal requirement to submit an Attainment Demonstration or a Reasonable Further Progress/Rate of Progress Plan, or to establish new lower Motor Vehicle Emission Budgets (MVEBs) as part of any State Implementation Plan (SIP) submittal. If the region does not meet the 2008 standard by the 2015 deadline, the region's classification will likely be increased to moderate non-attainment and the region will likely be required to adopt additional regulatory programs to achieve and maintain attainment of the NAAQS.

EPA is considering establishing a new more stringent NAAQS for 8-hour ozone in the range of 60-70 ppb, with an anticipated attainment deadline of 2020. As part of the agency's 5-year review process, the EPA's Clean Air Scientific Advisory Committee (CASAC) recommended a 60-70 ppb standard was necessary to protect public health.[i] If such a standard is passed, stronger measures will be needed to bring regional air pollutant levels in attainment with the new NAAQS.

Federal and State control measures included in past SIP submittals continue to provide air emission reductions and benefits to the region. Some of the most significant control measures include: motor vehicle emission standards, emission caps or permits for power plants, emission standards for non-road engines, and product formulation requirements for aerosols, adhesives and paints. New control measures currently being developed include: Tier 3 motor vehicle emission standards, measures to reduce emissions being transported into the region from upwind states, and tighter emission standards for non-road engines.

Local Activities & the Gold Book

For several decades, local governments in the area have led by example – adopting strategies and implementing programs that help to improve air quality for the entire region. COG began tracking the Air Quality Index (AQI) and issuing daily air quality readings in 1970. This led to work with local governments to reduce air pollution in the region, and to build public awareness of air quality issues. Though important, most local measures are not easily quantifiable and/or are not being credited in the SIP. Additional initiatives continue to be explored and are of significant interest, but have not been fully implemented by state and local governments because of a shortage of time or resources.

The Gold Book is a compendium of these local initiatives. It presents the innovative measures that are now underway and promising measures for the future that could make a difference in our region's air quality. Through the efforts of the participating state and local governments, as outlined in this document, the region has taken many important steps to reduce emissions above and beyond the requirements of federal or state law. The measures contained in this Gold Book are organized into the following categories:

- Climate, Energy, and Sustainability Plans
- Regional Partnerships
- Green Power and Grid Modernization
- Energy Efficiency
- Transportation Demand Reduction
- Transportation Options
- Vehicle Emission Reduction
- New & Additional Ideas

A description of the measure, information on the regional implementation status, opportunities for expansion, and an explanation of air quality benefits are included for each measure in the Gold Book. Many programs are already in place. There are numerous current initiatives that could be expanded, some without significant new investment. Finally, there are promising initiatives that could be implemented in the future, but which may require additional effort, support, or investment. The second and third categories include measures that have been discussed at the regional level but not implemented, and those that are already planned but will not take place until after the region's 2015 ozone attainment date.

The Gold Book reflects the progress local governments in the metropolitan Washington region are making to improve air quality, and helps local governments identify additional measures they can take. It is intended to be a living document, so feedback, suggestions and additions are welcome. Please direct comments to Isabel Ricker at iricker@mwcog.org.

CLIMATE, ENERGY AND SUSTAINABILITY PLANS

Climate, energy and sustainability plans cover a variety of planning initiatives including greenhouse gas (GHG) reduction, climate adaptation and resilience, fossil fuel consumption reduction, energy efficiency, renewable energy generation and use, energy security, and more general community livability goals. These plans include a multitude of different measures, strategies and recommendations for achieving climate and sustainability goals, many of which are difficult to quantify but can have very important benefits for both greenhouse gas and air quality goals.

In June 2014, EPA proposed carbon emissions limits for existing power plants under the Clean Power Plan. The rule is expected to go into effect in June 2016, at which time states will be required to submit plans for meeting EPA's carbon emissions target. Many of the measures states are likely to include in these plans are part of existing climate, energy and sustainability plans, such as programs, incentives and requirements to promote renewable energy and energy efficiency. A new open-access EPA tool called AVERT (Avoided Emissions and Generation Tool) enables states, local governments and other stakeholders to estimate hourly emissions benefits of energy efficiency and renewable energy policies and programs. This tool helps state and local governments develop, track progress, and prioritize measures for climate, energy, sustainability, and air quality planning, and will be important for demonstrating compliance under the Clean Power Plan.

State Climate and Energy Plans

District of Columbia

Sustainable DC is the District's first sustainability plan that lays out a path forward to make the District the healthiest, greenest, most livable city in the nation over the next 20 years. A few of the plan's goals to achieve by 2032 include minimizing GHG emissions 50 percent; cut citywide energy use by 50 percent and increase use of renewable energy use by 50 percent; increase use of public transit, biking, and walking to 75 percent of all commuter trips; and achieve ZERO unhealthy air quality days.

Some of the actions identified to help meet those goals include introducing legislation to reduce fossil fuel-based power use; requiring all new buildings to be net-zero energy or net-positive; expand performance-based parking program; expand car-sharing programs to low-income residents using financial tools; encourage private businesses to offer incentives for employee travel by transit, walking, or biking; encourage and promote telecommuting and alternative work schedules for employees; require District government, and encourage private businesses, to purchase clean fuel, low-emission fleet vehicles; expand electric vehicle charging infrastructure throughout the city; offer incentives to avoid driving and other emission-generating activities on predicted Code Red and Orange air quality days; and track and report mileage data from clean fuel, low-emission, and electric vehicles.

Maryland

In 2007, Governor Martin O'Malley signed Executive Order 01.01.2007.07 establishing the Maryland Commission on Climate Change. Sixteen State agency heads and six members of the General Assembly comprise the Commission. The principal charge of the Commission was to develop a Plan of Action (the Climate Action Plan) to address the drivers of climate change, to prepare for its likely impacts in Maryland, and to establish goals and timetables for implementation.

In 2009, Maryland Governor O'Malley and the Maryland General Assembly passed the Greenhouse Gas Emissions Reduction Act of 2009 (GGRA). The law requires the State to develop and implement a Plan (the GGRA Plan or the Plan) to reduce GHG emissions 25 percent from a 2006 baseline by 2020. The top ten measures to help the state reach the goal are the Regional Greenhouse Gas Initiative (RGGI), EmPOWER Maryland Program, Renewable Portfolio Standards, Maryland Clean Cars Program, corporate average fuel economy (CAFE) standards, public transportation initiatives, zero waste goals, building codes, managing forests to capture carbon, and planting forests in Maryland.

RGGI is a multi-state emissions cap and trade program with a market-based emissions trading system. The cap and trade program is designed to reduce CO_2 emissions, while maintaining electricity affordability and reliability. Maryland's participation in RGGI will reduce CO_2 emissions from the State's electricity generators by roughly 10 percent from current levels by 2019. The program also directly funds energy efficiency and cleaner energy programs that will lower greenhouse gas emissions.

The EmPOWER Maryland Energy Efficiency Act of 2008 sets targets to reduce both per capita energy consumption and per capita peak demand by 15 percent by the end of 2015 (based on a 2007 baseline). To help achieve this goal, the Maryland Energy Administration (MEA) encourages residents to adopt the energy saving measures that are most appropriate for their home.

Virginia

The Virginia Governor's Commission on Climate Change released its final report on December 15, 2008, stating that greenhouse gas emissions in the state could increase by 31 percent by 2025 under business as usual. The report presents recommendations to meet the state GHG reduction target of 30 percent below the business-as-usual projection by 2025.

The Virginia General Assembly established state energy policy and directed the Department of Mines, Minerals and Energy to update the Virginia Energy Plan by July 1, 2010. The plan recommends actions to meet several key goals:

1. Grow both traditional and alternative energy production, jobs and investment;
2. Increase the use of conservation and efficiency;
3. Expand public education about Virginia's energy production and consumption, its effect on our economy, and how Virginians can use energy more efficiently; and
4. Maximize the investment in clean energy research and development through the work of the Universities Clean Energy Development and Economic Stimulus Foundation.

Regional Implementation

The District of Columbia's 2011 Greenhouse Gas Emissions Inventory shows an emissions reduction of 12.5 percent from the 2006 baseline year, even with continued population and employment growth. In addition, emissions associated with District government operations, a subset of the city's total greenhouse-gas emissions, fell by 23 percent between 2006 and 2011.

The status of all Sustainable DC actions can be found in the 2013 Earth Day Baseline Report. Maryland's 2011 Greenhouse Gas Emissions Inventory shows a 10.5 percent reduction in net emissions from its 2006 emission inventory. To help reach the EmPOWER Maryland 15 percent by 2015 target the MEA estimates that 64,000 MWh were saved through MEA programs between 2009 and 2010.

Regional Sustainability Plans

Description

Region Forward is COG's vision. It's a commitment by COG and its member governments, who together seek to create a more accessible, sustainable, prosperous, and livable National Capital Region. *Region Forward* draws its climate and energy related goals from the 2008 National Capital Region Climate Change Report. The regional GHG emissions reduction goals include 10 percent below business as usual by 2012, 20 percent below the 2005 levels by 2020, and 80 percent below 2005 levels by 2050.

Regional Implementation

COG's Climate, Energy and Environment Policy Committee (CEEPC) supports the *Region Forward* vision by providing leadership on climate change, energy, green building, alternative fuels, solid waste and recycling issues and by supporting area governments as they work together to meet *Region Forward* goals. In May 2013, CEEPC adopted the second edition of the Regional Climate & Energy Action Plan, which identifies short-term goals and actions (2013-2016) to help move the region toward achieving long-term *Region Forward* goals. A Resource Guide was developed to assist local jurisdictions with plan implementation. Progress toward implementation of the action plan is tracked through annual surveys and published in an annual Climate and Energy Progress Report (link is to the 2013 Report).

To begin to understand progress made toward the 2012 goal, COG has conducted preliminary analysis of electricity and transportation sectors. Preliminary results show that the region is surpassing reduction goals in the electricity sector, with a 17 percent reduction in CO_2 emissions from 2005 to 2012. Combined emissions from natural gas and electricity consumption showed a 16 percent decrease from 2005 levels. According to the most recent regional transportation emissions analysis, emissions from the transportation sector are estimated to be holding steady at 2007 levels. Analysis of other emissions sources, including stationary fuels, is pending.

Opportunities for Expansion

To continue to encourage local action to meet the 2020 GHG reduction goal, CEEPC has announced a "Focus on the Leaders" initiative. The goal is to identify successful models both locally and nationally that can be implemented in local communities. Each CEEPC meeting in 2014 will feature best practices that leaders can work to advance in the National Capital Region.

In addition, CEEPC has approved the development of a pilot Climate and Energy Leadership Awards Program to recognize environmental achievements of local governments and non-governmental organizations in the region, encourage friendly competition, and provide an opportunity to learn from each other. A key component of the awards program is to share how the leading programs, projects, and policies in the region are transferable to other local communities. The Awards program and the "Focus on the Leaders" initiative have the potential to expand current air quality improvement measures and to bring new ideas to the region.

Local Climate & Energy Plans

Regional Implementation

Eleven of the COG member jurisdictions have their own climate, energy or sustainability plans. Each locality is in various stages of development and implementation of their local plans. A summary of local government plans and goals is provided below:

- The City of Alexandria's Energy and Climate Change Action Plan goals include the following: by 2010, reduce GHG emissions to 2005 levels; by 2020, reduce GHG emissions by 20 percent below 2005 levels and 25 percent of City's energy will be from clean renewable sources; by 2030, all buildings will be carbon neutral; and by 2050, reduce GHG emissions by 80 percent below 2005 levels and 80 percent of the City's energy will be from clean, renewable resources.
- Arlington County's Community Energy Plan was adopted as a new element of the County's Comprehensive Plan in 2013. Under the County Government goals in this plan, emissions would be reduced 76 percent by 2050 from 2007 levels, with interim goals of 10 percent below 2000 levels by December 2012, 25 percent reduction by 2020, 42 percent reduction by 2030 and 59 percent reduction by 2040. The community-wide target is to reduce greenhouse gas emissions by 70 percent from 2007 to 2050, from 13.4 mt CO_2e per capita per year to 3.0 mt CO_2e per capita per year. Arlington County has evaluated progress towards their greenhouse gas emission reduction goals. Arlington County's 2012 Government Operations Greenhouse Gas Inventory shows that the County has achieved a reduction of 11.7 percent in its emissions, even as its services and facilities increased.
- The City of Bowie is in process of developing a climate action plan where a target reduction goal for city operations is to reduce GHG emissions associated with city government vehicles by 25 percent by 2020 against a 2007 baseline. The target reduction goal community-wide is to reduce citywide GHG emissions by 10 percent by 2015 and 20 percent or more by 2020.
- Fairfax County's plan recommends policy changes and agency actions across government operations to reduce GHG emissions, and is updated annually. The Facilities Management Department (FMD) has set an internal goal of reducing energy use per square foot (kBTU/sf) by one percent per year. Over the last decade, FMD has achieved this goal, avoiding over $7 million in energy costs in that time.
- Frederick County Sustainable Action Plan for County Operations has a goal of 25 percent GHG reduction by 2025. It also sets goals in the areas of leading by example, conserving energy and reducing emissions, green building, green purchasing, green infrastructure, recycling and reducing waste, and transportation alternatives that improve air quality. Each goal area identifies guiding principles, an action plan, highlights of current success, and how success will be measured.
- Greenbelt is in the process of developing their climate action plan. In line with State of Maryland and COG's initiatives, a goal has been established to reduce GHG emissions at City facilities 10 percent below 2005 levels by 2012, 20 percent by 2020 and 80 percent by 2050.
- The Loudoun County Energy Strategy sets a County goal to reduce greenhouse gases from 3.85 million metric ton to 3.0 million metric tons by 2040 County-wide. Although by that time the County's population projection increase is 86 percent. The County also has a government operations goal to reduce emissions 15 percent between 2007 and 2012.
- Montgomery County Climate Protection Plan includes 58 recommendations in the categories of renewable energy, residential building energy efficiency, commercial, multi-family and public building energy efficiency, transportation, forestry and agriculture, land use and planning, and

outreach. Each recommendation contains a summary, background information, and steps for implementation. The plan's goal is to reduce GHG emissions to 80 percent below 2005 levels.

- Prince George's County has finalized its Climate Action Plan (CAP) and it is pending approval from the County Executive's office and County Council after which it will be made public. The County has a Petroleum Reduction and Renewable Energy Action Plan which calls for the County to: reduce GHG emissions 80 percent below 2008 levels by 2050, to reduce County electricity consumption by 20 percent by 2022, to meet 20 percent of building electricity needs with distributed renewable energy by 2022, to incorporate Green Building principles into all county facilities, and to reduce County fleet petroleum consumption 20 percent by 2018.
- Rockville signed the US Mayors Climate Protection Agreement and is a member of ICLEI Local Governments for Sustainability, an international association of local governments and national and regional local government organizations that have made a commitment to sustainable development. The 2007 Sustainability Plan contains actions to conserve energy and reduce greenhouse gases.
- Takoma Park's Local Action Plan for Reducing Greenhouse Gas Emissions includes the community GHG inventory and describes in detail action measures by sector including municipal, commercial/residential, natural resources, waste, and transportation sectors. The goal of the plan is to reduce CO_2 emissions in Takoma Park to 80 percent of 1990 levels by 2010.

Air Quality Benefits

Climate, Energy and Sustainability plans increase public awareness of energy consumption and promote efficient technologies and conservation measures. Reducing energy consumption reduces emissions of conventional pollutants such as NOx, SO_2 and mercury, as well as greenhouse gases like methane and CO_2, by displacing electric generation from coal, oil, and natural gas-fired power plants. Reducing emissions from upwind power plants reduces ozone transfer and can make a significant contribution toward improving local air quality conditions. Additionally, transportation measures in these sustainability plans reduce levels of NOx, ozone and fine particles by encouraging low or no-emissions transportation options, increasing transportation efficiency and reducing travel demand.

Energy Security & Assurance Plans

Description
In recent years, extreme weather events, like hurricanes Sandy and Irene, the June 2012 derecho and recent winter ice storms have revealed the vulnerability of the energy system. An aging and patchwork infrastructure makes the metropolitan Washington region's electrical grid susceptible to power outages and poses an additional challenge to ensuring energy quality. Widespread power outages and concerns about the vulnerability of the region's energy system to security breaches and natural hazards led to a regional discussion about energy security and assurance planning.

Energy Assurance Plans (EAPs) identify key actions to take during an energy emergency to ensure that critical facilities continue to function. Strategies may include integrated energy planning, energy efficiency, distributed generation, grid modernization, and alternative power systems, including renewable energy. Plans may be based on state EAPs or formulated independently. EAPs can be stand-alone plans, or can be integrated into community energy or emergency management plans.

Regional Implementation
Several COG member jurisdictions are beginning to implement energy assurance measures, or are considering developing an EAP. The City of Bowie has installed generators at key City facilities and provides cooling and warming centers during severe weather events as part of its Emergency Operations Plan. The District Department of the Environment developed an EAP to assess the types of energy emergencies that could occur in the District, lay out a plan of action, and determine who responds in the event of an energy emergency. The Plan also recommends steps the District can take to promote policies and programs that enhance the resiliency of District energy systems and protect critical infrastructure.

Maryland has a grid reliability & resilience initiative, started in 2012 by Governor O'Malley. The Maryland Task Force on Grid Resiliency Report provides an in-depth analysis of the state's electric distribution system, functionality and performance during extreme weather events. The report explores numerous options for improving the resilience of the grid including: improved reporting requirements, technological and hardware changes, cost-recovery mechanisms for resilience improvements, and improved communication between utilities, state agencies, and emergency management agencies. In May 2013, the Energy Future Coalition released their proposal for a Maryland Utility 2.0 Pilot Project, which will provide a practical demonstration of potential future utility and electric grid practices to address challenges including security and resilience.

The state Public Service Commissions (PSCs) are taking steps to require utilities to improve reliability and address resilience challenges. The Maryland PSC has required that utilities provide reports detailing their preparedness for the derecho and actions taken since the storm to improve service. The Maryland PSC is also evaluating performance-based ratemaking options that would align utility incentives with reliability goals. Pepco and other utilities in the region have modernization efforts under way, particularly implementation of smart meters, which provide real-time energy data to customers and make it easier to track power delivery issues.

Opportunities for Expansion
Given the high level of interest in energy security and reliability issues in the region there are many opportunities for coordination. Collaboration between utilities and governments is crucial to the success of grid reliability efforts. The Department of Defense is making great strides to improve energy reliability

and resilience on military installations and has a large interest in these issues in the metropolitan Washington region. Partnerships with hospitals, universities, water and sanitation plants, and other critical services can also be expanded to address mutual energy assurance challenges.

COG is working with regional stakeholders to pursue energy assurance planning at the regional level. The project would include a comprehensive vulnerability assessment, identify current energy security policies in the region and make recommendations for strengthening and aligning practices across the region. Such an initiative could also develop energy assurance guidelines and provide resources and technical assistance for local governments.

Air Quality Benefits

In addition to the benefits for security and economic productivity, improving the reliability and resilience of the region's energy system is also beneficial for regional air quality. Many critical infrastructure facilities – including hospitals, airports, water and sanitation plants – in addition to commercial buildings in the region use diesel generators to provide power in the event of an emergency. These generators have significant negative air quality impacts: a diesel generator can release up to nine tons of NOx in one event. The Virginia Department of Environmental Quality estimates that distributed generators were responsible for over 396 tons of NOx emissions in 2007 in Northern Virginia alone. Energy assurance planning reduces the need for distributed diesel generators by improving reliability and resilience, reducing the frequency and length of blackouts and providing clean, alternative emergency generation sources.

Local Air Quality Plans

Description
Air Quality Improvement Plans and Action Guides can be effective tools for improving local air quality by educating the public on air quality issues and providing concrete steps which residents, employers and local governments can take to reduce air pollution. Such measures may include changing commuting behavior, particularly on poor air quality days, by encouraging teleworking, carpooling, public transit, walking and bicycling.

Local air quality programs may encourage or require the use of low-polluting materials like low-VOC paint and pesticides, begin a gas can replacement program, or even provide incentives for electric or alternative fuel vehicles. Other initiatives may focus on reducing or postponing polluting activities, such as vehicle refueling, lawn-mowing, paving and outdoor painting, vehicle idling, and pesticide application, to reduce the levels of NOx and VOCs exposed to sunlight on poor air quality days.

Regional Implementation
All COG members participate in the Clean Air Partners Program and encourage residents to participate in air quality improvement programs, including Air Quality Action Day measures. Some localities in the region also have independent initiatives to encourage measures such as those discussed above.

The Montgomery County Department of Transportation (MCDOT) has an Environmental Sustainability Policy which aims to reduce VOC and NOx emissions to improve air quality. MCDOT's policies include: reducing congestion, promoting low emission and alternative fueled vehicles, increasing transportation options, expanding and maintaining tree canopy, a waste-to-energy facility, and switching equipment to run on 20 percent soybean oil. Prince George's County hosts air quality educational information on its website and in 2008 performed an air quality messaging survey to inform development of an Air Quality Strategic Plan. The County also began a program to encourage air quality awareness and stewardship in County operations and among County employees.

The Arlington Initiative to Rethink Energy (AIRE) aims to help residents, businesses and government agencies reduce greenhouse gas and air pollutant emissions. Through the AIRE program, the County has transitioned over half of its vehicle fleet to clean and alternative fuels. Arlington Transportation Partners and BikeArlington also help to improve air quality by encouraging public transit, walking and bicycling.

Opportunities for Expansion
Local governments in the region that do not have air quality improvement policies should consider measures they can take, such as those discussed above and throughout this Gold Book, to reduce VOC and NOx emissions from public operations.

Localities can also lead or support air quality awareness programs to increase public participation in air quality improvement measures. For example, localities can participate in EPA's Air Quality Awareness Week (AQAW), which encourages residents to take simple actions – like bicycling, walking, using public transit, carpooling, refueling after dark, and using a broom or rake instead of a leaf blower – each day for one week to raise awareness of air quality issues.

Air Quality Benefits
Increasing awareness of air quality pollution and encouraging behavioral changes to improve air quality can have a significant impact on local air quality, particularly on days when air pollution is worst. Energy

efficiency and conservation measures lower electricity demand, reducing emissions of NOx, SO_2, fine particles and greenhouse gases from fossil-fueled power plants. Reducing emissions from upwind power plants reduces ozone transfer and can make a significant contribution toward improving local air quality conditions. Reducing car travel lowers NOx and fine particle emissions from motor vehicles. Easing congestion and improving traffic flow can also benefit local air quality because NOx emissions are greater at lower speeds associated with idling or congestion.

Regional Partnerships

Clean Air Partners Program

Description
In late 1994, the governments of Maryland, Virginia and the District of Columbia provided funds for a regional coordinated clean air public outreach program administered by the Baltimore Metropolitan Council (BMC) and the Metropolitan Washington Council of Governments (COG). The intent was to create a public education program, which would involve citizens and businesses in taking voluntary actions to reduce emissions and improve air quality.

Regional Implementation & Opportunities for Expansion
Clean Air Partners (formerly known as Endzone Partners) adopted an employer program as the key element of the public education effort in the summer of 1996. Employer participants agreed to promote voluntary actions among their employees and establish workplace policies to reduce emissions, especially during predicted ozone episodes. Program materials were developed and distributed to employers who joined program. In 2004, the Environmental Protection Agency (EPA) designated both Baltimore and Washington, D.C. metropolitan regions as nonattainment for fine particles. At that time the Clean Air Partners' Board of Directors expanded the program to include not only unhealthy ozone days but also days where particle pollution reached unhealthy levels.

Clean Air Partners provides daily air quality readings and alerts on the Air Quality Index for the public and businesses. By assigning the pollution level a color code (red/ orange/ yellow/ green), Clean Air Partners helps to educate people on the hazards of ground-level ozone and particle pollution, and encourages them to reduce or defer activities that create pollution. On unhealthy air days (Code Orange and above), Clean Air Partners distributes AirAlerts to more than 5,000 participants, including citizens, employers, and the local media. Clean Air Partners promotes voluntary actions such as carpooling, fueling after dark, ride-sharing, and trip reductions. Surveys have shown that the system is successful in educating the public and assists in the reduction of human based activities that create ground-level ozone and particle pollution.

Air Quality Benefits
Clean Air Partners improves air quality by encouraging behaviors that reduce emissions of NOx, VOCs, fine particles and other air pollutants. Clean Air Partners has quantified many of the program's benefits through surveys and transit ridership data collection. However, due to changes in funding levels, and the episodic nature of the program, estimated emissions reductions are not calculated. The program provides documented evidence of efforts to improve air quality on the worst days.

Green Cooperative Purchasing

Description
Cooperative purchasing programs bring together a group of individuals, organizations, or governments to exercise their collective purchasing power to leverage discounts on bulk purchase of goods or services. Recently, local governments have begun to explore green collective purchasing initiatives to both support emerging clean and green tech industries and to make it more affordable to pursue sustainability initiatives. Green purchasing can apply to a huge variety of products, such as highly-efficient light emitting diode (LED) street lights, alternative fueled vehicles and infrastructure, compostable food-ware, or energy efficiency services.

Regional Implementation
COG's Cooperative Purchasing Program began in 1971 with the primary goal of reducing costs through the economies of scale created with large volume purchasing, saving money for jurisdictions and their taxpayers. The region's Chief Purchasing Officers Committee (CPOC) estimates that participants in the Program save in excess of $2 million annually.

In March 2013, CPOC and the Baltimore Regional Cooperative Purchasing Committee (BRCPC) formed the Mid Atlantic Purchasing Team (MAPT), to leverage increased purchasing power through larger contracting volumes, and to more widely distribute the workload for planning and developing cooperative contracts. MAPT is developing a green contracts database and is available to provide support to local governments pursuing cooperative procurements.

The majority of local governments in the National Capital Region have developed or are developing green fleet policies, and approximately half have alternative fuel infrastructure projects. Through the COG Electric Vehicle Workgroup, interest has been expressed in a cooperative procurement of electric vehicles, electric vehicle infrastructure, and other alternative fuel vehicles and fuels.

Opportunities for Expansion
COG is in the process of surveying local governments, school districts, and water and wastewater utilities on green purchasing and alternative fuel vehicles. The information gathered will help identify green contracts that local governments can take advantage of through the COG Rider Clause, assess the feasibility of developing a cooperative purchase for AFVs and infrastructure, and begin to identify other possible green products to cooperatively purchase. Once the survey results are analyzed, COG should coordinate with local governments and other participants in the cooperative procurement program to pursue the purchasing of needs identified in the survey.

Air Quality Benefits
Through collective purchasing local governments are able to invest in cleaner and more efficient materials, equipment and vehicles. Practicing green procurement can reduce emissions of harmful air pollutants.[ii] Collective electric or low-emission vehicle purchasing can reduce NOx and fine particle emissions from cars, trucks, buses, and other mobile sources.[iii] Other opportunities to improve air quality include cooperative energy efficient or renewable energy technology purchases to reduce emissions from power plants, cool roof or cool pavement procurements, and bulk low-VOC materials purchases.

Urban Heat Island Mitigation

In developed areas, pavement, buildings and rooftops absorb the sun's energy and re-radiate heat, raising ambient air temperatures higher than surrounding natural landscapes. Engines, air conditioners, and other human activities also release more heat in urban areas. This phenomenon, called the urban heat island effect, causes urban summertime air temperatures to be 9 to 16 degrees Fahrenheit warmer than surrounding areas.

Trees and vegetation reduce ground-level ozone concentrations by reducing air temperatures, reducing emissions from energy generation needed for cooling, and directly removing ozone, particulate matter, and NOx from the air through deposition and absorption. Modeling has clearly shown that trees reduce ozone and can significantly cool urbanized areas with a substantial extent of hard surfaces.

This section covers three options for reducing the urban heat island effect and improving air quality with vegetation and 'cool' technologies, such as green roofs, cool roofs and cool pavements, Green Streets policies, and tree canopy protection and expansion.

Cool Roofs and Cool Pavements

Description
Cool roofs can be covered by vegetation ('green' roofs) or special coatings (elastomeric acrylic) that reflect the sun's light into the atmosphere and create less heat. Cool pavements contain special materials or coatings to reflect sunlight or are permeable. Permeable pavements have cooler surfaces due to evaporative cooling.

Regional Implementation
Several jurisdictions have green building codes or green building policies many of which incorporate green roofs. Forty-one percent of jurisdictions have at least one green roof on government property (CEEPC Annual Survey, 2012). Many green roofs have been installed on residential, commercial, and industrial properties throughout the region. No data is available on the prevalence of cool roofs or cool pavements in the region. No jurisdictions or states have cool roof programs or policies that COG is aware of.

There are about 75 green roofs in the District of Columbia covering around 350,000 ft^2. The District is partnering with the Anacostia Watershed Society to offer a green roof rebate program for residential, commercial, and industrial properties. The RiverSmart program offers rebates for retrofitting impervious surfaces. DDOT has implemented three Green Alleys, retrofitting the alleys with permeable pavement.

Cool roofs, green roofs, and cool pavements are more economically viable when the roof or pavement is already being replaced. Prince George's County's Rain Check Rebates program offers rebates for green roofs, pavement retrofits and urban tree canopy. Montgomery County's Rainscapes Rewards program offers rebates for green roofs and permeable pavement.

Opportunities for Expansion
To increase the environmental and social benefits of cool roofs and pavements, COG jurisdictions and member states could:

- Expand incentives for green roofs
- Create incentives for cool roofs and cool pavements
- Publicize current rebates, educate the public
- Post educational signage in buildings with cool or green roofs or cool pavements
- Make use of resources such as the Cool Roofs and Cool Pavements Toolkit

Green Streets Policy

Landscaped features -- such as plants and trees – in the road right-of-way help cool the air through evapotranspiration and shade, and reduce air pollutants through deposition and through their pores[iv].

Regional Implementation
In 2014, the Transportation Planning Board (TPB) adopted a Green Streets Policy. The policy states that "TPB supports a transportation system that enhances the region's natural environmental quality and the appearance of its communities, makes alternate travel modes such as walking and bicycling more attractive, and focuses economic development in walkable activity centers."

All jurisdictions in the COG region have implemented a Green Streets project or incorporated green streets elements in site plans or Master Plans; however only a few have implemented a Green Streets Policy. Maryland requires jurisdictions to use environmental site design in new and reconstructed development of all state and federal projects. Virginia Department of Transportation's Watershed Implementation Plan includes a provision to encourage LID where appropriate. The District of Columbia has a Green Streets Policy and routinely incorporates trees and environmental site design on city street corridors.

Opportunities for Expansion
COG jurisdictions and member states can adopt a green streets policy and develop or expand implementation. COG plans to conduct surveys of member adoption of Green Streets policies and hold trainings and share resources on Green Streets implementation.

Air Quality Benefits
High temperatures enhance ozone formation and increase VOC evaporative emissions. Cool roofs and cool pavements improve air quality by reducing outdoor temperatures in urban areas and by reducing energy consumption for cooling, thereby reducing emissions from power generation. Green roofs also contribute to improving air quality by directly removing pollutants such as ozone, particulate matter, and NOx from the air through deposition and absorption.

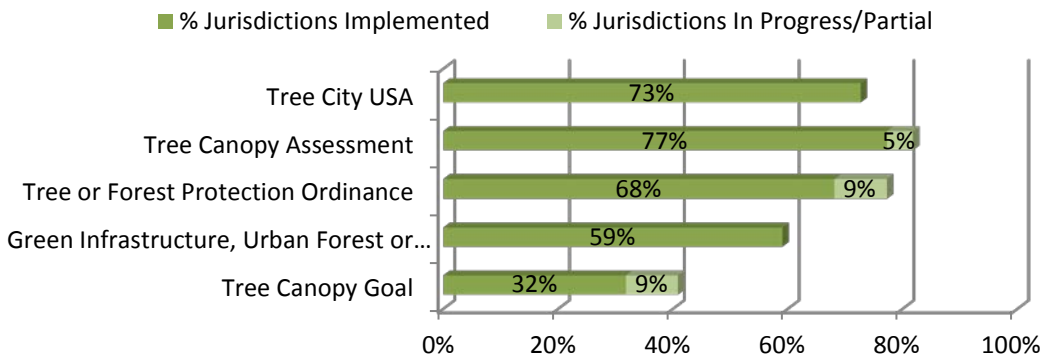
Tree Canopy Management

Regional Implementation

COG's Regional Tree Canopy Workgroup, whose members largely consist of foresters and arborists from local and state governments, has convened over the last two years to share expertise and recommend strategies to maintain and increase the health and extent of tree canopy in the COG region. COG's 22 jurisdictions have undertaken a variety of measures to protect, enhance and increase tree canopy, summarized in Figure 1.

Figure 1 summarizes jurisdiction actions to measure, manage, and plan for tree canopy through July 2013. Almost two-thirds of jurisdictions have adopted a tree or forest protection ordinance (64 percent) and a large majority of jurisdictions have completed a tree canopy assessment (82 percent). Only a few have established a specific tree canopy percentage goal (23 percent). While only 6 of the 22 jurisdictions implemented a plan to increase tree canopy, 12 jurisdictions have started to develop one.

Figure 1. COG Member Tree Canopy Policy & Program Status: July, 2013



Sources: CEEPC 2012 Member Survey, COG member jurisdiction websites, US Forest Service website, and/or http://gep.frec.vt.edu/va_utc.html. Tree City USA designees are listed on ISA website.

Most jurisdictions are designated as a 'Tree City, USA' (59 percent), a program sponsored by the Arbor Day Foundation in cooperation with the USDA Forest Service and the National Association of State Foresters that sets criteria at a basic minimum level for tree protection activities. The District of Columbia's Urban Forestry Administration, residing in the Department of Transportation, plants an average of 4,500 trees annually. The District requires permits to remove trees within the public right of way, or any tree more than 55" circumference. The RiverSmart Homes program offers incentives to homeowners for planting trees.

In Maryland, tree canopy is bolstered by the state's 40 percent tree canopy goal in 2013 and the Forest Conservation Act, which promotes the maintenance and protection of forest. Under the law, any person making application for a subdivision, grading permit or sediment control plan on a tract of 40,000 square feet or more must submit a Forest Stand Delineation (FSD) and a Forest Conservation Plan (FCP) (unless meeting criteria for exceptions under the rule). The law also enables the use of forest mitigation banks and other tools to offset the impacts of new development.

Opportunities for Expansion
Additional jurisdictions could:

- Achieve Tree City USA status
- Establish a forestry and tree planting program
- Conduct a detailed tree canopy assessment
- Set a tree canopy goal
- Develop an urban forest or green space plan
- Target tree plantings to mitigate urban heat island effect
- Engage property owners in tree stewardship, and
- Promulgate tree maintenance and protection ordinances and policies

The Regional Tree Canopy Workgroup can continue to leverage local resources to promote best practices for tree canopy preservation and expansion.

Air Quality Benefits
Trees and vegetation reduce ground-level ozone concentrations by reducing air temperatures, reducing energy used for cooling, and directly removing ozone, particulate matter, and NOx from the air through deposition and absorption. Modeling has clearly shown that trees reduce ozone and can significantly cool urbanized areas with significant hard surfaces.

Public-Private Partnerships

Higher Education

Description
The metropolitan Washington region has one of the highest concentrations of higher education institutions in the country. Colleges and universities tend to be high energy users: they are population-dense and have large building footprints. Schools can adopt sustainability plans to promote air quality protection on campus and in their investment decisions. There are a multitude of potential measures that colleges and universities can take to improve air quality on campus in operations, infrastructure, education and behavior of students. School vehicles, such as sports team buses and public safety fleets, can be switched to low or zero-emission vehicles. Schools can implement no-idling rules for vehicles and delivery trucks around campus, educate student drivers in eco-driving practices, and encourage low emission transportation options biking, walking, public transit and carpooling.

Regional Implementation
The presidents of colleges and universities in the District of Columbia and Mayor Vincent Gray signed the Mayor's College and University Sustainability Pledge (CUSP) at American University in February 2012. The Mayor's CUSP is a voluntary, public affirmation between the District of Columbia's municipal government and the local higher education sector to signify and support collective work toward a better, healthier, and more environmentally sustainable city.

CUSP Signatories include: American University, Corcoran College of Art & Design, Catholic, Gallaudet University, Georgetown University, George Washington University, Howard University, Trinity University and the University of the District of Columbia. CUSP signatories have staff that serve on a working group that's convened quarterly by the District Department of the Environment and the Consortium of Universities of the metropolitan Washington region. The working group provides opportunities for ongoing dialogue among signatories and the District government on the development and implementation of sustainability plans and progress toward commitments.[v]

Opportunities for Expansion
In 2014, COG hosted a meeting of CUSP that went beyond the District and incorporated universities from across the National Capital Region. Participants discussed opportunities for universities in the region to contribute to meeting local and regional sustainability goals. Interest was expressed in idle reduction initiatives and cooperative purchasing. There is potential for the expanded group to continue discussions and potentially cover air quality-related issues.

Air Quality Benefits
The CUSP program educates local higher education students and institutions about air quality and sustainability issues and engages them in undertaking measures that improve air quality, reduce pollution, and potentially foster long-term awareness and behavioral changes.

Airports

Description
The Metropolitan Washington Airports Authority (MWAA) is currently implementing their most ambitious ground transportation project ever: the 23-mile Silver Line Metrorail extension from West Falls Church to Loudoun County, serving Dulles International Airport by mass transit rail for the first time. Phase 1 of the Silver Line, currently in operation, extends rail service to Reston, VA. Phase 2 will bring service to Dulles and Loudoun County. This effort is one of the largest public works projects in America, and will provide new convenience for commuters and air passengers.

Reagan National Airport's popularity is fueled by its proximity to downtown Washington and its convenient access to Metrorail. In fact, Reagan National's Metrorail station has the highest usage of any airport rail stop in the country. In 2011, the operation of Dulles International's AeroTrain achieved a 99.54 availability of service and logged more than 2.8 million vehicle miles since inception. The AeroTrain, which serves the majority of the airport's passengers, links the Main Terminal with the A, B and C Gates. In May, the AeroTrain's Main Terminal was named the "Best Airport Rail Terminal" at the 2011 Global Air Awards ceremony. Phase 1 of the new Metrorail Silver Line opened for public use in July 2014. Phase 2 is currently under construction, and is expected to open for service in 2018.

The MWAA 2008 Building Codes govern airport facilities construction guidelines for the region. There are opportunities for improving the energy efficiency of airport operations through more stringent efficiency standards, or by creating incentives for improved energy performance. Additional benefits could be realized by investing in renewable energy or energy efficiency, such as through power purchase agreements or energy savings performance contracts.

Regional Implementation

MWAA is committed to other green initiatives, including conserving energy, recycling, using renewable resources, and adopting practices minimizing air and water pollution. It works closely with local jurisdictions to reduce its environmental footprint. MWAA Green Initiatives:

- Certified in the Loudoun County Green Business Challenge.
- Electric vehicle charging stations have been added to the Daily Parking garage.
- The first compressed natural gas (CNG) fueling station opened at Dulles in August 2014.
- Several new "clean diesel" airport shuttle buses have been placed into service.
- Solar panels were installed at the Dulles Toll Road Administration Building.
- Reagan National performed an energy audit of major facilities and feasibility assessments of energy-saving lighting systems, cogeneration and the use of alternative fuels for airport vehicles.
- A milestone in airline innovation occurred in 2011 when the first of 75 commercial flights using a biofuel blend, an Alaska Airlines flight from Seattle, landed at Reagan National.
- In 2010, the Airport Authority's recycling program expanded to additional tenants and airlines.

Air Quality Benefits
As large consumers of electricity and fuel, airports have the potential to make significant reductions of both criteria pollutants and greenhouse gas emissions. Airport-rail connections reduce vehicle emissions by encouraging travelers to take transit rather than drive to the airport. Regional airports are also encouraging cleaner vehicles for travelers, shuttle buses, and even in airplanes. Opportunities for

additional emissions reductions include transitioning airport maintenance vehicles, shuttles and other fleets to alternative fuels.

Powering airplanes with biofuel could significantly reduce emissions from the air transportation sector. While prices of this fuel blend are still quite high, the practice has proven to be safe and is likely to become more common as the production process and engine technology improves. An even larger impact could be made by reducing airplane idling, which contributes greatly to poor air quality.

Airports have begun to address emissions from electricity consumption by conducting energy audits to improve efficiency and by installing solar panels. There are great opportunities for further emissions reductions in this area, including the adoption of green building practices, expanding energy efficiency measures and purchasing renewable energy.

Energy efficiency and renewable energy purchases offset emissions from conventional electricity production, reducing emissions of NOx, SO_2, fine particles and greenhouse gases from fossil-fueled power plants. Reducing emissions from upwind power plants reduces ozone transfer and can make a significant contribution toward improving local air quality conditions.

Green Power and Grid Modernization

Renewable Energy Portfolio Standards

Description
Most states and localities in the region have adopted Renewable Portfolio Standards (RPS), also called Renewable Energy Standards (RES). These standards require a certain percentage of total electricity to be generated from renewable energy sources such as wind, solar photovoltaic (PV), geothermal, and biomass.

Regional Implementation
Maryland and the District of Columbia have enacted legislation establishing a mandatory RPS. Both standards include a "solar carve-out" to ensure that a certain percentage of this renewable energy comes from solar power. Maryland's RPS requires that all electricity providers in the state provide 20 percent renewable electricity by 2022, including 2 percent from solar power. The District of Columbia's RPS requires that all investor-owned utilities and retail suppliers provide 20 percent renewables by 2020, including 2.5 percent from solar by 2023. The Mayor has also set a goal to generate 50 percent of the District's energy supply from renewable energy by 2020. Virginia has a voluntary renewable energy goal, which encourages investor-owned utilities to provide 15 percent of their total electricity sales from renewable sources by 2025.

Opportunities for Expansion
The biggest opportunity for expansion of RPS policies in the region is in Virginia, where a mandatory RPS would have positive impacts on job creation and economic growth created by an in-state clean energy industry. Other opportunities include expanding the RPS to all retail electricity providers, as Virginia has many Rural Electric Cooperatives and Municipal Utilities that are not subject to the current voluntary goal. Virginia also has the most potential for solar power in the region – according to the National Renewable Energy Laboratory the state's solar generation capacity is estimated at 1.9 million gigawatt hours per year, about 17 times the state's annual electricity consumption.

Maryland recently considered several legislative measures to strengthen the RPS, including bills to increase the RPS to 40 percent by 2025, to include a minimum for hydrokinetic generation and to remove black liquor, a waste product from paper production that has significant emissions of air pollutants, from the list of qualifying renewable fuels. The Council of the District of Columbia has also considered a bill to remove black liquor from the RPS.

Air Quality Benefits
Renewable Portfolio Standards reduce emissions of conventional pollutants such as NOx, SO_2, mercury, fine particles and greenhouse gases from fossil-fueled power plants. Reducing emissions from upwind power plants reduces ozone transfer and can make a significant contribution toward improving local air quality conditions.

Local Government Renewable Energy Purchasing

Description
Following the EPA's designation of metropolitan Washington as a severe ozone non-attainment area in 2003, several localities in the region came together to purchase wind energy in order to reduce dangerous ozone transport caused by fossil-fuel power plants in upwind areas. Maryland included this local wind energy purchase in the 2004 SIP, the first inclusion of wind energy purchases as a control measure required under the Clean Air Act. Since then, many local governments in the region have begun to purchase renewable energy and numerous public agencies own, or are looking into owning renewable energy systems.

The EPA Green Power Partnership encourages organizations to use clean and renewable energy to reduce air pollution from conventional electricity. EPA resources are available to help participants identify benefits they could achieve by using green power and to help with green power purchases, including a Green Power Locator that lists available green power options by state.

Through this program, local governments can also partner with EPA to become a Green Power Community. Any locality participating in Green Power Partners can qualify to be a Green Power Community if the collective green power use by government, business and residential sectors meets or exceeds EPA's minimum requirement for the population size.

Regional Implementation
Many businesses and government agencies in the region have become Green Power Partners. There are now approximately 116 Green Power Partners in the District of Columbia, 197 in Maryland, and 27 in Virginia, including The District of Columbia, Montgomery County, Prince George's County libraries, the Cities of College Park, Gaithersburg, Greenbelt and Rockville, Arlington County, Arlington public schools, the City of Alexandria and the City of Falls Church. When the Gold Book was last updated in 2009 there were only 37 participating entities in the region and only two COG member jurisdictions. The full list is available here. EPA has recognized the District as the largest Green Power Community in the country two years in row. Collectively, green power now supplies more than 1 billion kWh per year, over 11 percent of total electricity use in the District.

Local Government Purchases
As part of the Mayor's Sustainable DC Plan, the District aims to cut electricity consumption in half by 2020 and to generate 50 percent of the District's energy supply from renewable energy by 2020. In early 2013, the Department of General Services signed a one-year contract for 100 percent wind power with Washington Gas. The city is now looking to go farther by purchasing its own wind and solar assets, rather than purchasing Renewable Energy Credits (RECs) for the power it uses. To this end, the D.C. Department of General Services issued a Request for Proposals (RFP) in March 2014 soliciting a power purchase agreement (PPA) for approximately 10 MW of solar to be installed on District facilities.

In 2005, the Montgomery County Clean Energy Buyers Group entered into a wind power purchase agreement with Washington Gas. The contract has been increased nearly every year since, with the goal of purchasing 20 percent renewable power by 2011. In 2012, the group announced a larger purchase, amounting to 25 to 30 percent of the collective energy needs. Localities participating in the Montgomery County Clean Energy Buyers Group include Montgomery and Prince George's counties, and the cities of College Park, Gaithersburg, Rockville, and Takoma Park.

In January 2014, Montgomery County's Department of General Services issued a Request for Energy Proposals (RFEP) to identify a solar PPA provider to develop solar systems on 17 County facilities. In April 2014, the County passed a law requiring that the County purchase 50 percent of its electricity from renewable energy sources by 2015 and move to 100 percent renewables by 2016.

In 2011, Prince George's County received a grant from the state to install two solar photovoltaic systems at County facilities in Capitol Heights and Landover. In the first year of operation, the solar panels produced approximately 527,000 kWh of electricity, enough to power approximately 46 homes. Moreover, these systems offset over 1.3 million pounds of carbon dioxide emissions. Prince George's County recently passed a law requiring new or renovated public facilities to install 1 kW of renewable energy generation for every 1,000 square feet.

In the spring of 2014, Prince George's County solicited proposals for two solar farm projects at County landfills, the Brown Station Road Sanitary Landfill and the Sandy Hill Creative Disposal Project. The projects will span several acres and will provide electricity service to public facilities and the surrounding community. The projects are anticipated to supply 4-5 megawatts of electricity, enough to power about 800 homes. If successful, the model will be replicated for other facilities in the County.

In 2012, Bowie solicited proposals to perform a Renewable Energy Feasibility Study and prepare and Implementation Plan. The City plans to complete the study in 2014 and to begin implementing renewable energy technologies in 2015.

The Washington Suburban Sanitary Commission (WSSC) also recently entered into a PPA agreement for solar projects at two water treatment plants. The solar systems began operation in the fall of 2013 and will generate approximately 6.6 million kWh each year, about 17 percent of the electricity required to operate the two plants, saving ratepayers approximately $3.5 million over 20 years.

Opportunities for Expansion

Local governments are able to take advantage of lower prices for bulk purchases of renewable energy. Wind energy prices are now comparable to traditional fossil fuel generation, and solar power is quickly becoming cost competitive. Local governments can usually pay less per kWh with a renewable energy contract than they would if purchasing the standard offer service through the local utility. The region is already a leader in green power purchasing, but these initiatives can be expanded to include other COG member jurisdictions, transit agencies, water utilities and other public entities like the Metropolitan Washington Airports Authority.

Air Quality Benefits

Using clean and renewable energy offsets energy from fossil fuels, reducing emissions of NOx, SO_2, fine particles and greenhouse gases from conventional power plants. Reducing emissions from upwind power plants reduces ozone transfer and can make a significant contribution toward improving local air quality conditions.

Cooperative Renewable Energy Purchasing

Description
Cooperative (also called collective, community or bulk) renewable energy purchasing allows residents to realize the economic and environmental advantages of solar power at a lower price. By sharing expertise and purchasing power, cooperative groups can achieve a significant discount (usually 20-40 percent) for participants, and are an effective way to bring more residents into the solar market. The "Solarize" model, which originated in Portland, Oregon, has become a popular method across the country.

Regional Implementation
Cooperative solar purchasing began in the metropolitan Washington region in 2006 with the Mount Pleasant Solar Co-op. The Mount Pleasant Co-op now has over 300 members and has installed solar on over 100 houses. More significantly, the model has spread across the region. D.C. Solar United Neighborhoods (DC SUN) encompasses 11 solar co-ops representing six of the District's eight wards. Similar groups have started in Virginia (VA SUN), Maryland (MD SUN) and West Virginia (WV SUN). The groups are part of the Community Power Network (CPN), an umbrella organization which supports local renewable energy purchasing initiatives nation-wide. CPN helps to connect these various groups and provides resources for communities interested in starting a collective purchasing project.

In 2013 Frederick, Maryland started "Solarize Frederick" with support from EPA's Climate Showcase Communities Program. The program had over 300 workshop attendees and resulted in 78 solar installations (66 solar PV and 12 solar thermal). Collectively, these systems will produce approximately 685,696 kWh of electricity and reduce CO_2 emissions by 484 metric tons annually. In October 2013, the District passed the Community Renewable Energy Act, which allows D.C. ratepayers to purchase power from solar facilities not located on their property with virtual net metering. This bill greatly reduces the barriers to solar adoption in the District, and opens the door for those who do not own their homes, have suitable roof space or the necessary financing to install solar on their own.

Opportunities for Expansion
Other localities in the region can adopt "Solarize" or "SUN" programs and work with regional partners to provide collective purchasing opportunities for residents interested in going solar. These programs could also be expanded to include other technologies like wind, storage or energy efficiency to maximize energy saving potential. Other jurisdictions can adopt community energy legislation to allow renters, those with shaded roofs, and others to participate in rooftop solar via virtual net metering.

Additional opportunities include community choice aggregation, whereby individual customers within a jurisdiction secure an alternative, usually renewable, energy supply contract community-wide, usually at a reduced group rate. Organizations like Groundswell are helping communities in the metropolitan Washington region pursue this opportunity.

Air Quality Benefits
Renewable energy purchases offset emissions from conventional electricity production, reducing emissions of NOx, SO_2, fine particles and greenhouse gases from fossil-fueled power plants. Reducing emissions from upwind power plants reduces ozone transfer and can make a significant contribution toward improving local air quality conditions. By aggregating community energy needs and purchasing power, the programs described above are able to secure renewable energy at a discounted rate and to greatly increase participation in solar procurement, expanding their impact on air quality.

Maryland Game Changers Program

Description
The Maryland Energy Administration (MEA) runs a "Game Changer" grant program to promote deployment of advanced clean energy technology from private and public laboratories to market applications benefiting Maryland's citizens. The grants support "game changing," innovative, early-commercialization stage energy generation (electric or thermal energy) technologies in actual installed projects. MEA evaluates the efficacy of each technology through performance data analysis, and the cost/benefit ratio through life cycle analyses. MEA's goal is to reduce the risks associated with installation of new technologies and to accelerate deployment and market penetration of clean energy technology that will significantly advance the State's clean energy market.

Regional Implementation
The first round of funding was announced in June 2012 and received over 30 applications. MEA made four grants in early 2013 and an additional five in June 2013. The current projects are:

- TimberRock Energy Solutions, for Solar-Charged Electric Vehicles (EVs) at a General Motors Plant in White Marsh
- Standard Solar, for the State's First Solar Microgrid at a property owned by Konterra, near Laurel
- Skyline Innovations, for Cost-effective Glazed Polymeric Solar Water Heating Systems
- Land and Cultural Preservation Fund, for Community-scale Wind Project Assessment and Development across the State
- Allied Well Drillers, for Validating Large-Scale Residential Geothermal Heating & Cooling Leasing Opportunity at the Chesapeake Club in North East.
- EnergyWise Partners, for Metering of 70 Commercial Geothermal Heating & Cooling Projects to Validate Leasing Model Across Maryland
- Alice Ferguson Foundation, for Geothermal Heating & Cooling for the Living Building Challenge at the Potomac Watershed Study Center at Hard Bargain Farm in Accokeek
- Kentlands Citizens Assembly, for Installation of a Standing Column of Water (SWC) Geothermal Heating & Cooling System at Kentlands Community Center in Gaithersburg
- Maryland Hawk Corporation and Cambridge Environmental Technologies, for a Greenhouse Installation of a Biomass Boiler/Organic Rankine Cycle Generator CHP System, at the University of Maryland-Eastern Shore Campus

Opportunities for Expansion
The state announced round two funding in November 2013, requesting applications in additional areas including hybrid solar PV and thermal systems, combined heat and power, district energy, biofuel, biomass, and community solar projects. Counties in Maryland can work with local businesses to develop ideas for projects located in their area. The game changer grant could also be used as a model for new programs in Virginia and the District of Columbia.

Air Quality Benefits
Facilitating commercial demonstration projects for promising new technologies and performing a life cycle cost/benefit analysis allows the state to accelerate market deployment and industry growth. These technologies replace or reduce energy from fossil fuels, and thereby reduce emissions of NOx, SO_2, fine particles and greenhouse gases from fossil-fueled power plants. Reducing emissions from upwind power plants reduces ozone transfer and can make a significant contribution toward improving local air quality conditions.

Rooftop Solar Challenge

Description
The Rooftop Solar Challenge is a program of the U.S. Department of Energy's SunShot Initiative. The goal of the SunShot Initiative is to make solar PV cost-competitive with fossil fuels and conventional generation by 2020. The Rooftop Solar Challenge incentivizes 22 teams across the country to make it easier for Americans to go solar by streamlining permit processes, updating planning and zoning codes, improving standards for connecting solar power to the electric grid, and increasing access to financing. The Rooftop Solar Challenge also enables teams to share best management practices and fosters communication across regions.

Regional Implementation
COG has received Rooftop Solar Challenge grants as part of two teams. COG is one of nine regions across the country participating in the Solar Ready II project, run by the National Association of Regional Councils (NARC) and the Mid-American Regional Council (MARC). The region is also participating in a national Rooftop Solar Challenge project managed by the solar consultancy Optony. Under this program, COG jurisdictions are participating in the online Solar Roadmap platform, which connects governments, utilities and consumers with the nation's largest resource library of solar best practices and online tools. Optony hopes to have more than 200 jurisdictions around the country participating in the Solar Roadmap by the end of 2014.

Ten COG member jurisdictions have officially joined the Rooftop Solar Challenge effort: the District of Columbia, Arlington, Fairfax, Montgomery and Prince George's counties, as well as Bladensburg, Bowie, College Park, Greenbelt and Rockville. The kickoff event was held in January of 2014. Over the course of the year, teams will choose which soft cost measures to focus on and how to implement best management practices in each jurisdiction.

Opportunities for Expansion
COG hopes that programs and initiatives begun under the Rooftop Solar Challenge will serve as models for actions other member jurisdictions can take in the future. If the region demonstrates good progress toward creating a healthy solar market there is a possibility of receiving additional funding to continue work in 2015. While the Rooftop Solar Challenge's immediate objective is to streamline processes within jurisdictions, there is a potential to magnify the effectiveness of streamlining by adopting unified processes across jurisdictions and even across states, such as with the same online application processes, permit application checklists, fee structures or even zoning requirements. The national Rooftop Solar Challenge program may expand into more states and localities with each successive round of funding.

Air Quality Benefits
By helping to facilitate solar deployment, the Rooftop Solar Challenge aims to increase the volume of installed solar photovoltaic systems and to get solar installed at a much quicker rate. By lowering demand for fossil fuel-powered electricity this program has the potential to contribute significantly to meeting the region's ozone and PM2.5 goals by reducing emissions of NOx, SO_2, fine particles and greenhouse gases from fossil-fueled power plants. Reducing emissions from upwind power plants reduces ozone transfer and can make a significant contribution toward improving local air quality conditions.

Energy Efficiency

Energy efficiency investments and conservation efforts can effectively reduce demand for electricity and associated emissions of conventional pollutants (e.g., ozone precursors) and greenhouse gases (e.g., carbon dioxide) from electric power plants, while saving resources and money. Localities in the metropolitan Washington region are undertaking many strategies to improve energy efficiency, including developing improved energy efficiency finance tools, creating a Sustainable Energy Utility, improving building codes, benchmarking energy use, requiring higher efficiency standards for public facilities, and incorporating energy efficiency into school facilities and curricula.

Energy Efficiency Financing

Description

Investments in energy conservation measures and efficient technologies available today could save homes and businesses 30-50 percent on monthly energy bills, yet only about one-fifth of potential cost-effective energy improvements are made each year. In addition to traditional financing options like loans, subsidies, rebates and tax credits, numerous other financing mechanisms exist to help homeowners, businesses and governments make energy efficiency and renewable energy investments. While financing models like Energy Savings Performance Contracts and Energy Services Agreements are fairly well established, there is much opportunity for expanding their use by local governments and public agencies. Newer finance tools such as Property Assessed Clean Energy (PACE) financing, On-Bill Financing or Repayment (OBF or OBR), Warehouse for Energy Efficiency Loans (WHEEL) programs, and Green Banks have been successful financing models around the country but have yet to be widely adopted in our region.

Many federal agencies and non-profit organizations have national and state level databases of available financial incentives, including the Department of Energy, the Small Business Association, the Database of State Incentives for Renewables & Efficiency (DSIRE), and the American Council for an Energy Efficient Economy. Regional sources for financing programs are included in COG's CEEPC Action Plan Resource Guide, which is updated annually.

Regional Implementation:

Washington, D.C.

In the District of Columbia, the Sustainable Energy Utility (DCSEU) now administers most energy efficiency incentives and outreach programs. The city offers rebates for residents, businesses and institutions for a range of new energy-efficient equipment, including home heating and cooling systems, lighting, refrigerators and washing machines, as well as a personal property tax exemption for solar energy systems and cogeneration systems. In summer 2014, D.C. announced a Solar Advantage program that provides a $2,000 rebate for residential systems and $4,000 for commercial systems. Solar Advantage plus also offers a $2.50 per watt rebate for low-income customers. Following the Council's passage of the Energy Efficiency Financing Act of 2010, D.C. established a Commercial Property Assessed Clean Energy (PACE) program, which allows businesses to repay the District for energy efficiency and renewable energy upgrades through a property tax assessment over 20 years.

Maryland

Maryland offers numerous renewable energy incentives, including rebates for solar PV, solar hot water and geothermal heat pumps for the residential and commercial sectors through the Clean Energy Grant Program. Rebates are available for residential, commercial and community-owned wind energy systems through the Windswept program. The state also offers a property tax exemption for solar PV, solar hot water and residential wind energy systems and a personal tax credit of 0.85 cents per kWh produced from geothermal energy, solar energy, hydropower, hydrokinetic, municipal solid waste and biomass resources. Montgomery County offers commercial property tax credits for numerous renewable energy systems and Prince George's County offers residential property tax credits for solar and geothermal systems.

Maryland's Be SMART program offers loans for residential, commercial and multi-family property owners for energy efficiency improvements. The Maryland Small Town Energy Program (STEP), funded through the U.S. Department of Energy Better Buildings Program, pairs residents with an Energy Coach who performs a whole-house evaluation, recommends energy efficiency improvements, and helps participants find qualified contractors and applicable rebates. The state enacted legislation in 2009 that authorized counties to establish PACE programs to enable property owners to pay for renewable and energy efficiency investments through a surcharge on their property tax bill. Montgomery County offers residential property tax credits for home energy conservation measures and equipment.

Virginia

Virginia has several energy efficiency and clean energy financial incentive programs, including grant programs for clean energy and solar manufacturing. The state also offers a $500 per year income tax credit to companies for every green job created with an annual salary over $50,000. In 2015, business-owned solar equipment will become exempt from local taxation. Local governments may choose to make individual-owned solar property partially or fully tax exempt. In the COG region, the City of Alexandria as well as Fairfax, Loudoun and Prince William Counties have implemented this exemption.

Virginia's Local Energy Assistance Program (LEAP) covers 20 percent of cost up to $500 for a range of home energy improvements for Northern Virginia and other cities statewide. Residents can also take a personal tax deduction of 20 percent of the sales tax paid for Energy Star appliances. Arlington County's Green Building Incentive Program grants bonus densities, or additional floor space beyond the amount allowed by the zoning code, to building projects that receive LEED certification.

The Virginia Resources Authority (VRA) was established in 1984 to provide financial assistance to local governments for a variety of projects, including energy and energy conservation projects. Virginia passed legislation in 2009 allowing local governments to establish PACE loan programs for property owners via local ordinance. The state also allows localities to charge reduced property taxes for energy efficient buildings – none of the Northern Virginia jurisdictions have implemented such a program. In 2011, renewable energy was added to the list of eligible projects. The state also has a leasing program that provides financing for energy efficiency projects at a minimum of $100,000 in facilities operated by state agencies or institutions.

Opportunities for Expansion

The metropolitan Washington region has one of the highest concentrations of energy efficient buildings in the country but the price of making energy efficiency upgrades and clean energy investments is still high. The region has made initial progress in enabling commercial PACE financing, but implementation programs at the local level have been slow to take off. Additionally, there are a multitude of other

financing mechanisms that local and state governments could explore to facilitate clean energy adoption.

Green Banks are state-established banks that use limited public or ratepayer dollars and leverage private funds to provide low-interest and 100 percent up-front loans for clean energy and energy efficiency projects. Connecticut's Clean Energy Finance and Investment Authority (CEFIA) was the first full scale Green Bank, and has proven to be a viable and effective way to providing clean energy financing at low cost. CEFIA is a quasi-independent entity, but other states have followed the Infrastructure Bank model (such as California Infrastructure and Economic Development Bank) or the State Clean Energy Financing Authority model, where the bank is part of the state government.

The Warehouse for Energy Efficiency Loans (WHEEL) is a new financing structure being developed in Pennsylvania to provide low-cost, large-scale capital to state and local government and utility-sponsored residential energy efficiency loan programs. The WHEEL entity borrows from both private and public sources, but because the public funds take a subordinate position to the private debt, the model attracts investment-grade capital and can offer very low interest rates. The model also allows loans to be securitized, creating a secondary market and generating more capital for borrowers.

While Commercial PACE has been widely adopted, Residential PACE is still in nascent stages due to the Federal Housing Finance Agency (FHFA) recommendation that Fannie Mae and Freddie Mac refrain from purchasing loans on properties with PACE liens due to "safety and soundness concerns." Some states do allow residential PACE as long as homeowners are aware of the legal issues. In March 2014, California announced a $10 million loan loss reserve, which would provide residential PACE loans through CaliforniaFIRST. Several Southern California localities have also begun offering residential PACE financing through the Home Energy Renovation Opportunity (HERO) Program. More information is available from Sullivan Solar Power, one of the certified solar contractors under the program.

The private sector is exploring other innovative financing methods. Crowdfunding can enable small companies and startups to raise more capital than traditionally has been available by pooling small contributions from a large number of investors. In 2014, Maryland passed a law allowing businesses to raise up to $100,000 per year via crowdfunding, with individual investments up to $100.

Air Quality Benefits

Reducing energy consumption through conservation and efficiency measures reduces emissions of conventional pollutants such as NOx, sulfur dioxides and mercury, as well as greenhouse gases methane and CO_2, by displacing electric generation from coal, oil, and natural gas-fired power plants. Reducing emissions from upwind power plants reduces ozone transfer and can make a significant contribution toward improving local air quality conditions.

Energy Savings Performance Contracting

Description
Energy Savings Performance Contracts (ESPCs) can be used to provide improved energy efficiency and renewable energy improvements to government entities in jurisdictions that have enacted performance contracting authority. Under these contracts, the government entity reaps long-term energy savings without any additional energy costs on a yearly basis. A so-called Energy Service Company (ESCO) provides capital up-front for alternative energy or energy efficiency measures, and receives payment based on the cost-shared energy savings realized over the term of the contract, usually up to 20 years.

Regional Implementation
Virginia and Maryland have authorized shared savings and long-term government contracts to foster performance contracts. Virginia also has a list of pre-certified contractors. The Maryland Board of Public Works has approved 21 ESPC projects which will save the state approximately $310 million over the life of the contract and reduce greenhouse gas emissions by 130,000 tons annually. In 2013, WMATA entered into a 10-year ESPC with Phillips for LED lighting upgrades in 25 parking garages, which will save energy and provide real time data on energy consumption. WMATA estimates the project will reduce energy usage by 68 percent, or 15 million kWh per year, and reduce greenhouse gas emissions by over 11,000 metric tons annually.

Opportunities for Expansion
Thus far, local governments in the region have primarily focused on energy efficiency improvements, but the funding structure can be used in a multitude of project types, which may provide additional value and benefits. Solar photovoltaic systems on schools and government buildings can be designed to provide emergency shelter during natural disasters or other incidents. Integrated storage, microgrids and other resiliency improvements can greatly improve energy security for essential services and critical infrastructure.

Air Quality Benefits
Performance contracting has the potential to save government agencies millions of dollars spent on electricity, and to contribute significantly to meeting the region's ozone and PM2.5 goals by reducing emissions of NOx, SO_2, fine particles and greenhouse gases from fossil-fueled power plants.

Sustainable Energy Utility

Description
A Sustainable Energy Utility (SEU) is an independently funded entity that provides energy efficiency, conservation and distributed renewable energy services to utility ratepayers. SEUs act as a single point of contact for area ratepayers for energy efficiency and self-generation, much as conventional utilities are the single point of contact for energy supply. SEU activities include performing energy audits, energy use benchmarking, weatherization and other energy efficiency upgrades, solar installations as well as outreach, education and training. The SEU model is an innovative departure from energy supply utilities as the SEU has a direct interest in helping ratepayers reduce energy consumption and generate their own power.

Delaware established the first SEU in the country in 2006. This program was based on best practices from California, Massachusetts, New Jersey and Vermont, states recognized for their utility or state-administered energy efficiency programs. Vermont was the first state with an independent non-profit managed energy efficiency utility, Efficiency Vermont.

Regional Implementation
The District of Columbia is the first jurisdiction in the metropolitan Washington region to create a sustainable energy utility. The D.C. Sustainable Energy Utility (DCSEU) came about through the Clean and Affordable Energy Act (CAEA), passed by the D.C. Council in 2008. The DCSEU is charged with administering sustainable energy programs in the District to achieve the following:

1. Reduce per-capita energy consumption in the District of Columbia;
2. Increase renewable energy generating capacity in the District of Columbia;
3. Reduce the growth of peak electricity demand in the District of Columbia;
4. Improve the energy efficiency of low-income housing in the District of Columbia;
5. Reduce the growth of the energy demand of the District of Columbia's largest energy users; and
6. Increase the number of green-collar jobs in the District of Columbia.

The DCSEU is operated by the Vermont Energy Investment Corporation (VEIC) and eight other local partners under contract to the District Department of the Environment (DDOE). DCSEU is funded by a surcharge on all electric and natural gas utility ratepayers in the District, which flows to the Sustainable Energy Trust Fund (SETF). The DCSEU began operating in March 2011.

Opportunities for Expansion
The DCSEU is working to expand its work to additional District ratepayers and into other energy-saving activities. The DCSEU does not currently address transportation fuels, but could have a significant impact on air quality and greenhouse gas emissions by expanding services to include transportation demand reduction, low-emission fuels, diesel retrofits, air quality education, etc. There is a huge opportunity for expansion across the region if other jurisdictions wish to use the DCSEU model to establish their own sustainable energy utility.

Air Quality Benefits
By helping ratepayers reduce energy consumption, sustainable energy utilities have the potential to contribute significantly to meeting the region's ozone and PM2.5 goals by reducing emissions of NOx, SO_2, fine particles and greenhouse gases from fossil-fueled power plants and potentially NOx and fine particles from the mobile sector as well.

High Performance Buildings

Description
The Energy Policy Act of 2005 defines a high-performance building as one that integrates and optimizes all major high-performance building attributes, including energy efficiency, durability, life-cycle performance, and occupant productivity.

The metropolitan Washington region has a history for striving for high performance buildings. In December 2007, the COG Intergovernmental Green Building Group (IGBG) issued a report, *Greening the Metropolitan Washington Region's Built Environment*, which review best practices and green building standards, and recommends measures that COG and local governments could implement to improve building performance region-wide. The report recommended U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) as the preferred green building rating system for the region, and recommended LEED-Silver for local government new construction. The report created the "COG Regional LEED Certified Standard" for private commercial and high-rise residential buildings, which means attainment of LEED Certified with at least 4 credits addressing issues of energy and renewables, stormwater management, heat island impacts, and construction waste management.

Regional Implementation
This green building report was the first COG effort to set a prevailing regional green building standard. The region aims to have 100 percent of jurisdictions adopt a green building policy by 2020. As of December 2013, 64 percent currently have or are in the progress of developing a green building policy. State and local governments have taken complimentary actions that continue to elevate the region to national recognition. Most notably, the District of Columbia, Maryland and Virginia were all in the USGBC's top ten list for new LEED certifications in 2012. Virginia was ranked fourth at 170 projects, Maryland ranked seventh at 127 projects, and the District of Columbia eighth at 110 projects. Significant projects include the City of Alexandria's Police Headquarters, Community Room, Montgomery College Science Center in Rockville, and the U.S. Mint Building in D.C., which are all LEED Gold certified.

Energy Benchmarking and Disclosure: Energy benchmarking is a standardized process of measuring building energy efficiency over time and compared to similar buildings. In the metropolitan Washington region, local governments are leading by example by benchmarking and disclosing energy data for their own buildings, with phased-in benchmarking and disclosure policies for the private sector. COG's 2013 Climate and Energy survey revealed that 95 percent of local jurisdictions are in the process of tracking and/or benchmarking government building energy performance; while 50 percent of jurisdictions require commercial sector energy benchmarking. Benchmarking and disclosure policies can facilitate competition in the market and spur investment in energy efficiency. To that end, benchmarking should be part of a larger framework that includes other measures such as energy audits and commissioning.

Energy Building Codes: Model codes present a significant opportunity to save energy in residential and commercial buildings. In the U.S., energy codes are adopted at the state and local level. In absence of a national energy code, states and localities most often look to the international model, the International Energy Conservation Code (IECC), as a starting point for their own codes. The IECC is updated on a three year cycle, with the most recent being the 2012 IECC. For a current status of energy codes and adoption processes in the region, see Table 1.

TABLE 1: Regional Building Energy Code Status

	DISTRICT OF COLUMBIA	MARYLAND	VIRGINIA
Code Adoption Process	Proposals to the D.C. Conservation Energy Code are initiated by the District of Columbia Building Code Advisory Committee. The D.C. Council has final approval of all proposed code changes.	The MBPS (Maryland Building Performance Standards) is updated every three years. The State allows each jurisdiction to make local amendments to the code provided the amendments do not weaken the code requirements. MD Department of Housing and Community Development in the process of amending the Energy Code to adopting the International Green Construction Code.	The Board of Housing and Community Development has the authority to adopt changes to the state code, the Unified State Building Code (USBC). Local government building inspections department responsible for enforcement of the USBC.
Code Adoption Cycle	Every 3 years	Every 3 years	12-18 month process after publication of new I-Codes.
RESIDENTIAL BUILDINGS			
Current Code	2009 IECC with Amendments/ASHRAE 90.1-2007	2012 IECC/ASHRAE 90.1-2010	2009 IECC with Amendments
Amendments	Amendments include provisions of IECC 2009.		
Effective Date	10/10/08	1/1/12	3/1/11
COMMERCIAL BUILDINGS			
Current Code	2009 IECC/ASHRAE Standard 90.1-2007	2012 IECC/ASHRAE 90.1-2010	2009 IECC
Amendments	Based on 2008 D.C. Construction Code with several amendments.		References to ASHRAE 90.1-2007
Effective Date	12/26/2009	1/1/2012	1/1/12
Additional Information	ASHRAE 90.1-2007 Mandatory Adoption of the 2012 I-Codes, including a Green Construction Code now under consideration.	Meets or exceeds ASHRAE 90.1 or equivalent. <u>Local County Code Amendments</u>: Montgomery Co. – 2012 IECC Frederick County – 2012 IECC City of Frederick – 2012 IECC Gaithersburg – 2009 IECC with amendments Prince Georges – 2006 IECC/IBC/IRC Rockville – 2012 IECC	ASHRAE 90.1-2007 Mandatory

Relevant Legislation: The high-performance green building movement in the metropolitan Washington region has accomplished much in a short amount of time. However, without effective policies set in place the threshold for increased awareness and ongoing improvements to building performance may not have occurred. For a review of key legislation see Table 2.

TABLE 2: Key Regional Legislation

DISTRICT OF COLUMBIA	MARYLAND	VIRGINIA
Green Building Act (GBA) of 2006 Requires LEED Silver performance of all new public projects and progressive requirements for publicly financed and private projects. The GBA includes first green building standard for affordable housing. **The Clean and Affordable Energy Act of 2008 (CAEA):** Requires the energy performance of public and private buildings to be rated using ENERGY STAR and disclosed annually. • Public buildings: began in 2010 • Private buildings: began April 1, 2013 for buildings over 100,000 SF and April 1, 2014 for buildings 50,000 to 99,999 SF	**High Performance Building Act of 2008** Requires all new public construction (including schools) and major renovation projects greater achieve either the LEED Silver standard or two Green Globes. **LOCAL LEVEL ACTION:** **Montgomery County Bill 2-14: Environmental Sustainability – Buildings-Benchmarking** Would require building owners to benchmark energy use of and retro-commission certain building systems to improve their energy efficiency. **Prince George's County CB-83-2013: Clean Renewable Energy Technology in Public Buildings** Requires clean energy systems for new County buildings and major renovations of public buildings	**Executive Order 48 of 2007:** Requires public facilities over 5,000 square feet attain LEED Silver or equivalent.

High-Performance Schools: A growing number of studies show that high-performing green schools improve the learning environment of students while saving energy, resources, and money. Although there is no regional goal, local school districts have implemented green and high performance building policies that promote design and construction of schools based on LEED standards, ENERGY STAR standards, or other nationally recognized green building standards. COG's annual survey results show that 75 percent of local school districts are participating in a green schools program and benchmark their energy performance. School districts are also recognizing the reduced environmental impact of purchasing locally produced food: approximately 40 percent indicated they plan to increase the use of local food in school lunches.

Loudoun County Public Schools has been named an ENERGY STAR Partner of the Year each year from 2009-2013. District of Columbia Public Schools has partnered with the USGBC National Capital Region Chapter on an inaugural program, the DC Green Schools Challenge. The goal of the program is to save money, reduce environmental impacts, and to foster educational and leadership opportunities across

D.C. schools. Participating schools compete to reduce the most energy consumption and group energy efficiency research and design projects.

Opportunities for Expansion

While the metropolitan Washington is a proven leader for high performance buildings, there are several other national best practices that could further the high performance and sustainability goals of local governments, including:

- Commissioning: Employ commissioning practices to verify performance of building components and systems to ensure that design requirements are met.
- Measurement and Verification: Install building level electricity meters in new major construction and renovation projects and existing buildings to track and continuously optimize performance; include equivalent meters for natural gas and steam, where natural gas and steam are used.
- Indoor Water Efficiency: Consider use of harvested rainwater, treated wastewater, and air conditioner condensate for nonpotable and potable uses; install water meters to allow for water use management during occupancy.
- Outdoor Water Efficiency: Use harvested rainwater to reduce outdoor potable water consumption and install water meters for locations with significant outdoor water use.
- On-Site Renewable Energy: Meet a percentage of the hot water demand through the installation of solar hot water heaters.

Air Quality Benefits

Much of the environmental impact of buildings is due to their energy use. High-performance green buildings use less energy while providing a variety of environmental, economic, and human resource benefits, including improved productivity, lower operating costs and reduced environmental footprint. Less tangible benefits like positive branding and customer approval are also driving demand for energy efficiency. Building owners and developers are becoming increasingly aware of the link between environmental issues and health concerns in buildings. High performing buildings reduce emissions of NOx, SO_2, fine particles and greenhouse gases from power plants, as well as VOCs emissions from paint and other building materials.

Green Leasing

Description
Green leasing programs establish energy efficiency and conservation standards for leased buildings, usually set by tenants that wish to improve the sustainability of their facilities. Traditionally, tenant and landlord incentives have not been aligned for making energy efficiency improvements, due to the fact that tenants paying utility bills benefit from the lower cost, but landlords are generally responsible for making energy efficiency investments. Green leases work to solve this problem by identifying provisions that can be altered to meet both landlord and tenant sustainability goals.

Retail, industrial and governmental entities are high-value tenants and therefore have substantial influence in lease negotiations to pursue sustainability goals. The Retail Industry Leaders Association (RILA) and other retail associations are exploring requiring energy efficiency and "green" elements in their lease terms. In cooperation with the Institute for Market Transformation (IMT), RIMA released a Retail Green Lease Primer in August 2013 to communicate best practices in green leasing and help further the conversation between retailers and developers.

Regional Implementation
The U.S. General Services Administration (GSA) has several green leasing policies for federal buildings. The Energy Independence and Security Act of 2007 (EISA) requires that federal agencies only enter into leases for Energy Star certified buildings. The U.S. Department of Energy's Better Buildings Alliance and IMT have developed a Green Lease Leader program to recognize firms and brokers that are successfully introducing green lease language into new or existing leases. Several local governments in the region require that new construction and major upgrades to public facilities are designed to achieve 75 points on the ENERGY STAR scale, but do not yet incorporate green requirements into leases.

Opportunities for Expansion
Local governments in the region that do not currently have environmental or energy efficiency requirements for leased space can borrow from the federal and private sector models. Additionally, existing green leasing programs could be expanded to consider other factors – such as low-VOC materials, sustainable supply chains and availability of non-vehicle transportation options like bike racks, pedestrian corridors and public transit – which would encourage air quality awareness in the real estate sector and increase demand for air-quality-improving measures in the real estate market.

Air Quality Benefits
Green leasing is another way to encourage adoption of energy efficient and high performance building practices. By putting pressure on building owners and property management companies, green leasing policies create a larger market demand for green buildings which are reflected in subsequent construction projects and developer choices. Green leasing encourages building owners and developers to build or acquire energy efficient and high performing buildings, which contributes to meeting the region's ozone and PM2.5 goals by reducing emissions of NOx, SO_2, fine particles and greenhouse gases from fossil-fueled power plants.

The same principle of tenant-induced standards could be used to encourage other air quality improvement measures in transportation, land use, supply chains, manufacturing, and building use, such as by adding criteria to contractor selection rubrics that will result in reduced emissions of NOx, VOCs, SO_2 and fine particles.

Smart Grid & Advanced Metering

Description
Demand for clean energy, the growth of distributed generation, and new environmental and security concerns are leading utilities and regulators to explore ways to make the grid more efficient, reliable and secure. Smart metering, demand response programs and time-of-use rates can lead to significant efficiency gains simply by increasing customer information and engagement. Grid-level improvements such as voltage optimization and smart switches can greatly improve reliability and security.

Smart or advanced meters are electronic electricity meters that record usage hourly, or more frequently, and send the utility that information for monitoring and billing purposes. This enables the utility to implement time flexible rates, which can incentivize customers to turn off power when demand is high, helping with load shaving. Smart meters also encourage consumer awareness of energy consumption and can therefore lead to improved energy efficient behaviors.

Regional Implementation
Pepco's smart grid project in the District of Columbia involves distribution automation, advanced metering, and demand response programs using load control devices and time-based rate programs. When combined with demand response programs, smart meters will help customers reduce electricity usage and peak demand. As part of its smart grid project, Pepco is installing smart meters for all customers in its territory across Maryland and the District of Columbia. The utility has built a separate smart meter website to answers ratepayers' questions about the new devices: takecontroldc.com and takecontrolmaryland.com/pepco. Pepco is doing a similar program in Maryland under the Maryland Energy Administration's smart grid program.

The Northern Virginia Electric Cooperative (NOVEC) has a smart grid project, called the Electric Distribution System Automation Program, under which the utility is deploying smart meters, a new communications system and other smart grid devices to provide precise monitoring of grid operations and improve system efficiencies. Dominion has begun smart meter installation in Northern Virginia and plans to install a total of 200,000 smart meters by the end of 2014. Dominion's smart grid plans also include demonstration projects for energy efficiency, LED street lights and battery storage for renewable energy systems.

Opportunities for Expansion
Harnessing the benefits and efficiencies of clean, distributed energy resources and load management systems can contribute to a resilient and efficient energy system. Monitoring and storage can be used to maximize these benefits and minimize interconnection and variability challenges. Localities and utilities are working to implement these new "smart grid" technologies but many are still at the pilot stage. Additionally, the region has yet to deploy many renewable energy systems to maximize the benefits of smart-grid capabilities.

Air Quality Benefits
Smart grid and advanced metering programs can improve system efficiency for distribution utilities, and can encourage customers to adopt more energy efficient behaviors. By reducing energy consumption system-wide and facilitating deployment of renewable energy, this measure contributes to meeting the region's ozone and PM2.5 standards by reducing power plant emissions of NOx, SO_2, fine particles and greenhouse gases.

Transportation Demand Reduction

Transit-Oriented Development

Description
Concentrating future residential and commercial development in specific areas of the region that are linked by the regional transit system can lead to significant air quality improvements. Pursuing land use and transportation policies that support this kind of development will lead to densely developed clusters where residents can live, work, shop, and play, connected along major transit and highway corridors. The most benefits can be realized when transportation and land use decisions are mutually supportive, enhancing circulation within and connections between densely developed areas. The National Research Council has found that "doubling residential density across a metropolitan area may reduce vehicle miles traveled (VMT) by 5 to 12 percent, and perhaps as much as 25 percent if coupled with higher employment densities, mixed uses, and transit improvements."[vi]

How it is Being Implemented
Concentrated growth has become a hallmark of regional land use policy in the metropolitan Washington region. In 1998, the *TPB Vision* first called for the identification of Regional Activity Centers that would serve as focal points for job and housing development throughout the region, and as nodes for transportation linkages. Support for Activity Centers was reiterated in 2010 when *Region Forward*, a vision for regional development through 2050, was adopted and endorsed by each of COG's member jurisdictions. More recently, Activity Centers have been highlighted by two new regional plans – *The Regional Transportation Priorities Plan (2014)* and *Place + Opportunity (2014)* – both which reflect an understanding that concentrated development is a concept that will provide benefits for all of the region's jurisdictions.

Local and regional agencies have begun to implement these ideas on the ground by incentivizing compact and transit-oriented development. Today, the region has many examples of successful Activity Centers, including the NoMa neighborhood in the District of Columbia, Silver Spring in Maryland, and the Rosslyn-Ballston Corridor in Virginia. In order to encourage more concentrated development, many local governments have offered incentives, such as increasing the maximum development density allowed under certain zoning categories, utilizing transfer of development rights programs, pursuing street-scape improvement programs, and offering other financial benefits. In addition, the Transportation Planning Board (TPB) awards federal grants to support to local governments as they work to improve transportation/land use coordination though the Transportation Land Use Connection (TLC) program. Through the program, the TPB provides communities with technical assistance to catalyze or enhance planning efforts.

The region's commitment to concentrated growth and transit-oriented development is demonstrated in population and employment forecasts as well as local land use plans. It is forecast that through 2040, 61 percent of new households and 75 percent of new jobs will be located in Activity Centers. Current local plans for development show that by 2040, Regional Activity Centers will be served by 166 Metrorail, light rail, and commuter stations – 70 percent by rail transit, and 84 percent by the MetroBus Priority Corridor Network (PCN).

Opportunities for Expansion
Though progress has been made, there remain many unrealized opportunities to coordinate concentrated development and transportation in more efficient ways, and to improve the jobs and housing balance in the region's Activity Centers. Many Activity Centers currently lack access to high-capacity public transit—Metrorail, bus rapid transit, commuter rail, or light rail. Some Metrorail stations serve areas that are not currently Activity Centers and represent unrealized opportunities to greater efficiency by attracting higher-density development nearby. This is especially true on the eastern side of the region, where many Metro stations are surrounded by undeveloped or underdeveloped land, limiting the number of people who can live or work close to transit and leaving unused capacity in reverse-commute directions on several Metrorail lines.

While concentrated and transit-oriented growth are reducing VMT in the region, there are opportunities to better focus regional investment in geographic areas and on activities that provide greater air quality improvement. Other regions are leading on this front through prioritizing transportation investments based on climate and air quality benefits. For example, the Portland metropolitan region's Climate Prosperity Project recommends developing a "regional investment strategy to support green infrastructure, smart growth and sustainable development projects." The Southeastern Florida Regional Climate Action Plan prioritizes "transportation investments and service expansions on projects and strategies that will contribute to greenhouse gas emissions reductions and enhance resilience to climate change."

Similar principles could be incorporated into long term regional planning principles for transportation, land use, housing and economic development in our region. Guidance on air quality, as well as other sustainability issues, could be provided to Activity Centers and other communities in the region to assist them in including these principles into their planning efforts. Initiatives like the Seattle 2030 District, Boston Innovation District, and Kansas City's Green Impact Zones are other examples of investment in green, clean and just growth in specific geographic areas that could serve as models for improving air quality in Activity Centers.

Air Quality Benefits
Concentrated, transit oriented development provides air quality benefits by reducing automobile dependency through collocating jobs and housing and offering viable alternatives to automobile travel. By reducing vehicle trips and VMT, concentrated growth helps then region meet our ozone and climate goals by causing fewer NOx and greenhouse gas emissions.

Commuter Connections

Description
Commuter Connections is a regional network of transportation organizations coordinated by the Transportation Planning Board (TPB) to provide employers and commuters in the region with information on commute options. Services provided by Commuter Connections include transit information, carpool/vanpool matching, the regional 'Pool Rewards' carpool and vanpool incentive, a regional Guaranteed Ride Home program, park-and-ride lot and high occupancy vehicle (HOV) lane information, bicycle to work information, telecommute/telework program assistance and commuter information online and through smart devices.

Regional Implementation
Commuter surveys are used to help determine employees' commute patterns and generate a free electronic commuter "matchlist" of all alternative commute options available in the region. Commuter Connections network members meet with employers to provide free services in designing and implementing an effective on-site ridesharing program, including on-site meetings with employees to further assist with options that may be available to help lessen the daily commute to and from work.

Commuter Connections also coordinates the region's Bike to Work Day and Car Free Day events. Bike to Work Day has been rapidly growing in popularity: in 2014, over 17,600 people registered to participate at 79 pit stop events around the region – a 14 percent increase in participation from 2013. Car Free Day encourages participants to choose other modes of travel, such as transit, walking and biking, or to go "car-lite" by making fewer vehicle trips. In 2011, about 11,800 people registered to participate, but participation declined in 2012 and 2013.

The regional SmartBenefits Program makes employer-provided transit subsidies available to a growing numbers of workers. The increasing use of WMATA's Smartrip cards allows the direct provision of transit and vanpool subsidies at fare card machines, and the expansion of this technology to commuter rail and buses has provided for seamless transfers for transit and vanpool riders. In addition, a new federal bicycle benefit of $20 per month is available to employees who bicycle to work. With these developments, Commuter Connections has expanded to reach many more participating employers and commuters, and to provide more information on available benefits to the public.

Opportunities for Expansion
There are opportunities to increase participation in Commuter Connections programs through public awareness campaigns, marketing or increased communications. Additional programs or strategies to promote transit, car sharing, bicycling and walking could also be explored. However, notable increases in participation may be difficult to achieve if the current programs have reached most willing participants.

Air Quality Benefits
By educating employers and employees on available commute options and by fostering car trip coordination, Commuter Connections reduces the number of cars on the road and therefore reduces vehicle miles traveled (VMT). Reducing VMT is one of the most effective ways to reduce emissions of NOx, fine particles and greenhouse gases.

Telecommute Initiatives

Description
Telecommuting, or teleworking, allows wage and salary employees to occasionally work at home, at a telework center or an employer's satellite office during an entire workday instead of traveling to their regular workplace. Communication is accomplished by phone, e-mail, internet and teleconferencing.

Regional Implementation
Regionally, more than 675, 000 workers report telecommuting for at least part of their work time.

Opportunities for Expansion
Employers should become knowledgeable about their jurisdiction's telework policy and make teleworking available to employees. Employers can identify employees with tasks that can be accomplished remotely, or encourage employees to identify themselves. In order for employees to telework successfully form home, employers should provide or assist in securing the necessary software and equipment. Employers can also have employees keep some work items at home or in their vehicle to help ensure business continuity in the event of an emergency. Employers can contact Commuter Connections at www.commuterconnections.org or at 1-800-745-RIDE with further questions or additional information to either start or expand a telework program.

Air Quality Benefits
Teleworking reduces traffic congestion and air pollution, increases economic vitality, and bolsters overall quality of life. For every 10 percent of employees that telework an average of 1.5 days per week, total vehicle trips are reduced 2-3 percent. Reducing vehicle trips and vehicle miles traveled are some of the most effective ways to reduce emissions of NOx, fine particles and greenhouse gases.

Safe Routes to School

Description
Recent studies show that 20-25 percent of morning automobile traffic in some communities is generated from parents driving their children to school. This has caused increased traffic congestion around schools, prompting even more parents to drive their kids. Safe Routes to Schools is a popular program in Canada and the U.S. designed to decrease traffic and pollution and increase the health of children and the community. The program promotes walking and biking to school through education and incentives that emphasize fun and safety. The program also addresses the safety concerns of parents by encouraging greater enforcement of traffic laws, educating the public, and exploring other ways to create safer streets.

Regional Implementation
A national Safe Routes to Schools program makes resources and training available to communities that want to establish local programs. Safe Routes to Schools funds can be used for infrastructure improvements, enforcement, and education. Eligible activities include bicycle parking, bicycle lanes, sidewalks, crosswalks, and traffic calming on any public road or trail within vicinity of a school. Funds are administered by the State Departments of Transportation, with 100 percent federal share – no local funds required. Each State has a Safe Routes to Schools Coordinator who administers the program. For more information see www.saferoutesinfo.org.

In the metropolitan Washington region, many transportation planners, public health advocates, and school representatives are working with the Safe Routes to Schools program to implement education and awareness activities to encourage walking and biking to school. Montgomery County established a Safe Routes to School program in 2007 and hosts competitions and games to teach safe biking and walking practices. In Fairfax County, some schools have “bike trains” to help teach safe biking practices and help make both parents and students more comfortable biking to school.

Opportunities for Expansion
Existing Safe Routes to Schools programs could be expanded to offer programs for students in kindergarten through 12th grade, and schools can borrow activity ideas from the success of others. Additionally, state and local governments, schools or school districts that do not yet participate in Safe Routes to Schools can apply for funds to become involved in the program. Colleges and universities can also implement Safe Routes to Schools-type programs to encourage non-vehicle travel on and around campus.

Air Quality Benefits
This program aims to increase opportunity for more people to walk or bike to schools rather than drive. Reducing vehicle trips and VMT is one of the most effective ways to reduce emissions of NOx, fine particles and greenhouse gases.

Transportation Options

Public Transit

Description
Public transit systems are shared-transport services available to the general public. Transport options include subway or underground train lines, buses, trolleys and shuttles. In the United States, public transit systems are usually operated by a municipal transit agency and subsidized by state and local governments.

Regional Implementation – WMATA
The regional Metro rail and bus system operated by the Washington Metropolitan Area Transit Authority (WMATA) is the largest public transit asset in the region. WMATA was created in 1967 by an interstate compact between Virginia, Maryland and the District of Columbia. WMATA operates 91 metro stations and 117 miles of track, as well as 1,500 buses – providing 1.2 million trips each day. Approximately 45 percent of people working in the central core use WMATA for their commute.

WMATA's Strategic "Momentum" Plan emphasizes low energy usage, alternative fuels and sustainable development criteria to be used when making funding decisions for new facilities and vehicles. WMATA has over 500 buses powered by compressed natural gas (CNG), and more than 600 hybrid electric buses in service. These alternative fuel buses have significantly lower emissions of air pollutants and greenhouse gases.

Metro's Sustainability Agenda, released in March 2014, calls for the agency to undertake numerous measures to support regional sustainability, reduce resource consumption, and promote smart growth development. Specific targets include: increasing Metro ridership 25 percent by 2025; reducing energy use per vehicle mile 15 percent by 2025, and cutting greenhouse gas emissions per vehicle mile in half by 2025. These initiatives will yield air quality benefits by reducing NOx and fine particle emissions by displacing vehicle trips, and reducing fossil-fueled power plant emissions of NOx, SO_2, mercury, fine particle and greenhouse gases.

Regional Implementation – Other Public Transit Services
In addition to Metro, many COG member jurisdictions fund a local or commuter bus service. These include: Alexandria's DASH, Arlington Transit (ART), the Fairfax County Connector, City of Fairfax's CUE system, Montgomery County's Ride-On, Prince George's The Bus, and the District's Circulator. Loudoun County offers a commuter bus service and Prince William County, Manassas and Manassas Park operate commuter buses through the Potomac and Rappahannock Transportation Commission (PRTC). The Maryland Mass Transit Administration (MTA), a division of the Maryland Department of Transportation (MDOT), runs commuter bus and trains service (the MARC service). Commuter trains in Virginia are operated through Virginia Railway Express (VRE). Commuter rail is discussed more in the next section.[vii]

Opportunities for Expansion
Transit agencies are planning several system expansions in the region that would help promote transit-oriented-growth, economic development and community revitalization, as well as reduce vehicle trips and congestion. In general, opportunities for expansion that would have air quality benefits will either:

expand the network to provide access for residents farther away from the core, encourage ridership, or increase the number of vehicles, vehicle capacity, or trip frequency.

WMATA's system has been struggling to keep up with the pace of growth in the metropolitan Washington region, especially as reliance on public transit is rising faster than population. The new Silver Line will provide rapid transit service to Dulles International Airport and Loudoun County. The line will be 28 miles long and consist of 34 stations, 11 new, making it the largest expansion project since WMATA Metrorail service began in 1976. The first phase of the Silver Line, connecting to Reston, opened in July 2014. The full line is intended to open in 2018. WMATA's Regional Transit System Plan (RTSP) for 2040 proposes two additional Metrorail lines to "reduce future crowding on Metrorail, provide enough capacity for future development, and expand the reach of transit in the region, especially to regional activity centers."[viii]

MTA's Purple Line project would be a 16-mile east-west light rail route through the inner suburbs of Montgomery and Prince George's counties. The Purple Line will include 21 light rail stations and provide direct connections to WMATA's Red, Green, and Orange lines at four stations, as well as connections to all three MARC lines, Amtrak, and local bus routes. Construction is expected to begin in 2015 and the Purple Line is expected to open in 2020.

Arlington's six-year Transit Development Plan (TDP), provides a framework for expansion of the system and better connection to WMATA. The plan was updated in 2012 to reflect recommendations for 2014-2019, including primary transit network improvements to encourage low-vehicle-usage lifestyles and improvements to the quality of service such as connectivity and on-time performance. RIDE ON has 42 CNG buses and plans 15 more.

Transit education and information are crucial to creating a user-friendly system. New developments in this area, particularly real-time arrival information and mobile phone apps have the potential to greatly improve rider experience and increase ridership. When considering transit expansion projects, agencies should encourage alternative fuel and low-emission vehicles and prioritize projects that will contribute to walkable, sustainable communities.

Air Quality Benefits

Public transit systems reduce the number of people that need to commute and travel by car, and can greatly reduce VMT by providing a fast, convenient alternative transport mode. Reducing VMT is one of the most effective ways to reduce emissions of NOx, fine particles and greenhouse gases. WMATA estimates that Metro avoids 260 tons of VOC emissions, 22 tons of particulate matter emissions and 500,000 tons of CO_2 equivalent emissions per year.

Additional air quality benefits can be realized by using CNG, which reduces carbon monoxide (CO) emissions 90 percent and NOx emissions 60 percent. Carbon dioxide emissions are reduced 30 to -40 percent. For heavy-duty and medium-duty applications, natural gas engines have demonstrated more than 90 percent reduction of CO and particulate matter, and more than 50 percent reduction of NOx relative to commercial diesel engines.

Commuter Rail

Description
Commuter rail offers the option of passenger rail service to suburban residents who regularly commute to and from major metropolitan areas. Train systems in general emit less harmful pollutants and greenhouse gases on a per capita basis than automobiles, so increased use of this mode of transportation can result in air quality benefits. These benefits are even more pronounced when the trains either run on natural gas or electricity.

Regional Implementation
Two commuter rail companies serve the metropolitan Washington region – Virginia Railway Express (VRE) in Virginia, and Maryland Area Commuter Rail (MARC) in Maryland. The two systems provide over 50,000 rides per day on over 280 miles of commuter rail track (including lines serving the suburbs of Baltimore). In addition, Amtrak provides regional and intercity service to and from the region, which serves as a form of commuter rail with a much further reach.

Opportunities for Expansion
There are plenty of opportunities to increase commuter rail use region-wide and improve efficiency in the current system. Commuter rail companies can increase service offerings by providing extended timetables on workdays and weekends, so that commuters and non-commuters alike can utilize the system already in place. Existing commuter trains can also be converted to cleaner energy sources, such as natural gas or electricity. Currently only one line on the MARC system uses electric trains.

Infrastructure issues, however, need to be addressed by local governing bodies in order for service to be expanded. Both commuter rail lines and Amtrak largely rely upon aging infrastructure that is shared with, and owned by, freight rail lines. Schedules are controlled by the owners of the tracks, which severely limits the frequency and time-tables for commuter rail trains.

The Long Bridge, a 2,500-foot bridge between Virginia and the District of Columbia and the region's only freight and passenger rail crossing over the Potomac River, is a particularly important link in the system. Freight and passenger trains currently share the bridge's two tracks, which are nearing capacity during rush hour times. The bridge's private owner, CSX, maintains the right to give priority to freight traffic over passenger rail, which highly limits the schedule and frequency of passenger trains. In order to fix this major bottleneck and allow for growth in passenger rail frequencies, a major renovation or replacement of the bridge is necessary.

Union Station, the central train station located in the heart of the District of Columbia near the U.S. Capitol, is also in need of major improvement. The station is operating beyond capacity during peak periods, and upgrades will be needed to meet the future transit demands.

Air Quality Benefits:
Trains generally emit fewer harmful pollutants and greenhouse gases per capita than automobiles. Commuter rail offers air quality benefits by reducing vehicle trips, which means fewer NOx, fine particle and greenhouse gas emissions from automobiles.

Bus Priority Enhancements

Description

Bus priority enhancements are measures that can be taken to make bus transit faster, more reliable, and more convenient while utilizing existing transit infrastructure. Instead of implementing new transit services, which can be capital intensive, bus priority enhancements create new transit capacity without requiring new operating expenditures. This includes measures such as: signal prioritization, roadway improvements such as bus-only lanes and queue jump lanes, construction of curb extensions and station platforms, implementation of pre-boarding payment systems, and allowing buses to operate on the shoulders of highways in order to bypass traffic.

Regional Implementation

Bus priority enhancements have been implemented throughout the region to improve bus service along key transit routes. Jurisdictions have made roadway improvements that help buses move faster, such as bus-only lanes and queue jump lanes, and there is a great deal of interest in expanding these efforts because the benefits can be significant. WMATA's priority corridor network (PCN) effort is making targeted improvements along 24 key bus corridors, which currently carry about half of Metrobus riders in the region, but make up less than one sixth of Metrobus lines. Streamlining operations and stops, such as with transit signal priority and exclusive lanes, as well as improved transfer and park and ride facilities will improve travel times and reliability on these key transit corridors.

The region's first bus rapid transit (BRT) line, Metroway, opened in the summer of 2014 in the City of Alexandria and Arlington County, connecting Crystal City and Braddock Road Metrorail stations along Route 1. In 2015, the route will be extended to connect to S. Glebe Road and Pentagon City. Montgomery County is working on an 80-mile BRT network that will enhance transit opportunities to support the County's economic development, mobility and environmental goals. In December 2013, the Maryland- National Capital Park and Planning Commission adopted the Planning Board Draft of the Countywide Transit Corridors Functional Master Plan which recommends transportation network improvements needed to serve the most densely developed areas, including the BRT network.

In 2010, the TPB was awarded $58.8 million in federal Transportation Investment Generating Economic Recovery (TIGER) funding to implement bus priority projects in the metropolitan Washington region. The grant funded 16 projects that demonstrate the efficiency benefits of bus priority treatments along major transit corridors in the region. The projects, which will be implemented by 2016, will improve the efficiency of these routes by investing in a bus transit-way, bus-only lanes, queue jump lanes, transit signal priority technology, traffic signal management technology, bulb outs, real-time arrival technology, and other enhancements. Altogether, these bus priority corridor improvements will decrease travel time and improve quality of bus service on approximately 75 bus lines throughout the region.

Opportunities for Expansion

Jurisdictions in the region have the opportunity to provide bus priority enhancements in many more places. One such effort to improve bus service is WMATA's Priority Corridor Network (PCN) plan, which aims to improve bus service, travel times, reliability, capacity, productivity, and system accesses along 24 major transit corridors in Maryland, Virginia, and the District of Columbia. To accomplish this, the PCN encourages roadway improvements, better passenger amenities and information, new buses with lower floors, and new limited stop service. One of the initiatives in WMATA's Metro 2025 plan calls for additional funding to support expansion of the PCN.

The benefits of pursuing bus priority enhancements are significant. An analysis of WMATA's PCN found that bus-only lanes and off-board fare collection can each provide time savings of upwards three minutes per mile, and that signal prioritization can save an additional 30 seconds per mile.

Air Quality Benefits

Bus priority enhancements can yield air quality benefits by providing better, more reliable bus service that attracts those who would otherwise use an automobile for mobility. Buses generally emit fewer harmful pollutants and greenhouse gases per capita than automobiles. This can lead to a reduction in NOx, fine particles and greenhouse gas emissions.

Variably Priced Lanes / High Occupancy Toll Lanes

Description
Variably priced lanes require vehicles to pay a toll that varies based on demand (called congestion pricing) in order to use the lane. Tolls in these lanes change throughout the day according to real-time traffic conditions to help manage the number of cars and reduce congestion. High Occupancy Toll (HOT) lanes allow single occupancy vehicles willing to pay a fee to use High-Occupancy Vehicle (HOV) lanes, which are generally reserved for vehicles with multiple passengers, including carpools and buses.

Regional Implementation
Virginia currently operates several HOT lanes on the Capital Beltway, called the 495 Express Lanes. The Virginia Department of Transportation has begun construction of more Express Lanes on Interstate 95 extending from Stafford County to Fairfax County. These highway facilities put a price on the use of new road capacity, help to manage congestion, and raise revenue to cover construction costs.

The Intercounty Connector (ICC) is Maryland's first electronic variably priced toll facility.[ix] The ICC is a multi-modal east-west highway that will link existing and proposed developments in central and eastern Montgomery County and northwestern Prince George's County. Tolls on the ICC vary depending on traffic conditions, with the goal to deliver dependable travel times and low congestion.

The TPB has endorsed the use of tolled or variably priced lanes in roadway expansion projects. The recently approved Regional Transportation Priorities Plan (RTPP) recommends that jurisdictions looking to build new lanes or roads consider implementing a tolling mechanism to help manage congestion. The Plan suggests that tolling lanes may also be the most practical way to fund needed road improvements throughout the region.

Opportunities for Expansion
Jurisdictions throughout the region have expressed interest in pursuing tolling mechanisms such as variably priced or HOT lanes on future road improvement projects, and TPB has studied the concept extensively. In the 2013 "CLRP Aspirations Scenario," TPB studied the effects of building a region-wide network of express toll lanes, operating high-quality express bus service along much of that network, and implementing land use policies to promote denser, transit-oriented development throughout the region. This scenario capitalized on the efficiencies gained by implementing these elements together, and produced significant impacts on daily travel patterns in the region. When analyzed with the regional transportation model, pursuing this scenario led to a reduction in average congestion and an increase in walk trips, bicycle trips, commute trips made by bus, and carpools with three or more people.

Air Quality Benefits
Variably priced lanes and HOT lanes can lead to slower growth in NOx, fine particle and greenhouse gas emissions by controlling vehicle trips and VMT without compromising roadway capacity. New lanes decrease congestion and idling, leading to lower NOx emissions. Additionally, overall vehicle trips are expected to rise more slowly after implementation of a toll. Tolled lanes also offer the opportunity to implement high-quality express bus service on low- congestion lanes, which could expand transit options.

Vehicle Share Programs

Description
Vehicle share programs are membership-based car rental services that provide members as-needed access to the program's network of vehicles. Most programs require vehicles to be reserved in advance, which can be done via internet, smart devices or over the phone. Membership and rental fees cover the cost of the rental, gas, maintenance, and parking. By providing convenient access to its vehicle fleet, car share programs are a viable alternative to car ownership. Vehicle share programs reduce congestion, alleviate constrained parking options, lower car ownership rates, and may reduce vehicle miles travelled by participants in the operating area.

Regional Implementation
The metropolitan Washington region has four vehicle share programs: ZipCar, Car2Go, Hertz on Demand and Enterprise CarShare. ZipCar began offering service in the District of Columbia in 2001. By 2012, the company had over 670,000 members and approximately 8,000 vehicles in the region. Hertz began its On Demand program in the District in February 2012 with 20 vehicles, shortly followed by Car2Go with 200 "smart fourtwo" vehicles. Enterprise CarShare began in September 2013 with 40 locations.

ZipCar, Hertz and Enterprise use dedicated reserved parking spaces, require reservations, and require drivers to return the car to a designated drop-off location. Car2Go uses a "free-floating" model that allows members to drop off a Car2Go in any legal on-street parking space within the "Home Area," including metered, non-metered, and residential neighborhood parking spaces. All of the programs use mobile applications that allow members to view available vehicles on smart devices. Participation in vehicle share programs has been increasing, and the entrance of three new programs in the last two years indicates that there is a healthy market for on-demand vehicle access in the region.

Air Quality Benefits
By reducing vehicle ownership, car share programs can reduce VMT per capita – one of the most effective ways to reduce emissions of NOx, fine particles and greenhouse gases. It is difficult to assess the direct impact of car share programs on VMT. The programs may reduce car trips for households that choose membership over car ownership, or may enable car trips that would otherwise not be taken. However, studies indicate that the programs reduce overall car ownership and vehicle emissions levels within the operating area.

A report funded by the U.S. Department of Transportation found in 2010 that car share programs have a net impact of reducing per capita greenhouse gas emissions;[x] this finding likely holds true for criteria pollutants as well. UC Berkley's Transportation Sustainability Research Center has found that car-share programs around the country have significantly reduced car ownership among participating households.[xi] Indeed, car ownership is on the decline in the region's inner core – in 2012, approximately 38 percent of District of Columbia households did not own a car, a 2.4 percent increase over 2007.[xii] A recent automotive industry report found that for every vehicle that is used in a car-sharing fleet, automakers lose 32 vehicle sales.[xiii]

Bicycle and Pedestrian Programs

Description
Bicycle and pedestrian programs can cover a variety of initiatives, including enhancing access to transit stations and bus stops, grocery stores, cultural attractions, offices and retail, which encourages people to choose non-motor transport modes for commuting and other trips when possible.

Regional Implementation
The region has made great strides to improve bicycle and pedestrian infrastructure in the last decade. Nearly every jurisdiction in the region has completed a bicycle or pedestrian plan, and most have a bicycle or pedestrian planner at least part time. A full list of local plans is available in the 2010 National Capital Region Bicycle and Pedestrian Plan. The regional plan was recently updated in January 2014. It includes a total of 409 projects, including over 450 miles of bicycle lanes, 630 miles of shared use lanes, 20 intersection improvements and 10 bridge upgrades. By 2040, the plan aims to have over 1,400 miles of bicycle routes in the metropolitan Washington region.

Other initiatives include encouraging more easily accessible bicycle facilities, improving signage on established bicycle routes, encouraging racks and/or lockers for bicycles at workplaces and public transit, permitting bikes on transit at more times of the day, and outfitting buses with bike racks. The Washington Area Bicyclist Association (WABA) provides training, maps, information on commuting and bicyclist rights, as well as other resources for bicyclists in the area. WABA also organizes an annual Bike to Work Day, sponsored by Commuter Connections, which encourages new riders and bike-friendly workplaces.

According to the League of American Bicyclists, the number of people commuting by bike in the District of Columbia more than doubled between 2000 and 2011, almost 3.5 percent of commute trips are now made by bike. One of the major bicycling improvements has been the inception and growth of Capital Bikeshare. In 2008, D.C. became the first city in the country with a bike share program, SmartBike D.C. In 2010, D.C. and Arlington County jointly established Capital Bikeshare, which was joined by Alexandria in 2012 and Montgomery County in 2013. The network now includes over 200 stations and over 1800 bikes. Arlington County developed a Capital Bikeshare Transit Development Plan to establish a strategic expansion and funding plans for the County's bicycle share system.

Between 1994 and 2008, walk trips grew from 7.7 percent to 8.5 percent as a share of total trips in the region. Transit-oriented development is a hugely important measure for encouraging walking instead of driving. By collocating residential, retail, recreation and office space, localities and real estate developers can help to greatly reduce VMT. To improve existing pedestrian infrastructure, the region is working to improve sidewalks, locate bus stops on sidewalks, provide shelters at bus stops and design crosswalks to enable people to access bus stops on each side of a busy road.

A related initiative, "Complete streets," aims to design and operate streets to enable safe access for all users, including motorists, pedestrians, bicyclists, and transit users, as well as senior citizens, children, and persons with disabilities. The District of Columbia, Virginia, Arlington, Alexandria, and a number of other jurisdictions have adopted or are moving towards Complete Streets policies.

Opportunities for Expansion
While the region is experiencing growth in both bicycling and walking as preferred transit modes, there is much opportunity for expansion. 25 percent of automobile trips are 1.5 miles or less, but bicycling still

makes up only 0.5 percent of all trips in the region. Local funding targeted towards improved access to bicycle paths, safe bicycle racks, bicycle education, repair shops or Capital Bikeshare may increase participation. The National Capital Region Bicycle and Pedestrian Plan identifies many areas of improvement and prioritizes projects based on the potential benefits the project could have from access to transit, connectivity to the bike network, local support, pedestrian safety and reasonableness of costs.

Air Quality Benefits

Increasing the accessibility and safety of bicycling and walking between residential areas, public transit, retail, offices and cultural destinations helps to encourage people to bike, walk or use public transit instead of driving. Reducing vehicle trips and VMT is one of the most effective ways to reduce emissions of NOx, fine particles and greenhouse gases.

Vehicle Emission Reduction

Alternative Fuel Vehicles

Description
The transportation sector contributes a third of the metropolitan Washington region's total greenhouse gas (GHG) emissions. To minimize the impacts of the transportation sector, the 2013-2016 Climate and Energy Action Plan established a goal to increase the use of alternative fuel (AFV) and high efficiency vehicles (HEV), and to implement AFV charging and/or fueling infrastructure projects.

Regional Implementation
Unlike federal and fuel provider fleets, local government and private fleets are not required under the Energy Policy Act (EPAct) to operate alternative fuel vehicles. Despite the lack of federal requirements, many in the metropolitan Washington region have embraced the use of clean fuel vehicles. According to a survey by the Greater Washington Regional Clean Cities Coalition, there currently are over 6,700 AFVs and over 260 alternative fuel stations in the region. Strong leadership by the local governments has been vital to the region's progress. Over 70 percent of jurisdictions plan to implement a green fleet policy for the public fleet and 50 percent have alternative fuel infrastructure in place. In 2009, Montgomery County Department of General Services, Division of Fleet Management Services, won second place in the 2009 Government Green Fleet Award, a national competition open to all federal, state and local government fleets in North America.

On the state level, significant steps are being taken to increase alternative fuel use through new minimum fuel standards and financial incentives. For a review of federal and state alternative fuel laws and incentives affecting the region, see Table 3. For more information on federal and state alternative fuel laws and incentives, see the US Department of Energy's Alternative Fuels Data Center.

TABLE 3: FEDERAL AND STATE LAWS AND INCENTIVES

FEDERAL
Qualified Plug-In Electric Drive Motor Vehicle Tax Credit A tax credit for new qualified plug-in electric drive motor vehicle for minimum of $2,500, and the credit up to $7,500 for vehicles acquired after December 31, 2009.
Alternative Fuel Excise Tax Credit A $0.50 per gallon tax credit available for an alternative fuel sold for use or used as a motor fuel. Expired December 31, 2013 but will remain posted until income tax deadline.
Alternative Fuel Infrastructure Tax Credit Eligible for alternative fueling equipment installed between 1/1/06 – 12/31/13 for a tax credit of 30 percent of the cost, not to exceed $30,000; Tax credit towards multiple states allowed. Expired December 31, 2013 but will remain posted until income tax deadline.
Airport Zero Emission Vehicle (ZEV) and Infrastructure Incentives Program provides funding to airports for 50 percent of the eligible cost to acquire ZEVs; vehicles must be used on-road, employed exclusively for airport purposes, and must meet the FAA's Buy American requirements. Funding for installation or modification of fueling infrastructure is also available.

DISTRICT OF COLUMBIA	MARYLAND	VIRGINIA
Low Emission Vehicle (LEV) Standards It is expected that EPA's finalized Tier 3 rule will be referenced in the regulations and implemented through the new vehicle registration program. Tier 3 is harmonized with the California Air Resources Board (CARB) Low Emission Vehicle program (LEVIII)	**Low Emission Vehicle (LEV) Standards** Maryland has adopted the California motor vehicle emission standards California emissions standards and compliance requirements set forth in the California Code of Regulations.	**State Energy Plan** The plan includes policies to promote alternative fuel and efficient vehicle use, encourage efficient driving techniques, and reduce vehicle miles traveled.
Alternative Fuel and Fuel-Efficient Vehicle Tax Exemption Qualified AFVs and motor vehicles with an average city fuel economy of at least 40mpg are exempt from the excise tax; Purchasers of the same vehicle are also exempt.	**Electric Vehicle Supply Equipment (EVSE) Tax Credit** Maryland Energy Administration offers an income tax credit equal to 20 percent of the cost of qualified EVSE; the credit may not exceed the lesser of $400 or the state income tax imposed for that tax year.	**Alternative Fuel and Hybrid Electric Vehicle (HEV) Emissions Testing Exemption** Alternative fuel vehicles are exempt from emissions testing. Hybrid electric vehicles with city fuel economy ratings of at least 50mpg are also exempt.
Reduced Registration Fee for Fuel-Efficient Vehicles A new motor vehicle with an estimated average city fuel economy of at least 40mpg is eligible for a reduced vehicle registration fee of $36; Rate applies to the first two years of registration and only the original purchaser.	**Electric Vehicle Supply Equipment (EVSE) Regulation Exemption** Owners and operators of EVSE are not subject to state regulation as electricity suppliers or public service companies.	**Retail Electric Vehicle Charging Regulations** Retail plug-in electric vehicles charging services provided by an individual who is not a public utility, public service corporation, or public service company, is not considered the retail sale of electricity.
Alternative Fuel Vehicle Acquisition Requirements Fleets that operate at least 10 vehicles in an ozone nonattainment area must ensure that 70 percent of newly purchased vehicles are clean fuel vehicles.	**Zero Emission Vehicle (ZEV)[xiv] Deployment Program** Maryland, California, Connecticut, Massachusetts, New York, Oregon, Rhode Island, and Vermont signed a memorandum of understanding (MOU) to support the deployment of 3.3 million ZEVs by 2025.	**Alternative Fuel Program** The plan provides for the replacement of state-owned or operated vehicles with vehicles that operate on alternative fuels. The plan also requires development of alternative fuel infrastructure.

Opportunities for Expansion

Local governments are pursuing AFVs to help solve local air quality issues, develop local economic opportunities, and demonstrate regional leadership. The District of Columbia and Maryland have adopted California's emission standards, which are more stringent than EPA's requirements. While the progress is commendable, state and local governments in the region must continue to expand their efforts. The District and Virginia could make a strong commitment to promoting low emission vehicles

by joining the Zero Emission Vehicle Deployment Program along with eight other state governments, including Maryland. Under this agreement, governors of each state sign an MOU to support the deployment of 3.3 million ZEVs by 2025 by developing deployment strategies and infrastructure requirements, uniform standards to promote consumer approval, and by exploring opportunities for coordinated vehicle and fueling station equipment procurement. Joining this effort would further help reduce air pollution and protect public health in the region.

Cooperative purchasing represents a viable option for local governments to realize lower prices, higher product quality, and contracting efficiencies. Montgomery County's Division of Fleet Management Services recently developed a solicitation for Electric Vehicle Charging Stations. Through the COG EV Work Group, Montgomery County received interest in joining the solicitation from Prince George's County, Charles County Public Schools, and Anne Arundel County Public Schools. Executing a cooperative purchase of AFVs, alternative fuels or AFV infrastructure would be an effective tool for COG member jurisdictions to expand their AFV programs.

Additionally, COG member governments should consider using Virginia's Public-Private Education Facilities and Infrastructure Act (PPEA) contracts for natural gas and propane infrastructure where feasible. Virginia has awarded contracts for natural gas and propane vehicles using PPEA contracts, including provisions for fueling infrastructure and statewide fuel pricing. For more information, see Virginia's Alternative Fuel Program.

Air Quality Benefits

Alternative fuel and hybrid vehicles have lower tailpipe emissions of air pollutants like carbon monoxide, NOx, SO_2 and fine particles, and provide higher fuel economy than conventional gasoline-powered cars. Switching to cleaner fuels and/or vehicles can significantly reduce ozone and fine particle levels to improve local air quality.

According to the US Department of Energy Alternative Fuel Vehicle Data center, using natural gas reduces GHG emissions by 6 – 11 percent, using corn-based ethanol instead of gasoline reduces GHG emissions by 19 – 52 percent, and using cellulosic ethanol reduces GHG emissions by up to 86 percent.[xv] Plug-in hybrid and electric vehicles running only on electricity have zero tailpipe emissions of criteria air pollutants, and produce 50 – 65 percent of the GHG emitted by a conventional gasoline-powered vehicle (using our region's average electricity supply mix).

Voluntary Diesel Retrofit Program

Description
Diesel vehicles and locomotives emit significant levels of NOx and particulate matter. To reduce emissions, diesel engines can be retrofitted with emission control devices or new cleaner burning engines, repowered, rebuilt or upgraded to run on cleaner fuel. Many technologies for reducing emissions exist, including: Diesel Oxidation Catalysts (DOCs), Diesel Particulate Filters (DPF), Closed Crankcase Ventilation (CCV) for reducing particulate matter emissions, and Selective Catalytic Reduction (SCR), Exhaust Gas Recirculation (EGR) and Lean NOx Catalyst (LNC) for reducing NOx emissions. EPA maintains a list of diesel retrofit devices on the Transportation and Air Quality office website. Ultra Low Sulfur Diesel Fuel is a requirement for use of DPFs, and is now widely available across the country.

Regional Implementation
The region has made significant progress retrofitting diesel school bus fleets and public transit buses. In 2005, Fairfax County retrofitted 148 transit buses and 1,329 school buses. In 2009, COG partnered with 12 regional fleet operators, including Washington Metropolitan Area Transit Authority (WMATA), Washington Area Sewer and Water Authority (DCWASA), Montgomery County, Fairfax County, Prince William County and eight private fleet operators, to retrofit 130 transit buses and 64 non-road diesel construction equipment engines, repower 3 heavy duty dump trucks, and replace or upgrade other vehicles including school buses and ambulances.

Local and state governments participate in the Mid-Atlantic Diesel Collaborative to establish project priorities in advance of potential new sources of federal funding. In 2011, COG received a Diesel Emissions Reduction Act (DERA) grant awarded through EPA's National Clean Diesel Funding Assistance Program to replace the existing diesel engines in two Amtrak switcher locomotives at Union Station in the District of Columbia. Working with Amtrak and the Brotherhood of Locomotive Engineers and Trainmen, the project will replace the old engines with two smaller, independently controlled GenSet engines, which cut fuel consumption in half and reduce emissions up to 90 percent, depending on the pollutant. The first repowered switcher, Ella, was unveiled on Earth Day 2014.

Opportunities for Expansion
Public agencies and localities that do not yet have a voluntary diesel retrofit program can join existing regional efforts.

Air Quality Benefits
Diesel retrofits can significantly reduce emissions of NOx and fine particles, and have been shown to be more cost effective than other congestion and mitigation projects. Diesel retrofits are an attractive air quality improvement measure because results are significant and nearly always immediate, which reduces the need for tracking behavior or other ongoing monitoring activities. In metropolitan areas with high concentrations of heavy-duty vehicles or construction, retrofits can have an even larger impact.

Retrofitting diesel vehicles can reduce in-use emissions of particulate matter by 20-90 percent and NOx emissions by 25-75 percent depending on the technology used and vehicle specifications. The regional diesel retrofit collaboration retrofitted a total of 789 pieces of heavy duty diesel on-road and off-road equipment to reduce diesel emissions. The emissions reduction benefit from this project is estimated at 572 tons per year of NOx and 40 tons per year of fine particles.

Traffic Signal Optimization

Description
Poor operating conditions, such as sitting in congestion, driving aggressively, or starting and stopping frequently can have a significant impact on automobile emissions. Because fuel efficiency is sensitive to vehicle speed and emissions are a direct product of fuel combustion, operating speed impacts the volume of emissions. Traffic signal optimization aims to improve the flow of traffic, reduce congestion and delay, and reduce the amount of time vehicles are stopped in traffic.

Until recently, optimizing traffic signals has been a challenging and expensive task, relying on inductive loops, cameras or manual counts to monitor traffic. With new technology it is increasingly possible to monitor traffic and update traffic signals in real-time to respond to unexpected conditions. Now, traffic agencies can match Bluetooth or WiFi devices in passing cars to obtain an accurate picture of travel times along a particular corridor, and can use smart traffic lights that can be remotely updated by the system operator. Intelligent Transportation Systems (ITS) are advanced applications of software and hardware that aim to improve traffic management.

Regional Implementation & Opportunities for Expansion
Traffic signal optimization is one of the region's Transportation Emissions Reduction Measures (TERMs), which are used to support the region's air quality conformity determination. The TPB provides periodic updates on regional practices related to traffic signal optimization. Between 2009 and 2012, approximately 76 percent of the region's traffic signals were optimized, checked, or adjusted. 47 percent were optimized using computer software, and 22 percent are actively managed using real-time data. While additional benefits may be possible to achieve by expanding the active management program, the region is doing quite well on this measure.

Air Quality Benefits
Signal optimization improves air quality by reducing congestion and idling, which cause higher levels of NOx emissions. The emission reduction potential is relatively high because signal optimization affects the entire fleet, including heavy-duty vehicles which are responsible for a growing proportion of NOx and fine particle emissions.

Idling and Emissions Enforcement

Description
Inspections and maintenance are key components of reducing vehicle emissions. The EPA has set stringent pollution standards for all new passenger cars and trucks sold in the United States today, but even these vehicles can become high polluters if the engine and emission controls are not functioning properly. The federal government recommends that states require periodic emissions performance checks, and repairs for vehicles that fail emissions tests, to encourage proper vehicle maintenance and discourage tampering with emission control devices.

Emissions of ozone precursors are greatest when running a vehicle at low speeds or while idling. EPA estimates that idling truck engines consume over 500 million gallons of diesel fuel and emit 5.5 million tons of carbon dioxide, 100,000 tons of oxides of nitrogen, and 2,500 tons of particulate matter into the air each year. Idling uses unnecessary fuel and can cause additional wear or even engine damage, so reducing idling can save drivers money on fuel and maintenance.

Regional Implementation
All jurisdictions are covered by their state's vehicle inspection and maintenance program: in the District of Columbia the Enhanced Emissions Inspection Program (EEIP), in Maryland the Vehicle Emissions Inspection Program (VEIP), and Virginia's Air Check program. Virginia also has a Remote Sensing program, which identifies high-emitting vehicles, notifies owners and requires them to perform maintenance to reduce emissions. The program is operated using roadside vehicles equipped with devices to measure tailpipe emissions. When a vehicle is detected to exceed emissions limits, a notice of violation is sent to the vehicle owner.

Most jurisdictions in the region have promulgated rules and ordinances to limit vehicle idling, but these rules are difficult to enforce. State and County Departments of Transportation also play a large role in idling reduction by working to reduce congestion.

Opportunities for Expansion
The District of Columbia and Maryland could implement a remote sensing program to support their vehicle inspection and maintenance programs. Localities can also perform education and outreach to make drivers more aware of the benefits of routine maintenance, and the penalties for violation. Targeting education efforts for delivery companies, mail carriers, public transit agencies, and other frequent idlers may be an effective way to encourage idling emissions reduction. Improved idling and maintenance compliance could also be addressed through driver's education and visible public notices.

Air Quality Benefits
Increasing maintenance, inspections and idling enforcement, such as with remote sensing, improve vehicle performance and helps to reduce mobile sector emissions of air pollutants including NOx and fine particles.

Incident Management and Communication

Description
Incidents such as traffic accidents, fires, security breaches, and water main breaks can interrupt the usual flow of traffic or make transportation routes unsafe or inaccessible. In such situations it is crucial to have a coordinated system with established procedures and functioning communication channels that can quickly address and resolve the problem.

MATOC
The Metropolitan Area Transportation Operations Coordination (MATOC) Program is a coordinated partnership between regional transportation and transit agencies to improve traveler safety and reduce delays caused by incidents and emergencies. MATOC provides timely and reliable information to enable individuals to make better travel decisions as well as a mechanism for better coordination of the transportation management agencies.

MATOC was established in 2008 and began operations in 2009. The program includes District of Columbia, Maryland, and Virginia Departments of Transportation along with County and City transportation departments and transit providers like WMATA and other local providers, and is funded by DDOT, MDOT/Maryland State Highway Administration (SHA) and VDOT.

Safety Service Patrols
The District, Maryland and Virginia Departments of Transportation all operate safety service patrols that help to manage traffic incidents by safely removing disabled vehicles from the travel lanes. Safety Service Patrols operate as part of a multi-agency incident response team to provide: incident detection, temporary traffic control and detours, disabled vehicle relocation, debris removal, jump starts, tire changes, fuel or water for overheating vehicles, phone access to call tow services, map and directions, as well as standard first aid. These services not only improve road and highway safety, but also reduce delay, traffic stoppage time and congestion around traffic incident sites.

Air Quality Benefits
Reducing travel delay lowers fuel consumption and mobile sector emissions of air pollutants. The MATOC Program estimates that the 2013 savings in time, emissions, and fuel consumption from incident coordination was worth $16.88 million, 5 percent of which was savings from emissions and fuel consumption. Because NOx emissions are greater at lower speeds associated with idling or congestion, improving traffic flow can have a large benefit for local air quality.

New & Additional Ideas

Learning from Other Regional Governments

The metropolitan Washington region has had great success improving the region's air quality. However, there is more progress to be made, especially in anticipation of probable new and more stringent air quality standards from the EPA.

New programs are continually being developed and implemented, and the region can learn much from local governments and regional councils around the country. Numerous regional transportation and sustainability plans include air quality improvement measures that metropolitan Washington has not yet pursued. National leaders in regional-level planning efforts for air quality include:

- Sacramento Area Council of Government (SACOG): Metropolitan Transportation Plan/Sustainable Communities Strategy
- San Diego Association of Governments (SANDAG): 2050 Regional Transportation Plan
- San Francisco Planning and Urban Renewal Association (SPUR): Agenda for Change and Transportation 2035 Plan for the San Francisco Bay Area
- Southern California Association of Governments (SCAG): 2012-2035 Regional Transportation Plan/Sustainable Communities Strategy
- Portland Metropolitan Region: Climate Prosperity Strategy and Climate Smart Communities Scenarios Project
- Southeast Florida Regional Climate Change Compact Counties: Regional Climate Action Plan

The following section describes several measures that local governments in the region are exploring but have not yet implemented, or which have great potential for expansion in the region.

Microgrids

Description
Microgrids are small-scale electricity distribution systems that include distributed generation resources linked to one or more users. Microgrids are nearly always connected to the grid but can be switched to operate independently, called "islanding." Because of this capability, microgrids are another element of grid security and resilience efforts being explored in the region. Microgrids are technology agnostic, and can include any number of different technologies, including combined heat and power (CHP), solar photovoltaic and thermal systems, geothermal heat pumps, or battery storage, which can add energy security and resilience value by reducing dependence on fuels and central grid-provided energy.

Regional Implementation
The region is looking into opportunities to use microgrids to ensure energy security and resilience, especially for critical infrastructure. Maryland's Game Changer program awarded one of the first grants to Standard Solar for the state's first solar microgrid, located in Prince George's County. The U.S. Food and Drug Administration's White Oak research facility in Montgomery County operates on a microgrid with four CHP turbines as well as diesel generators. There are currently no microgrids in the District of Columbia or COG's Virginia member jurisdictions. Dominion is partnering with VCU's Engineering School in Richmond to build a microgrid that will make continuous, real-time energy adjustments to the building, lights and equipment. The project is expected to reduce the building's energy use by 4 percent, saving $20,000 annually. The National Renewable Energy Lab is conducting initial studies for a microgrid at the Naval Support Facility in Dahlgren, Virginia.

Opportunities for Expansion
The region is exploring opportunities for microgrids at critical infrastructure, such as water sanitation facilities and pump houses. Howard University has also explored building a microgrid using two natural gas generators to provide at least 50 percent of the school's electricity needs.

Air Quality Benefits
In addition to the benefits for security and productivity, improving the reliability and resilience of critical infrastructure has benefits for regional air quality. Many essential facilities, including water and sanitation plants, hospitals, airports, data centers, as well as universities and industrial customers in the region use diesel generators to provide power in the event of an emergency. These generators have significant negative air quality impacts: a diesel generator can release up to 9 tons of NOx in one event. The Virginia Department of Environmental Quality estimates that distributed generators were responsible for 396.1 tons NOx emissions in 2007 in Northern Virginia alone.

Microgrids can eliminate the need for generators by providing reliability through grid-independent clean or renewable energy generation and storage. If integrating clean and renewable energy, microgrids can offset electricity from fossil-fueled power plants, reducing emissions of NOx, SO_2, fine particles and greenhouse gases. Reducing emissions from upwind power plants reduces ozone transfer and can make a significant contribution toward improving local air quality conditions.

Combined Heat & Power

Description
Combined heat and power (CHP), or cogeneration, is the use of a heat engine or power station to simultaneously generate electricity and useful heat. In conventional electricity production, some energy must be discarded as waste heat, usually through a cooling tower. CHP captures some or all of the thermal energy for use in heating, achieving much great energy efficiency than independent electric and thermal generation. CHP is often used in district energy systems, which provide heating and cooling services in the form of hot water, steam or chilled water from a central plant to multiple buildings in the vicinity. This can be used for space heating, air conditioning, domestic hot water, or industrial heating and cooling processes. District energy systems may also include a microgrid to provide electricity to the end users in the system.

Regional Implementation
There are currently no CHP systems operating in the District of Columbia. The US Department of Energy estimates that installing CHP systems in D.C.'s commercial and industrial sector could generate 1320 - 2410 MW of electricity. Maryland has 14 CHP facilities with a total capacity of 766MW, approximately 6.5 percent of the states total energy market. The University of Maryland has two CHP facilities in College Park, and the FDA's White Oak campus in Silver Spring has four CHP turbines and a district energy system for distribution. Virginia has 44 CHP facilities statewide, generating 2,147MW annually – 11.4 percent of the state's energy market. Fort Belvoir in Alexandria has the only CHP facility in the Northern Virginia region.

Opportunities for Expansion
The U.S. Department of Energy has set an aggressive goal to reach 20 percent of national generation capacity from CHP by 2030. EPA's Combined Heat and Power Partnership seeks to promote the use of CHP to reduce the harmful environmental and air quality impacts of electricity generation. The region has several good models for CHP deployment already, but there is enormous potential for new CHP installations, which could help the region realize energy efficiency and climate change goals, as well as air quality targets.

Air Quality Benefits
According to the EPA, CHP systems achieve effective electrical efficiencies of 50-70 percent, while the average US fossil-fueled power plant has efficiencies of around 33 percent. This added efficiency means reduced fossil fuel consumption, reduced greenhouse gas emissions, and reduced NOx and fine particle emissions from power plants for the same amount of useful energy produced. Reducing emissions from upwind power plants reduces ozone transfer and can make a significant contribution toward improving local air quality conditions.

Waste-to-Energy

Description
Waste-to-energy refers to an energy recovery process that generates energy in the form of electricity and/or heat from waste. Incineration and direct combustion is the most common form of waste to energy, but several non-combustion technologies exist, including: gasification, anaerobic digestion, fermentation and thermal depolymerization, which can convert waste to liquid fuels.

Regional Implementation and Opportunities for Expansion
The region has a small number of waste-to-energy plants, notably the Covanta Energy Recovery facilities in Fairfax and Montgomery counties, but there is opportunity for expansion. Using waste to produce electricity has the advantage of reducing electricity needed to be produced from conventional power plants. However, there are some concerns that by monetizing waste, waste-to-energy projects may create an incentive to produce more waste.

Air Quality Benefits
Generating electricity from waste offsets energy consumption from power plants, reducing emissions of NOx, SO_2, fine particles, and greenhouse gases. Reducing emissions from upwind power plants reduces ozone transfer and can make a significant contribution toward improving local air quality conditions. While waste combustion does have significant carbon dioxide emissions, the CO_2 emitted has about half the global warming potential than the volume of methane that would have been emitted if the waste were landfilled.

Hoteling

Description
Hoteling is an extension of teleworking, whereby employees rotate their use of office space, similar to the functioning of hotel rooms. “Hot desking,” “free address workstations,” “touchdown workstations,” and “desk sharing” are similar office policies that allow for multiple employees to use the same office space, either on a pre-arranged rotational schedule or by random assignment. When many employees work remotely a company may find there are underutilized offices, which can enable the company to function with less office space. While hoteling may require employees to use non-dedicated, non-permanent workstations, it can contribute to expanding telework programs and to reducing office energy use.

Opportunities for Expansion
Thus far, this report found no local jurisdictions have hoteling policies, but some local companies and many organizations across the country have begun to use hoteling as a way to reduce both real estate and utility costs for office space, and to further encourage teleworking as a work mode.

Air Quality Benefits
Hoteling reduces vehicle trips and VMT per capita, reducing NOx, fine particle, and greenhouse gas emissions just as telework programs do. In addition to reducing transportation emissions from avoided commutes, hoteling has the added air quality advantage of reducing energy needs for office space, reducing emissions of NOx, SO_2, mercury, fine particle, and greenhouse gases from power plants. Reducing emissions from upwind power plants can reduce ozone transfer to further improve the region’s air quality.

Eco-Driving Programs

Description

Eco-driving is a driving practice that uses a number of methods to increase fuel efficiency, such as accelerating smoothly and braking softly, eliminating excess weight, reducing heating/cooling use, checking tires often, and performing regular maintenance. Ford Motor Company has conducted road tests which demonstrated that eco-driving improves fuel economy by an average of 24 percent. Public awareness on the impact of driving behavior and vehicle maintenance on fuel efficiency can help save drivers money at the gas pump, but also reduce tailpipe emissions.

Regional Implementation & Opportunities for Expansion

COG joined the I-95 Corridor Coalition's Eco-driving campaign in July 2011 and provides information on eco-driving on the COG website. Resources are available on driving more efficiency, driving less, maintaining your vehicle and calculating your savings. To expand the impact of these measures, COG and local governments in the region could undertake a public awareness campaign through the Commuter Connections program. Eco-driving practices could also be incorporated into driver education programs.

Air Quality Benefits

Eco-driving programs improve air quality by teaching drivers lower emitting driving behaviors, which can reduce fuel consumption by one-quarter. This is a very effective way to reduce emissions of NOx, fine particles, and greenhouse gases. National studies and pilot programs in the U.S. have found that eco-driving practices can improve vehicle fuel efficiency by 10-15 percent. Additionally, this measure has the potential to affect the entire fleet, including heavy-duty vehicles, which makes it more effective for reducing emissions than other more localized or vehicle-specific measures.

Usage-Based Insurance

Description
Usage-based, or pay-as-you-drive (PAYD) insurance, is a type of automobile insurance plan that charges based on your usage. At the simplest, the charge is based on the miles driven, but calculations can also include the type of vehicle used, location, time of day or year and driving behavior. Usage-based plans are offered by several major automobile insurers including Progressive, Allstate, and Liberty Mutual.

Regional Implementation & Opportunities for Expansion
Usage-based insurance is available to regional residents from several providers: Progressive, All State, Liberty Mutual and GMAC Insurance. Additional providers are expected to begin offering this service in the near future. As part of air quality education programs, local governments could encourage adoption of usage-based insurance policies by residents and government staff. Public agencies could also switch eligible fleets to usage-based insurance, or provide incentives for private companies and citizens to switch to usage-based insurance policies.

Air Quality Benefits
Usage-based insurance encourages drivers to drive only when necessary to reduce their insurance premiums, and rewards safe driving, which can ease traffic flow and prevent accidents that cause congestion. Such programs may reduce VMT and therefore reduce emissions of NOx, fine particles, and greenhouse gases. The TPB estimates that usage-based insurance could reduce VMT in the region by 100,414,209 miles and reduce greenhouse gas emissions by 48,979 tons for each 5 percent of the region's eligible drivers who switch to this type of insurance.

Parking Management

Description
Most harmful NOx and particulate matter emissions occur when operating at low speeds, such as while circling the block or neighborhood for a parking space. While free or cheap street parking is popular, it also encourages people to drive, and to occupy spots for long periods of time. Both these factors reduce the number of free spots for those looking to park, increasing the number of people searching for a spot and the amount of time it takes them to park.

Some cities have experimented with alternative parking management strategies that disincentivize long-term street parking, either through increased parking enforcement or by raising parking fees. Philadelphia raised parking meter rates from $1.50 per hour to $2 per hour in 2009 and again to $2.50 per hour in 2011. The change resulted in $4 million more in city revenues, and encouraged more drivers to choose off-street parking lots.

Regional Implementation and Opportunities for Expansion
The District of Columbia recently implemented a mobile payment option for on-street parking, Parkmobile. This creates ease and flexibility for drivers, and may reduce circling while looking for a parking spot. However, parking options remain quite limited in urban core areas. Parking management initiatives, such as raising meter rates or encouraging more off-street long-term parking could be an effective way to reduce congestion.

Air Quality Benefits
Studies show that circling for a parking spot is responsible for 30-50 percent of inner-city traffic congestion. A study done by the University of California, Los Angeles determined that drivers searching for on-street parking in just a 15-block area of Los Angeles burned 47,000 gallons of fuel and traveled four times the distance to the moon. Higher parking fees can encourage more people to take public transportation, carpool, bike or walk, and encourages drivers seeking longer-term parking to use off-street lots rather than on-street parking. This frees up spots for others and reduces the time it takes to find a short-term parking space, reducing NOx, fine particles, and greenhouse gas emissions while helping to ease congestion.

Glossary of Terms

Term	Definition
Activity Center	141 locations, including existing urban centers, priority growth areas, traditional towns, and transit hubs, that have been prioritized by COG members to accommodate the majority of the region's future growth.
Advanced Metering Infrastructure (AMI)	Advanced metering infrastructure is a system of smart meters, communications networks, and data management software that enables communication between utilities and customers to allow for improved grid performance and rate transparency.
Air Quality Index (AQI)	Index for reporting daily air quality which indicates how clean or polluted the air is. AQI codes correspond to different levels of health concern: Green (Good), Yellow (Moderate), Orange (Unhealthy for sensitive groups), Red (Unhealthy), Purple (Very unhealthy), or Maroon (Hazardous).
Alternative Fueled Vehicle (AFV)	A vehicle that runs on a fuel other than "traditional" petroleum fuels (petrol or diesel). May also be used to refer to any vehicle that does not run on petroleum (e.g. electric or hybrid vehicles, solar powered vehicles, etc.).
Attainment Area	An area considered to have air quality as good as or better than the NAAQS. An area may be an attainment area for one pollutant and a non-attainment area for others. Ozone non-attainment areas are classified as: Extreme, Severe, Serious, Moderate, or Marginal in decreasing order of severity.
Biogas	A type of biofuel that contains methane from landfills, animal waste, sewage, or other decomposing waste materials. The principal constituents are methane and carbon dioxide. Biogas can be burned to produce heat or electricity.
Built Environment and Energy Advisory Committee (BEEAC)	A technical advisory committee to CEEPC, with membership including local government energy managers, government staff supporting energy efficiency and renewable energy initiatives, as well as interested stakeholders. The group serves as a forum for discussion and monitoring of energy and green building issues in the National Capital Region (NCR).
Carbon Dioxide (CO2)	A naturally occurring gas made of carbon and oxygen and the most common greenhouse gas. Sources of carbon dioxide in the atmosphere include animals, which exhale carbon dioxide, and the burning of fossil fuels and biomass.
Carbon Monoxide (CO)	A colorless, odorless, poisonous gas produced by incomplete fossil fuel combustion.
Criteria Pollutants	The six pollutants for which EPA is required to set National Ambient Air Quality Standards to protect human health and welfare: particulate matter, ground-level ozone, carbon monoxide, sulfur dioxide, nitrogen oxides, and lead.

Clean Air Act (CAA)	Primary federal law on air pollution matters. Requires EPA to develop and enforce regulations to protect the public from airborne contaminants known to be hazardous to human health. Initially passed in 1963, the Act was expanded and amended in 1967, 1970, 1977, and 1990.
Clean Air Scientific Advisory Committee (CASAC)	Provides independent advice to the EPA Administrator on the technical bases for EPA's national ambient air quality standards.
Climate, Energy and Environment Policy Committee (CEEPC)	Created by the COG Board in 2009 to be its principal policy adviser on climate change, energy, green building, alternative fuels, solid waste and recycling policy issues, and to manage implementation of the National Capital Region Climate Change Report.
Code Red/Orange/etc.	See Air Quality Index (AQI)
Combined heat and power (CHP)	The generation of electricity and thermal energy from a single fuel source, which typically achieves effective electric efficiencies of 50 to 80 percent. A CHP system is also referred to as cogeneration.
Commissioning	Testing and adjusting HVAC, electrical, plumbing, and other building systems to assure proper functioning and adherence to design criteria.
Corporate Average Fuel Economy (CAFE) standards	Federal regulations to improve the average fuel efficiency of motor vehicles.
Eco-Driving	A driving practice that employs a number of driving and vehicle maintenance behaviors to increase fuel efficiency by approximately 24 percent.
Electric Vehicle (EV)	A vehicle that uses one or more electric motors. May be powered by stored electricity (e.g. a battery), or by an on-board electrical generator, such as an internal combustion engine (hybrid electric vehicles) or a hydrogen fuel cell.
Energy Savings Performance Contract (ESPC)	A contract between an energy services company and building owner that enables the owner to pay for an energy improvement project over time from the financial savings the project creates.
Energy Services/Savings Company (ESCO)	A business that develops and builds energy improvement projects where the project is paid for over time from the financial savings the project creates.
ENERGY STAR	A U.S. Environmental Protection Agency (EPA) voluntary program established under Section103(g) of the Clean Air Act, which promotes energy efficiency through certification for products, homes, commercial buildings and industrial plants.
Environmental Protection Agency (EPA)	Federal Agency responsible for protecting human health and the environment, including by regulating air quality under the Clean Air Act.

Geothermal Heat Pump	A type of heat pump that uses underground coils to transfer heat from the ground to inside a building. Also called a ground source heat pump.
Green Building	An approach to design, construction, and building operations that emphasizes conserving natural resources and protecting human health.
Greenhouse Gas (GHG)	Atmospheric gases that absorb and emit radiation within the thermal infrared range, which warms the atmosphere. The primary GHGs are water vapor, carbon dioxide, methane, nitrous oxide, and ozone.
Ground Level Ozone	Also called smog. Formed by a chemical reaction between volatile organic pollutants (VOCs) and nitrogen oxides (NOx) in the presence of sunlight. Ground level ozone causes adverse effects on lung function and other adverse respiratory effects.
High Occupancy Toll Lane	A high-occupancy vehicle (HOV) lane that allows single occupancy vehicles to pay a toll to use the lane. This can help to manage the number of cars in each lane and reduce congestion.
High Performance Building	A building that integrates and optimizes all major high-performance building attributes, including energy efficiency, durability, life-cycle performance, and occupant productivity.
Hybrid Electric Vehicle (HEV)	A vehicle that combines a conventional internal combustion engine propulsion system with an electric propulsion system, which achieves higher fuel economy than conventional fuel vehicles. (Note: HEV may also refer to high efficiency vehicle.)
Kilowatt-hour (kWh)	A unit of energy equal to 1,000 watt-hours, used to describe energy delivered to consumers by electric utilities.
Leadership in Energy and Environmental Design (LEED)	Rating systems developed by the U.S. Green Building Council for the design, construction, operation, and maintenance of green buildings, homes, and neighborhoods.
Light-Emitting Diode (LED)	A two-lead semiconductor light source. LED lamps have a lifespan and electrical efficiency several times better than incandescent lamps, and significantly better than most fluorescent lamps.
Megawatt-hour (MWh)	A unit of energy equal to 1,000,000 watt-hours, used to describe energy production or consumption at a large scale.
Metropolitan Washington Air Quality Committee (MWAQC)	The entity certified by the Mayor of the District of Columbia and the Governors of Maryland and Virginia to prepare an air quality plan for the DC-MD-VA Metropolitan Statistical Area under Section 174 of the federal Clean Air Act Amendments of 1990.

Metropolitan Washington Council of Governments (MWCOG)	An independent, nonprofit 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 22 local governments, the Maryland and Virginia state legislatures, and U.S. Congress.
Microgrid	A group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid, and is able to operate independently (or "island") from the grid.
Motor Vehicle Emission Budgets (MVEBs)	The limit of allowable on-road emissions required to attain air quality standards. The MVEB explicitly identified in the SIP is used in the transportation conformity process to cap emissions in the regional transportation planning process.
National Ambient Air Quality Standards (NAAQS)	Standards set by EPA under the Clean Air Act intended to protect the public from air pollutants "with an adequate margin of safety" (primary NAAQS) and to promote the public welfare (secondary NAAQS).
Net-Positive Energy (NPE)	Producing more energy on-site than is consumed.
Net-Zero Energy (NZE)	Having no net energy consumption. The total amount of energy used must be roughly equal to the amount of renewable energy created on-site.
Nitrogen Oxides (NOx)	A group of gases that cause acid rain and other environmental problems, such as smog and eutrophication of coastal waters. Burning fossil fuels such as coal and gasoline releases NOx into the atmosphere.
On-Bill Financing (OBF) or On-Bill Repayment (OBR)	Programs that allow utility customers to borrow funds for renewable energy or energy efficiency improvements from the utility and repay the funds through additional charges on their utility bills.
Ozone (O_3)	See ground level ozone
Particulate Matter (PM)	Particles in the air, such as dust, dirt, soot, smoke, and liquid droplets; may have significant effects on human health.
Parts per billion (ppb)	Concentration. Number of parts of a chemical found in one billion parts of a particular gas, liquid, or solid mixture.
Power Purchase Agreement (PPA)	A financial agreement where a project developer arranges for the design, permitting, financing, and installation of an energy generating unit and sells the power generated to customer at a pre-determined fixed rate, typically lower than the customer's previous retail rate. PPAs typically range from 10 to 25 years, after which time a customer may have the option to extend the PPA, have the developer remove the system, or choose to buy the solar energy system from the developer.

Property Assessed Clean Energy (PACE)	An innovative financing method that allows access to low-cost long-term capital for energy efficiency and renewable energy upgrades, repaid through a property tax assessment over a period up to 20 years.
Renewable Portfolio Standard (RPS)	Regulation that requires a certain amount of electricity to be generated from renewable energy sources by a certain date. Also called a Renewable Electricity Standard (RES).
Smart Meter	An electric meter that records energy use on an hourly or more frequent basis, reports energy use to the utility remotely and facilitates two-way communication between the utility and the customer. This enables improved load management, such as time-of-use rates and demand response.
Solar Lease	An arrangement whereby the right to use a solar power system is transferred from the owner (lessor) to the customer (lessee). The lessee may be treated as the system owner, or may simply acquire the right to use the system for a limited time in exchange for periodic rental payments (the second type of lease is similar to a Power Purchase Agreement).
Solar Photovoltaic (PV)	Technology that converts sunlight into usable electric power.
Solar Thermal	Technology that harnesses the thermal energy of sunlight, typically for heating water for residential or commercial use.
Solarize	A bulk solar purchase by community members that enables customers to secure volume discounts from a solar-installer selected by the group. Also called cooperative solar purchasing.
State Implementation Plan (SIP)	A detailed description of the programs and regulations a state will use to carry out its responsibilities to reduce air pollution to meet the NAAQS, which must be approved by EPA under the Clean Air Act.
Sulfur Dioxide (SO2)	A naturally occurring gas made of sulfur and oxygen that causes acid rain. Burning fossil fuels, such as coal, releases SO2 into the atmosphere.
Transportation Planning Board (TPB)	The federally-designated Metropolitan Planning Organization (MPO) for the metropolitan Washington region. TPB prepares plans and programs requiring federal approval in order for the region to receive federal transportation funds.
Urban Heat Island Effect	A phenomenon causing developed areas to be significantly hotter than nearby more rural areas due to absorption and re-radiation of solar energy by pavements and buildings.
Usage-Based Insurance	A type of automobile insurance plan that charges based on usage, and can include factors such miles driven, time and conditions of driving, and performance. Also called pay-as-you-drive (PAYD) insurance.

Variably Priced Lane	A vehicle lane that requires vehicles to pay a toll that varies based on real-time traffic conditions (called congestion pricing) in order to use the lane. This can help to manage the number of cars in each lane and reduce congestion.
Virtual Net Metering	A tariff arrangement that enables multiple homeowners to share the output from a single distributed renewable energy facility that is not physically connected to their property (or their meter). In some states, participants must be conjoining properties or a multi-metered property.
Volatile Organic Compounds (VOCs)	Any organic compound which evaporates readily to the atmosphere. VOCs contribute significantly to photochemical smog production and certain health problems. Common sources include housekeeping and maintenance products; paints, coatings, and inks; and building and furnishing materials.
Waste-to-Energy	A process through which recovered solid waste is converted into a usable form of energy, usually via combustion.

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Gold Book

State and Local Government Initiatives to Clean the Air

Metropolitan Washington, DC Ozone Nonattainment Area

METROPOLITAN WASHINGTON
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