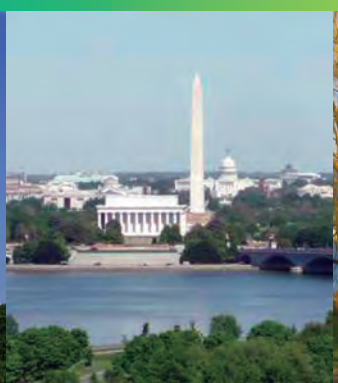
National Capital Region

Climate Change Report

Prepared by the Climate Change Steering Committee for the
Metropolitan Washington Council of Governments Board of Directors

Adopted November 12, 2008



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CLIMATE CHANGE STEERING COMMITTEE

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NOVEMBER 2008

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS

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Preface

The coming decades will likely be a time of rapid change and uncertainty, with dramatic changes in the environment and in the cost of energy. The metropolitan Washington region's historical growth trends in housing, land use, and energy have been disrupted by recent events, such as the fluctuations in the price of oil and the national financial crisis. Energy, climate, and environmental concerns are having profound effects on the region by reshaping development preferences and goals to meet the types of land uses and transit options that communities desire. Future economic growth will most likely depend on finding reliable low-carbon alternatives to build a sustainable future.

The metropolitan Washington region has unique advantages that enable it to respond rapidly to increasing energy prices and the vagaries of economic cycles. In facing the challenges of energy and climate change, the region has several advantages, including one of the best transit systems in the country, thoughtful and progressive governments that are able to coordinate strategic responses to rapidly changing conditions, a diversified economy, excellent airport and high-speed rail hubs, and many viable communities and "activity centers" that provide transit options for future growth.

The region also faces serious challenges in the near term dealing with the economy, environment, and energy prices. In the longer term, responding to the potentially dramatic impact of global climate change will present an enormous challenge. Early action in the United States and throughout the world is needed to avert the worst predicted impacts from climate change. The region needs to transition to a low-carbon future starting today. This report provides the regional framework for doing so.

Looking Back and to the Future

On April 11, 2007, the Metropolitan Washington Council of Governments (COG) celebrated its 50th anniversary. As part of its 50th anniversary year, the COG Board of Directors examined the extraordinary changes that took place during the first half century of COG's existence and how COG grew up along with the region and helped shape its growing and vibrant communities.

The Board then set its sights on the next fifty years. It recognized global climate change as a profound force fundamental to defining the decades ahead. The Board resolved that the metropolitan Washington region would become a leader in the growing national and international effort to combat this major challenge to the region's quality of life.

Thus on April 11, 2007, the Board adopted Resolution R31-07 (see Appendix A), creating a regional climate change initiative. In its resolution, the Board stated: "The failure to reduce greenhouse gases can undermine the quality of life in our region and its economic and environmental sustainability." The Board action called for creating a regional climate change program that would include developing a greenhouse gas inventory, setting regional goals, identifying best practices for reducing emissions, advocating policies at the federal and state levels, making recommendations on regional climate change policy, and recommending a structure to guide COG's efforts in the future.

By adopting R31-07, the metropolitan Washington region joined more than 35 states and 200 local governments that are taking actions to mitigate and prepare for climate change. The COG initiative is among a handful of regional climate action programs. With its focus on the National Capital Region, COG placed itself front and center on the national landscape of those jurisdictions taking leadership action on climate change.

Resolution R31-07 established a Climate Change Steering Committee (CCSC) to guide the initiative. The committee's initial work, which began in May 2007, focused on examining climate initiatives in Maryland, Virginia, and the District of Columbia, as well as among its 21 member local jurisdictions. Between May 2007 and October 2008 this work included:

- Reviewing the work of the Intergovernmental Panel on Climate Change, as well as local assessments of potential impacts in the Mid-Atlantic region;
- Preparing a report cataloguing best practices and greenhouse gas reduction activities already underway in the region;
- Developing an inventory of greenhouse gas emissions, and forecasting the future levels of emissions out to 2050 under a "business as usual" scenario;
- Evaluating a wide range of potential regional greenhouse gas reduction goals, and reaching consensus on an aggressive sequence of reduction targets starting in 2012;
- Examining state and federal legislation;
- Preparing advocacy positions primarily focused on enhancements to local and regional roles and resources to support local and regional initiatives;
- Endorsing the Cool Capital Challenge, a grassroots effort to jumpstart emission reductions in the region;
- Reviewing a wide range of measures to reduce greenhouse gas emissions;
- Preparing a regional Climate Change Report; and
- Recommending a committee structure to guide COG's efforts in the coming years.

This report reflects the work of the COG CCSC during the past 18 months. It presents recommendations for regional action by proposing broad goals, identifying actions that will begin to reduce regional greenhouse gas emissions, and setting in place a process to implement the regional framework crafted in this document.

An overarching tenet of this report is CCSC's acceptance of the overwhelming evidence presented by the Intergovernmental Panel on Climate Change, the U.S. National Academy of Sciences, the National Center for Atmospheric Research, the U.S. Environmental Protection Agency, the Chesapeake Bay Program, and others that the Earth is gradually warming and this warming trend is due in large part to human activities. The committee also acknowledged the need for taking action now in an effort to avoid the potentially catastrophic consequences of climate change forecast for the middle and latter parts of this century. CCSC was motivated not only by the need for action to address global climate change, but also by the growing body of evidence that adverse consequences are already taking place in our region.

While climate change concerns provided the foundation for the recommended actions in this report, CCSC also notes that many, if not virtually all, of the recommended actions will provide very significant benefits and will enhance the future of the region's quality of life, irrespective of whether the anticipated climate changes materialize as predicted, or whether the collective intervention of those in this region, across the United States, and elsewhere in the world ultimately produce the desired greenhouse gas mitigation benefits. The COG Board of Directors adopted this report and its recommendations on November 12, 2008. Resolution R60-08 (Appendix F) formalized the Board's action.

Executive Summary

Facing the Facts

The Washington metropolitan region is growing. The Metropolitan Washington Council of Governments (COG) forecasts that between 2005 and 2030, the region will gain 1.6 million new residents and 1.2 million new jobs. The forecasts are based on historical growth patterns or "business as usual" (BAU). The region's growth has been fueled by relatively inexpensive gasoline prices, which has encouraged development in outer suburbs and brought more cars and traffic congestion to the region's roads. Population in the outer suburbs is predicted to experience the fastest growth, a 47 percent increase by 2030, compared to 18–20 percent in the regional core and inner suburbs (MWCOG 2007c). Based on current BAU projections of growth in population, housing, employment, and energy use, total greenhouse gas emissions in the region will increase by 33 percent by 2030 and 43 percent by 2050 (see Figure ES-1).

An enormous amount of energy is needed to fuel the region's and the nation's economy and lifestyle. Industrial development and the spread of the automobile have created a strong, growing economy. However, the consequences are emissions that cause global warming, which in turn is leading to climate change that is accelerating faster than scientists anticipated as recently as three years ago (see Figure ES-2). The Intergovernmental Panel on Climate Change (IPCC) has concluded that "most of the observed increase in globally averaged temperatures since the mid-twentieth century is very likely due to the observed increase in anthropogenic (man-made) greenhouse gas concentrations" (IPCC 2007d). Scientists predict that irreversible changes in temperature and weather will occur by mid-century if current energy use, fuels, and lifestyles do not change. There is an urgent need to address the causes of global warming, as the costs of inaction are greater than the costs of mitigation and adaptation (i.e., preparation).

In addition to increases in air temperature, the metropolitan Washington region is experiencing the effects of climate change with rising sea levels and a warmer Chesapeake Bay—more than 2°C (3.6°F) in the past seventy years (see Figure ES-3). With the warming, the bay's ecosystems, such as submerged aquatic vegetation and oyster beds, are adversely affected. Changes in the climate will have significant effects on the region's natural and built environments, all sectors of its economy, and its residents and families, communities, and workplaces.

Taking Stock: Regional Inventory

Developing a greenhouse gas inventory is an important first step in reducing the region's contribution to global carbon dioxide (CO_2) and other greenhouse gas levels. The inventory provides a basis for developing an action plan and setting goals and targets for future reductions, helps to identify the largest sources of greenhouse gases, enables tracking of trends over time, and documents the impacts of actions taken to reduce emissions.

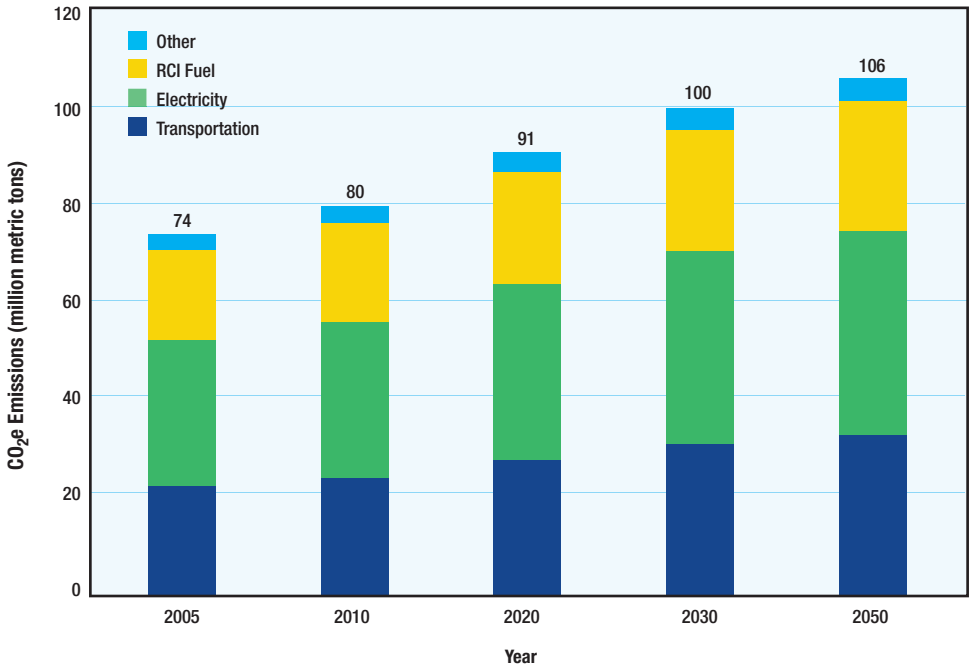
In the 2005 base year, greenhouse gas emissions in the metropolitan Washington region totaled 74 million metric tons (MMt). As shown in Figure ES-1, the inventory includes emissions from electricity generation; on-road motor vehicle transportation; residential/commercial/industrial and commercial aviation fuel use; and other sources, including hydrofluorocarbons used as refrigerants and solvents, and methane from wastewater treatment plants and landfills. In 2005, the, transportation and electricity use sectors contributed more than 70 percent of regional CO_2 emissions.

PROJECTED GROWTH

Based on current BAU projections of growth in population, housing, employment, and energy use, *total emissions from energy consumption (electricity and fuel use) in the region will increase by 35 percent by 2030 and 43 percent by 2050, and total emissions from transportation in the region will increase by 38 percent by 2030 and 47 percent by 2050* (see Figure ES-1). Energy consumption comprises 66 percent of the region's total greenhouse gas emissions inventory, and transportation comprises 30 percent.

Figure ES-1. Projected Growth in CO_2e Emissions for the Washington Metropolitan Area Under a BAU Scenario: 2005–2050

Based on current business-as-usual (BAU) projections of growth in population, housing, employment, and energy use, total emissions in the region will increase by 35 percent by 2030 and 43 percent by 2050.



Notes:

RCI fuel includes residential, commercial, and industrial natural gas, home heating oil, nonroad diesel, and aviation fuel.

Equivalent CO_2 (CO_2e) is the concentration of CO_2 that would cause the same level of radiative forcing as a given type and concentration of greenhouse gas, such as methane, perfluorocarbons, and nitrous oxide.

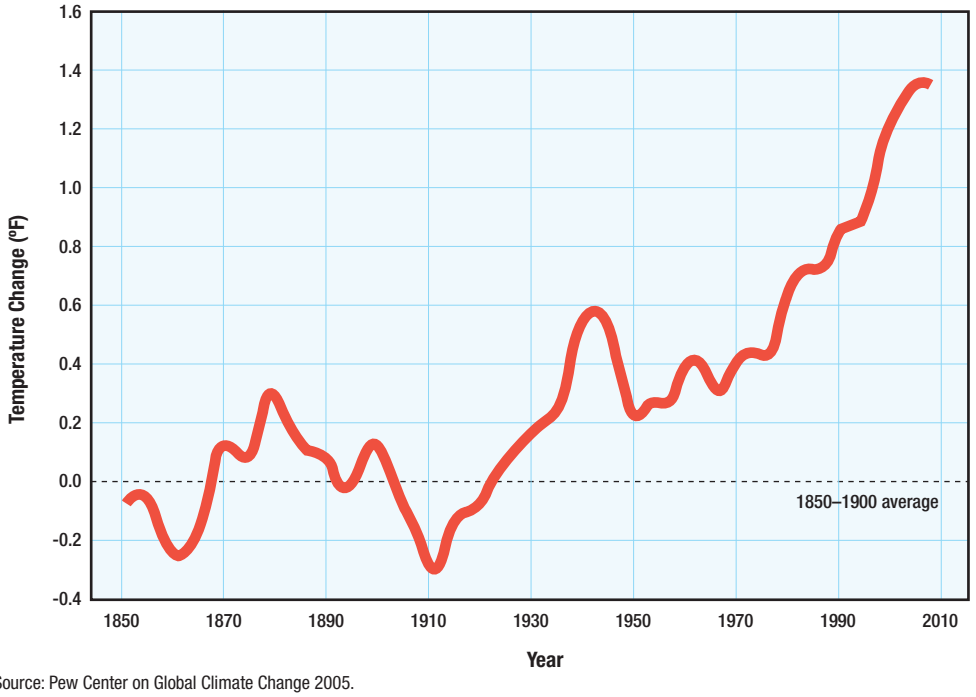
Other sources include methane from wastewater treatment and landfills, as well as high global-warming-potential gases used as refrigerants and solvents.

The inventory does not account for the 4.1 million metric tons of CO_2 emissions that are absorbed (or "sequestered") by the Washington metropolitan area's 1.3 million acres of undeveloped forests and grassland.

The business-as-usual projections do not account for new federal energy efficiency and corporate average fuel economy (CAFE) standards. The benefits of the new lower CAFE standards are 4.2 and 7.5 million tons of CO_2 in 2020 and 2030, respectively.

Figure ES-2. Observed Global Warming

Warming of the climate system is *unequivocal* (IPCC 2007d), as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level. In the past century, global average warming was 0.74°C (1.3°F).

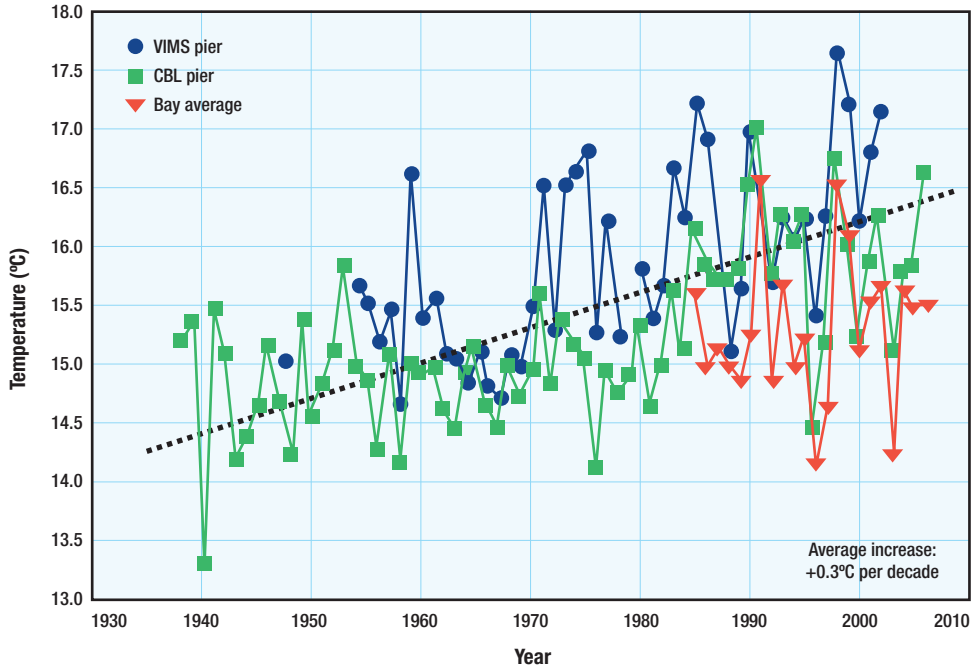


Source: Pew Center on Global Climate Change 2005.

Data: Crown © 2006.

Figure ES-3. Measured Temperature Changes in Chesapeake Bay Surface Waters: 1930–2005

Long-term temperature records indicate that Chesapeake Bay waters are warming.



Source: VIMS 2008.

The inventory projections do not account for federal energy legislation enacted in December 2007 that substantially strengthens fuel efficiency standards and energy efficiency standards for consumer products. The inventory also does not account for the 4.1 MMt of CO_2 emissions that are absorbed (or "sequestered") by the metropolitan area's 1.3 million acres of undeveloped forests and grassland. As development increases, these areas are expected to decline, reducing the region's overall capacity to absorb and temporarily store greenhouse gas emissions. Further research is needed to better project the anticipated loss of forests and grassland in the region.

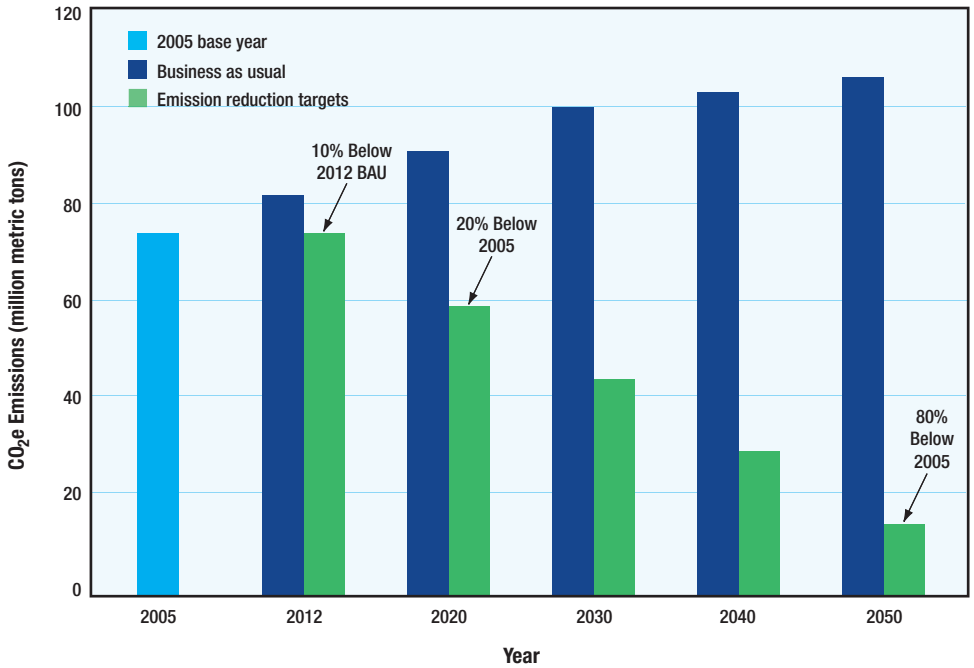
Taking Aim: Regional Targets

COG's Climate Change Steering Committee (CCSC) recommends establishing regional greenhouse gas reduction goals for three target years: 2012 to force early action, a medium-range goal (2020) to encourage expansion of recommended policies and programs, and a long-range goal (2050) to stimulate support for research into technologies and clean fuels needed to stabilize greenhouse gas emissions. CCSC recommends reassessing goals every three years to reflect updated science or significant changes to policy.

The recommended goals are based on scientific evidence from the IPCC (2007c) and are similar to comparable goals adopted by jurisdictions in the Washington region. These goals are to reduce greenhouse gas emissions by 10 percent below BAU levels by 2012, 20 percent below 2005 levels by 2020, and 80 percent below 2005 levels by 2050 (see Figure ES-4).

Figure ES-4. Recommended Regional Greenhouse Gas Emission Reduction Targets Compared to Regional Greenhouse Gas Emissions Under BAU: 2005–2050

As a compromise between IPCC recommended reduction levels and those adopted by COG member local governments, the Climate Change Steering Committee chose to set three targets for reducing greenhouse gas emissions: 10 percent below business as usual (BAU) levels by 2012, 20 percent below 2005 levels by 2020, and 80 percent below 2005 levels by 2050.



2012 TARGET: REDUCE BAU EMISSIONS BY 10 PERCENT

Between 2005 and 2012, regional energy consumption and greenhouse gas emissions are expected to grow by about 10 percent under a BAU scenario. The goal is to stop projected growth in regional greenhouse gas emissions by achieving a 10 percent reduction in regional emissions between 2008 and 2012, corresponding to returning regional emissions to 2005 levels.

2020 TARGET: REDUCE BAU EMISSIONS BY 20 PERCENT BELOW 2005 LEVELS

CCSC recommends an interim goal for 2020 to reduce emissions to 20 percent below 2005 levels. Some of the reduction will be achieved by a combination of federal and state policies, such as the Energy Efficiency Act of 2007, the new federal corporate average fuel economy (CAFE) requirements, and a regional cap-and-trade program for utilities, such as the northeastern states' Regional Greenhouse Gas Initiative (RGGI). To assess what would be involved in meeting the 2020 goal, CCSC prepared a preliminary analysis of current and potential future greenhouse gas reduction measures, with an estimated reduction benefit by 2020. That reduction works out to be 55–57 percent of the quantity of reductions needed to reach the 2020 goal. CCSC believes that a plan for achieving the full reduction can be developed in the next one to two years.

2050 TARGET: REDUCE BAU EMISSIONS BY 80 PERCENT BELOW 2005 LEVELS

An ambitious long-term goal of reducing emissions to 80 percent below 2005 levels by 2050 would present a challenge to the region and would place the region among national leaders calling for aggressive action to address climate change. Strategies to achieve the goal include energy efficiency and conservation, fuel switching and carbon capture and storage, renewable fuels and electricity/forest and soil storage, low-carbon vehicle technology, changes in development patterns in new and existing developments, and nuclear energy. All of these strategies require a coordinated effort involving actions on the part of individuals, businesses, federal and state policy and regulations, academic research and development, and new technologies.

COST OF MEETING THE TARGETS

McKinsey & Company and The Conference Board (2007) studied the costs of measures to reach a 2030 goal. The most cost-effective options are improving the energy efficiency of buildings (e.g., lighting and heating, ventilation, and air conditioning systems) and appliances, and increasing the fuel efficiency of vehicles. Such investment in energy-efficient technology can actually save consumers money. The most expensive options—but still less than $50 per metric ton of avoided emissions—involve shifting to less carbon-intensive energy sources, such as wind, solar, and nuclear power. The study concluded that the savings of these measures outweigh the costs, and the measures can significantly abate greenhouse gas emissions. A more intensive financial analysis of the specific measures identified in the report is recommended in the coming year.

COSTS OF INACTION

In addition to the costs associated with mitigating emissions of greenhouse gases, it is important to consider the potential costs associated with inaction. The United States has already begun to feel the effects of climate change through higher temperatures, flooding, and related health effects. These consequences will only worsen if action is not taken immediately. Climate change in the United States and specifically in the Mid-Atlantic region may continue to worsen. There could be significant costs for repairs,

maintenance, protection/preparedness, and health impacts. Effects could disproportionately harm the elderly, children, urban communities, and homeless and underprivileged populations.

Taking Action

MITIGATING EMISSIONS FROM ENERGY CONSUMPTION

The region has many advantages to help address the challenge of a changing climate. It has a diversified economy and good transit system, it serves as a hub for rail and air traffic, and local governments have a history of working together to develop strategic responses to changing conditions. The region also has a large network of environmentally focused nonprofit organizations, and a growing consortium of climate-focused universities and colleges. Efficient energy use provides significant regional benefits, such as enhanced quality of life and reduced energy expenses, greenhouse gases, and pollution. Rising to the challenge of transforming to a low-carbon economy will produce economic benefits for the region as well as help to minimize the adverse impacts of a changing climate.

CCSC recommends a number of measures to reduce regional CO_2 emissions, presented in Table ES-1 at the end of this executive summary. CCSC recommends reducing emissions from the energy sector, which contributes 66 percent of emissions in the region, by *improving energy efficiency, reducing demand for energy, and developing clean (alternative) energy sources.*

MITIGATING EMISSIONS FROM TRANSPORTATION AND LAND USE

CCSC recommends reducing GHG emissions from the transportation sector, which contributes 30 percent of emissions in the region, by *increasing fuel efficiency, reducing the carbon content of fuel, and reducing vehicle miles traveled (VMT).* Changes in land-use planning are recommended to reduce greenhouse gas emissions from future development. A list of recommendations for transportation and land use is presented in Table ES-1.

ANTICIPATING REGIONAL ECONOMIC DEVELOPMENT

Employment in the Washington region is projected to grow by 39 percent by 2030. What types of jobs will be created in the next 20–25 years? Are we adequately training our workforce to assume these positions? CCSC views environmental protection, greenhouse gas reduction, and green energy development as opportunities for creating new green jobs. The passage and expansion of renewable portfolio standards and increased purchases of renewable energy will play an important role in stimulating the green economy and creating new green jobs.

PREPARING FOR THE IMPACTS OF CLIMATE CHANGE

The full scope of the impacts of climate change on the Washington region is yet to be analyzed. Risks and costs are critical to any set of decisions that will require an investment of substantial resources. That said, it's not too early for the region to begin a systematic investigation of high-priority program areas and initiate early planning. The state of Maryland has been actively addressing adaptation priorities and opportunities, but so far has focused mainly on coastal areas, which are particularly vulnerable. Virginia has also begun to assess the potential damage climate change could have on its coastal areas, agriculture, and recreational resources.

Local governments and wastewater and drinking water utilities in the region are taking actions to adapt to the potential risks of climate change. In addition, CCSC recommends the region analyze changes and risks to the region's transportation infrastructure, buildings, and population living in low-lying areas. Regional adaptation policies need to be developed for regional emergency response planning.

ESTABLISHING FINANCING MECHANISMS

Local greenhouse gas reduction actions can help the region stabilize energy demand; diversify energy supply; lower utility bills; improve air quality; create more walkable community designs; and provide the region the chance to develop its impressive transit system, a "green collar" workforce, and a green building and technology base.

There are several ways area governments can cover the costs associated with climate change activities, such as paying for energy efficiency improvements through the use of both energy performance contracting and economies of scale through cooperative purchasing. Proceeds from federal Energy Efficiency Block Grants and proposed cap-and-trade legislation are also going to be essential for assisting the region with meeting its greenhouse gas reduction goals.

LAUNCHING A REGIONAL OUTREACH AND EDUCATION CAMPAIGN

Developing a regional public education campaign to promote individual and institutional efforts to reduce greenhouse gases in the region is essential. Changing the energy-consuming behavior of individuals, households, and businesses offers a potentially significant gold mine for greenhouse gas reductions. Efforts should be made to bridge the divide between research, technological innovation, and industry practice. Opportunities for education and outreach efforts include persuading individuals and institutions to improve energy efficiency in buildings and residences; purchasing energy-efficient cars, appliances, and heating and air conditioning units; driving less (use public transit, bike, walk); recycling more; and using less water. CCSC recommends developing partnerships with the private sector and other organizations, such as Local Governments for Sustainability (formerly the International Council for Local Environmental Initiatives [ICLEI]), Cool Counties, Cool Cities, and Climate Communities to achieve outreach goals.

LOCAL GOVERNMENT LEADING BY EXAMPLE

Local governments are already taking steps to reduce emissions from their operations, including efforts to reduce energy consumption and to purchase renewable energy and efficient automobiles. These governments are leading by example and are creating the framework, vision, and guidance to bring about changes in the community. Recommendations for local government leading by example are listed in Table ES-2.

ADVOCACY POSITIONS

CCSC recommends a number of advocacy positions for state and federal action to achieve maximum regional greenhouse gas reductions from improved energy efficiency, reduced energy consumption, use of low-carbon fuels, and improved vehicle efficiency. One of the roles of a new committee would be to provide ongoing recommendations on advocacy positions on climate and energy policy. Recommendations for potential advocacy positions are listed in Table ES-3.

Next Steps: COG Climate Change Initiative

CREATING AN ORGANIZATIONAL STRUCTURE FOR AN ONGOING COG CLIMATE CHANGE INITIATIVE

CCSC concludes that creating a permanent COG Climate Change Initiative is essential, given the long-term nature of this challenge. To provide oversight and direction for the initiative, a COG Board Climate and Energy Policy Committee should be established, with a broad membership from COG elected officials, state and federal agencies, and business and other key stakeholders.

SETTING PRIORITIES FOR ACHIEVING SHORT- AND LONG-TERM GOALS

The recommendations contained in this report fall broadly into several categories. Certain recommendations, such as the regional greenhouse gas emission reduction goals, are quantitative and time-specific. A significant number of the recommendations set the direction for regional policy, but require further analysis to support a definitive and quantifiable proposal—for example, setting a regional green power purchase goal, or a regional VMT reduction goal. Other recommendations reflect policy principles to guide the region and COG's members as the climate change program moves forward.

To help define the work program in the coming year and beyond, CCSC has developed the matrix in Table ES-1, which contains, classifies, and analyzes all of the recommendations included in this report. The matrix provides a sense of timing, with many of the initiatives listed as having an immediate time frame. The initiatives identified as immediate necessarily will be the focus in the next year. Partnership with regional stakeholders will be essential to carrying out most of the recommendations. In the next year, CCSC recommends that COG develop detailed plans both to achieve and to track progress toward achieving the reduction goals.

Table ES-1. Recommendations: Summary and Qualitative Assessment

Recommendations	Emission Impact	Implementation Timing	Cost	Economic Co-Benefits	Potential Partners
I. Regional Greenhouse Gas Reduction Goals					
1. 2012: Reduce 10 percent below BAU	Medium	Immediate	Low	Medium–High	COG members; fleet, energy, and building managers; general public; boards of trade; procurement officers; water and wastewater utilities, electric utilities, PUCs; state legislatures; federal government; private sector; others
2. 2020: Reduce 20 percent below 2005	High	Mid-range–Long-term	Low–Medium	Medium–High	COG members; fleet, energy, and building managers; general public; boards of trade; procurement officers; water and wastewater utilities, electric utilities, PUCs; state legislatures; federal government; private sector; others
3. 2050: Reduce 80 percent below 2005	High	Mid-range–Long-term	Medium–High	Medium–High	COG members; fleet, energy, and building managers; general public; boards of trade; procurement officers; water and wastewater utilities, electric utilities, PUCs; state legislatures; federal government; private sector; others
II. Energy					
Local/Regional Strategies for Government and Business					
A. Improve Energy Efficiency in Buildings					
1. Implement a COG Green Building Policy.	High	Immediate–Mid-range	Varies	Medium–High	COG members, IGBG, facilities managers, GSA, USGBC, private sector
2. Set energy performance goals for new and existing govt. buildings.	High	Immediate–Mid-range	Varies	Medium–High	COG members, IGBG, facilities managers
3. Identify best practices to reduce local govt. energy use by 15 percent by 2012.	Medium–High	Immediate–Mid-range	Low–Medium	High	COG members, COG Energy Advisory Committee, state energy offices, utilities, universities, businesses, general public, ACEEE
4. Develop incentives for retrofitting existing commercial and residential buildings.	High	Immediate–Mid-range	Varies	Medium–High	COG members, IGBG, facilities managers, GSA, USGBC
5. Develop affordable energy efficiency programs for homeowners and businesses.	Medium–High	Immediate–Mid-range	Low-Medium	High	COG members, utilities, state energy offices
6. Promote use of energy-efficient appliances.	Medium–High	Immediate-Mid-range	Medium–High	Low-Medium	COG, Clean Air Partners, Commuter Connections, Wise Water, COG Recycling Committee, IGBG
7. Revise state and/or local building codes to promote energy efficiency.	Medium–High	Immediate–Mid-range	Low–Medium	High	COG members, COG Energy Advisory Committee, state energy offices, utilities, universities, businesses, general public, ACEEE
8. Develop green affordable housing policies/programs.	Medium–High	Immediate–Mid-range	Varies	Medium–High	COG members, IGBG, facilities managers, housing directors, MDPC, planning directors, GSA, USGBC
9. Identify best practices for improving efficiency for public and private buildings.	High	Immediate–Mid-range	Varies	Medium–High	COG members, IGBG, facilities managers, GSA, USGBC
B. Reduce Demand for Energy					
1. Partner with electric, gas, and water utilities on regional energy conservation.	Medium–High	Immediate–Mid-range	Low–Medium	Medium–High	COG members, EPA ENERGY STAR®, USGBC, boards of trade, utilities
2. Expand recycling programs.	Low–Medium	Immediate–Mid-range	Varies	High	COG members, COG Recycling Committee

Table ES-1. Recommendations: Summary and Qualitative Assessment, *continued*

Recommendations	Emission Impact	Implementation Timing	Cost	Economic Co-Benefits	Potential Partners
B. Reduce Demand for Energy, continued					
3. Reduce energy use at area water and wastewater treatment plants and landfills.	Medium–High	Mid-range–Long-term	Medium–High	Medium–High	COG members, wastewater treatment facilities, landfills, EPA
4. Promote energy-efficient street lights across the region.	Low–Medium	Immediate	Medium–High	Medium	COG members, energy managers, utilities, boards of trade, private sector
5. Promote regional energy performance contracting and cooperative purchasing.	Low–Medium	Immediate–Mid-range	Medium–High	Medium	COG members, energy managers, state energy offices, utilities, private sector
6. Explore opportunities to remove the disincentive for utilities to invest in energy conservation.	Medium–High	Immediate–Mid-range	Low–Medium	High	State energy offices, state PUCs, utilities, state legislatures
C. Promote Clean Energy Sources					
1. Adopt a goal of 20 percent renewable energy purchase by local governments by 2015.	Medium–High	Immediate–Mid-range	Medium–High	Medium	COG members, COG Energy Advisory Committee, EPA Green Power Partnership, energy managers, utilities, procurement officers
2. Evaluate regional cooperative purchase to meet the 20 percent local government renewable energy purchase goal.	Low–Medium	Immediate–Mid-range	Medium–High	Medium	COG members, COG Energy Advisory Committee, EPA Green Power Partnership, energy managers, utilities, procurement officers
3. Examine options for removing barriers to implementing renewable energy (e.g., solar panels).	Low–Medium	Immediate–Mid-range	Medium–High	Medium	State legislatures, county leadership, state PUCs, utilities, COG Energy Advisory Committee, DOE
4. Explore the possibility of implementing a community energy planning process in the region.	Medium–High	Mid-range–Long-term	Medium	Medium–High	COG Energy Advisory Committee, utilities, energy managers
5. Develop a regional inventory of renewable energy capacity and production, including solar, geothermal, district heating/cooling, wind, and biofuels.	Low	Immediate–Mid-range	Low	Medium	COG Energy Advisory Committee, utilities, energy managers
D. Reduce Greenhouse Gas Emissions					
1. Identify and implement best practices to reduce methane and biosolids from wastewater treatment facilities.	Medium–High	Mid-range–Long-term	Medium–High	Medium–High	COG members, water and wastewater treatment facilities, landfills, EPA
2. Develop industry standard protocols to quantify greenhouse gas emissions and reductions for drinking water and wastewater utilities.	Medium–High	Mid-range–Long-term	Medium–High	Medium–High	COG members, water and wastewater treatment facilities, landfills, EPA, ICLEI, WRI
III. Transportation and Land Use					
Local and Regional Strategies for Government and Business					
A. Increase Fuel Efficiency and Use of Clean-Fuel Vehicles					
1. Promote clean-fuel vehicles (cars, trucks, buses).	High	Immediate–Mid-range	Medium–High	High	COG members, state legislatures, fleet managers, auto manufacturers, AFV partnerships
2. Adopt a regional green fleet policy.	Medium–High	Immediate–Mid-range	Medium–High	Medium–High	COG members, state legislatures, fleet managers, auto manufacturers, AFV partnerships
3. Promote the use of clean fuels.	Medium–	Immediate–Mid-range	Medium–High	Medium–High	COG members, state legislatures, fleet managers, auto manufacturers, AFV partnerships

Table ES-1. Recommendations: Summary and Qualitative Assessment, *continued*

Recommendations	Emission Impact	Implementation Timing	Cost	Economic Co-Benefits	Potential Partners
B. Reduce Vehicle Miles Traveled (VMT)					
1. Adopt VMT reduction goals.	Medium–High	Mid-range–Long-term	Medium–High	Low–Medium	COG members, TPB, DOTs, local govt., transit authorities
2. Expand transit use.	Low–Medium	Immediate–Mid-range	Low–Medium	Medium–High	COG members, Commuter Connections, TPB, DOTs, local govt., transit authorities
3. Invest/expand transit infra-structure.	Medium–High	Mid-range–Long-term	Medium–High	Medium–High	COG members, transit authorities, TPB, DOTs
4. Expand commuter options.	Low–Medium	Immediate–Mid-range	Medium–High	Low–Medium	COG members, local govt., Zipcar, Flexcar
5. Promote transit-oriented development.	Low–Medium	Immediate–Mid-range	Medium–High	Medium–High	COG members, TPB, DOTs, local govt., transit authorities
6. Examine parking policies to reduce VMT.	Low–Medium	Immediate–Mid-range	Medium–High	Low–Medium	COG members, state/local govt.
C. Increase Travel Efficiency					
1. Adopt best practices for traffic engineering improvements and road management to reduce VMT and congestion.	Low–Medium	Mid-range–Long-term	Varies	High	COG members, DOTs, TPB
2. Implement the Metropolitan Area Transportation Operations Coordination Program.	Low	Immediate	Medium	High	COG members, DOTs, TPB
3. Enforce existing idling regulations.	Low–Medium	Immediate	Low–Medium	Low–Medium	COG members, local govt., police
4. Explore opportunities to reduce emissions from the aviation sector.	Medium	Immediate–Mid-range	Medium–High	Medium–High	Airlines, MWAA, fleet managers
5. Explore opportunities to reduce emissions from the freight sector.	Medium	Immediate–Mid-range	Medium–High	Medium–High	Railroads, American Trucking Association, shippers, TPB, DOT
D. Improve Land Use					
1. Develop plan to meet goal of increased tree canopy.	Low–Medium	Mid-range–Long-term	Low–Medium	High	COG members, state and local forestry agencies, U.S. Forest Service, Casey Trees, Center for Chesapeake Communities
2. Evaluate LEED-ND standards for new development.	Medium–High	Immediate–Mid-range	Medium	Varies	COG members, planning directors, MDPC, TPB, boards of trade, DOTs, WMATA
3. Carefully plan the location and design of new, infill, and redevelopment projects.	Low–Medium	Midrange–Long-term	Medium–High	Varies	COG members, MDPC, planning directors, local planning agencies, local developers
4. Integrate GHG analyses into comprehensive planning and new capital projects.	Low–Medium	Immediate–Mid-range	Low–Medium	Medium–High	COG members, MDPC, planning directors, local planning agencies, local developers
E. Develop a Regional Metropolitan Planning Process					
1. Develop a regional metropolitan planning process for addressing greenhouse gases.	Medium–High	Mid-range–Long-term	Medium–High	Medium–High	TPB, MWAQC, DOT, EPA, state air agencies, state legislatures, Congress
2. Make greenhouse gas reduction a stated goal of regional trans-portation planning activities.	Medium–High	Mid-range– Long-term	Medium–High	Medium–High	TPB, DOTs, boards of trade, NVTC, WMATA
3. Consult with other regions around the country to broadly evaluate options for regional approaches to greenhouse gas reductions.	Medium–High	Mid-range– Long-term	Medium–High	Medium–High	TPB, DOTs

Table ES-1. Recommendations: Summary and Qualitative Assessment, *continued*

Recommendations	Emission Impact	Implementation Timing	Cost	Economic Co-Benefits	Potential Partners
IV. Economic Development					
Local and Regional Strategies for Government and Business					
1. Promote green businesses and green jobs.	Low	Immediate–Mid-range	Medium–High	Medium–High	COG members, boards of trade, universities, Sustainable Business Alliance
2. Promote eco-business zones.	Low	Immediate–Mid-range	Medium–High	Medium–High	COG members, boards of trade, universities
3. Promote cooperative green purchasing.	Low–Medium	Immediate–Mid-range	Low–Medium	Medium–High	COG members, procurement officers, boards of trade
4. Promote local vendors and suppliers.	Low–Medium	Immediate–Mid-range	Low–Medium	Medium–High	COG members, state/local govt., farmers' cooperatives, economic development authorities, COG Regional Agricultural Workgroup, community-supported agriculture, Freshfarm Markets
5. Promote regional green jobs analysis.	Low	Immediate	Low–Medium	Medium–High	COG members, boards of trade, universities, Sustainable Business Alliance
V. Adaptation					
Local and Regional Strategies for Government and Business					
1. Research best practices to prepare for effects of climate change.	Low	Immediate–Mid-range	Medium	Medium	COG members, universities, NOAA
2. Develop a regional climate adaptation plan to assist localities with vulnerability assessments, adaptation planning, and emergency preparedness.	Low	Mid-range–Long-term	Medium	Medium	COG members, utilities, state and federal govt., NOAA, private sector, universities
3. Partner with universities to research climate change and adaptation strategies.	Low	Immediate–Mid-range	Medium	Medium	COG members, universities, NOAA
4. Analyze impacts on and risks to the region's transportation infrastructure, buildings, and populations in low-lying areas.	Low	Immediate–Mid-range	Medium	Medium	COG members, universities, NOAA
5. Develop regional adaptation policies.	Low	Mid-range–Long-term	Medium	Medium	COG members, utilities, private sector, state and federal govt.
6. Conduct adaptation workshops.	Low–Medium	Mid-range–Long-term	Medium	Medium	COG members, universities, NOAA
VI. Financing Mechanisms					
Local and Regional Strategies for Government and Business					
1. Evaluate financing mechanisms for energy efficiency projects (energy fee, tax, other).	Medium–High	Immediate–Mid-range	Low–Medium	High	COG members, Chicago Climate Exchange, MD Strategic Energy Fund, block grants, Energy Efficiency Partnership of Greater Washington
2. Establish a clean energy fund.	Medium–High	Immediate–Mid-range	Low–Medium	High	COG members, Chicago Climate Exchange, MD Strategic Energy Fund, block grants, Energy Efficiency Partnership of Greater Washington
3. Participate in cap-and-trade program revenues.	Medium–High	Immediate–Mid-range	Low–Medium	High	COG members, Chicago Climate Exchange, MD Strategic Energy Fund, block grants, Energy Efficiency Partnership of Greater Washington
4. Develop a regional carbon offset fund for preserving tree canopy.	Medium	Immediate–Mid-range	Medium	Medium	COG members, state and local forestry agencies, U.S. Forest Service, Casey Trees, Center for Chesapeake Communities

Table ES-1. Recommendations: Summary and Qualitative Assessment, *continued*

Recommendations	Emission Impact	Implementation Timing	Cost	Economic Co-Benefits	Potential Partners
VI. Financing Mechanisms, Local and Regional Strategies for Government and Business, *continued*					
5. Secure additional financing for public transit.	Medium–High	Immediate–Mid-range	High	High	COG members, state and federal govt., WMATA
6. Establish funding for building retrofits.	Medium–High	Immediate–Mid-range	High	High	COG members, state and federal govt., ESCOs
VII. Regional Outreach and Education					
Local and Regional Strategies for Government and Business					
1. Implement a regional public education campaign.	Medium–High	Immediate–Mid-range	Medium–High	Low-Medium	COG members, Clean Air Partners, Commuter Connections, Wise Water, Recycling Committee, IGBG
2. Develop partnerships with private-sector and other organizations.	Medium–High	Immediate–Mid-range	Medium–High	Low-Medium	COG members, boards of trade, federal government, WMATA, MWAA, Cool Capitol Challenge
3. Support COG member outreach efforts.	Low–Medium	Immediate–Mid-range	Low–Medium	Low-Medium	COG members, Cool Capitol Challenge, EPA, ICLEI, Sierra Club
VIII. COG Climate Change Program					
Local and Regional Strategies for Government and Business					
1. Establish a COG Climate and Energy Policy Committee.	—	Immediate	Low–Medium	—	COG members, state/local govt.
2. Develop work program priorities, schedule, staffing plan, and budget.	—	Immediate	Low–Medium	—	COG members, state/local govt.
3. Prepare regional plans to achieve the 2012 and 2020 goals.	—	Immediate	Low–Medium	—	COG members, state/local govt.
4. Evaluate the cost-effectiveness of the proposed measures.	—	Immediate	Low–Medium	—	COG members, state/local govt.
5. Design an outreach and education program.	—	Immediate	Low–Medium	—	COG members, state/local govt.
6. Track state and federal initiatives, and develop and advance regional advocacy positions.	—	Immediate	Low–Medium	—	COG members, state/local govt.
7. Develop a system for tracking progress toward GHG goals and periodically review targets.	—	Immediate–Mid-range	Low–Medium	—	COG members, state/local govt., EPA, ICLEI, WRI, state air agencies, state energy offices, state PUCs, utilities
8. Develop a regional standardized analytical methodology for use by individual local governments in developing their greenhouse gas emission inventories.	—	Immediate–Mid-range	Low–Medium	—	COG members, state/local govt., EPA, ICLEI, WRI, state air agencies, state energy offices
9. Prepare an annual progress report to the COG Board of Directors on implementation progress for COG's Climate Change Initiative.	—	Immediate–Mid-range	Low–Medium	—	COG members, state/local govt.

Abbreviations: ACEEE = American Council for an Energy Efficient Economy; AFV = alternative-fuel vehicle; COG = Metropolitan Washington Council of Governments; DOE = U.S. Department of Energy; DOTs = state departments of transportation; ESCO = energy service company; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; govt. = government; GSA = General Services Administration; ICLEI = Local Governments for Sustainability; IGBG = Intergovernmental Green Building Group; LEED-ND = Leadership in Energy and Environmental Design for Neighborhood Development; MD = Maryland; MDPC = Metropolitan Development Policy Committee; MWAA = Metropolitan Washington Airports Authority; MWAQC = Metropolitan Washington Air Quality Committee; NOAA = National Oceanic and Atmospheric Administration; NVTC = Northern Virginia Transportation Commission; PUC = public utility commission; TPB = National Capital Region Transportation Planning Board; USGBC = United States Green Building Council; WMATA = Washington Metropolitan Area Transit Authority; WRI = World Resources Institute.

Timing: Immediate = present to June 2009; Mid-range = 3 years; Long Term = more than 3 years.

Emission Impact: Low = minimal emission reduction expected; Medium = some emission reduction anticipated; High = significant emission reduction anticipated.

Cost: Low = relatively low cost; Medium = moderate financial costs; High = expensive option to implement.

Economic Co-Benefits: Low = action will have limited impact on other areas of the economy; Medium = some economic synergies are anticipated; High = significant enhancements to the economy or sector are possible.

Table ES-2. Recommendations for Local Governments to Lead by Example

Local governments are taking steps to reduce emissions from their operations and are creating the framework, vision, and guidance to bring about changes in the community.

Energy
Increase Energy Efficiency
Implement the 2007 Metropolitan Washington Council of Governments (COG) Regional Green Building Policy: All new government buildings meet the Leadership in Energy and Environmental Design (LEED) Silver standard, ENERGY STAR®, or equivalent.
Identify best practices to support reducing overall local government energy use by 15% by 2012.
Examine options and develop plans for replacing street lights with energy-efficient lighting (LED [light-emitting diode] or other options) across the region.
Promote regional energy performance contracting to reduce energy use in public buildings.
Consider a regional cooperative purchase approach to facilitate cost-effective implementation.
Develop a long-term goal for carbon neutrality for all government buildings.
Enhance and expand existing recycling programs.
Encourage provision of energy audits and energy retrofits for individuals and businesses through a regional cooperative effort.
In collaboration with local governments and area wastewater utilities, identify best practices and evaluate the potential for reducing greenhouse gas emissions through methane recapture and use of biosolids as a fuel as means for reducing energy requirements for operations at area wastewater treatment plants and landfills.
Reduce Energy Consumption/Demand Management
Partner with electric, gas, and water utilities on regional energy conservation and energy efficiency program outreach.
Partner with the Greater Washington Board of Trade Green Committee and Potomac Conference to assist businesses with taking action to reduce greenhouse gas emissions and implement best practices.
Expand Use of Clean Energy Sources
Establish a 2015 regional goal of having renewable energy comprise 20% of the energy purchased by local governments.
Evaluate regional cooperative purchase and/or reverse auctions to facilitate green power implementation among COG membership.
Work with jurisdictions exporting electricity into the metropolitan Washington region to encourage investments in clean low-emitting energy sources.
Transportation and Land Use
Increase Fuel Efficiency
Establish a regional green fleet policy with measurable goals and timetables.
Promote transit-supportive street designs.
Increase enforcement of existing idling regulations to prevent extended vehicle idling.
Promote Low-Carbon "Clean" Fuels
Promote adoption of CA LEV-II (California Low-Emission Vehicle Phase II) standards for all jurisdictions in the region.
Promote/accelerate adoption of efficient clean-fuel vehicles, including hybrids (cars, trucks, buses).
Evaluate the benefits of specific "green fleet" conversion percentages. Provide incentives for purchase of clean-fuel vehicles.
Assess benefits from a "Cash-for-Clunkers" program and rebates or tax incentives for the purchase of hybrid vehicles.
Reduce Vehicle Miles Traveled (VMT)
Expand existing and fund new programs to enhance access to transit and alternative modes, Commuter Connections, guaranteed ride home, telework programs, bike/pedestrian access, park-and-ride lots.
Evaluate the greenhouse gas reduction benefits of expanding existing and establishing new exclusive bus transit routes, lanes, on-ramps, and corridors.
Promote equalization of transit and parking benefits.
Promote car sharing.
Examine parking policies and their relationship to VMT. Implement new parking policies to reduce VMT.
Fully fund construction of bicycle/pedestrian paths in the region, as outlined in the regional bicycle/pedestrian plan. Provide incentives to developments that speed improvements to bicycle/pedestrian access, including improvements to sidewalks, curb ramps, crosswalks, lighting, etc.
Design a regional program to promote bike sharing.
Land-Use Planning
Establish a goal and develop a program and plan to increase the region's tree canopy.
Research and develop specific regional goals (up to 95%) to significantly increase the percentage of new development located in regional activity centers.
Promote regional policies that support walkable communities and affordable housing near transit.
Identify best practices for local governments to include greenhouse gas reduction and energy as an element in their local comprehensive planning. Such efforts should include practices that address climate change risk reduction to guide local zoning, building codes, site planning, and review.

Table ES-3. Advocacy Positions

CCSC recommends a number of advocacy positions for state and federal action to achieve maximum regional greenhouse gas reductions from improved energy efficiency, reduced energy consumption, use of low-carbon fuels, and improved vehicle efficiency.

Energy
A. Improve Energy Efficiency
1. Adopt energy performance goals for state and federal government buildings.
2. Develop state and federal financial incentives for renewable energy.
3. Support state and federal climate change legislation, including a cap-and-trade system, that would provide funds for local government energy efficiency programs.
4. Organize a consortium of local governments to apply for Energy Efficiency Block Grant funds as they become available.
B. Reduce Demand for Energy
1. Implement policies to remove the disincentive for utilities to invest in energy efficiency, demand management, and renewable energy.
2. Advocate for adoption of Cool Schools or the equivalent by local school boards or local governments.
3. Support the establishment of and funding for programs designed to supply locally produced food to schools (e.g., statewide farms-to-schools program).
4. Identify best practices for improving energy efficiency for public buildings.
C. Promote Clean Energy Sources
1. Adopt a 20 percent renewable portfolio standard in the District of Columbia and Virginia by 2020.
2. Urge state public utility commissions to prioritize energy efficiency, demand reduction, and renewable energy sources.
3. Urge state and federal governments to establish new policies to remove the disincentive for utilities to invest in energy efficiency, demand management, and renewable energy.
4. Create federal and state financial incentives for energy efficiency and renewable energy, including federal tax subsidies for renewable energy production.
5. Urge federal support for technology development, including solar energy, battery technologies, and clean vehicles.
6. Expand the Regional Greenhouse Gas Initiative to the District of Columbia and Virginia.
7. Work with jurisdictions exporting electricity into the metropolitan Washington region to encourage investments in clean, low-greenhouse-gas-emitting energy sources.
8. Promote equitable subsidies for different sources of energy (e.g., nuclear versus renewable).
Transportation and Land Use
A. Increase Fuel Efficiency and Use of Clean-Fuel Vehicles
1. Promote the California Low-Emission Vehicle Phase II (CA LEV-II) program.
2. Extend corporate average fuel economy requirements past 2020 and include heavy-duty trucks.
3. Support incentives for fuel-efficient and alternative-fuel vehicles.
4. Support incentives for early vehicle retirement.
B. Reduce Vehicle Miles Traveled (VMT)
1. Urge lawmakers to increase investment in transit.
2. Evaluate financial incentives, such as pay-as-you-travel insurance, and road management to reduce VMT and congestion.
3. Advocate for federal income tax benefits for transit use that equal or exceed the benefits of employer-provided or -subsidized parking.

Getting Smart on Climate Change

Chapter 1

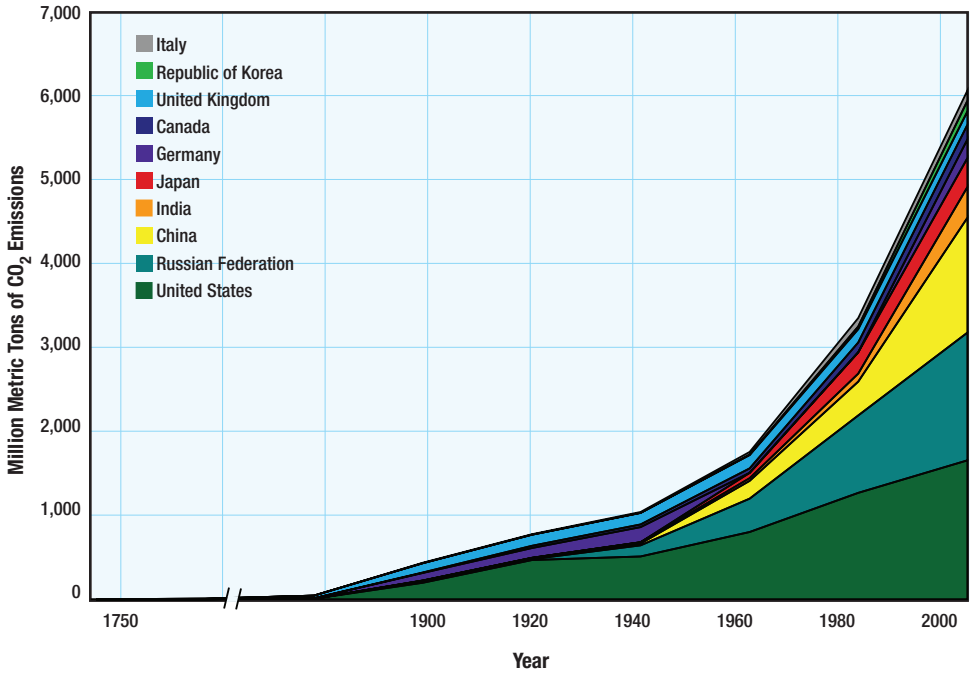
Facing the Facts: Our Climate Is Changing

An overwhelming body of scientific evidence indicates that climate is indeed changing and has changed rapidly, starting at the beginning of the 20th century (Glick et al. 2008, NSCT 2008, USCCSP 2008). According to the scientific consensus of the Intergovernmental Panel on Climate Change (IPCC), the National Academy of Sciences, and other scientific organizations, starting in the mid-20th century, the greenhouse effect and associated global warming have been accelerated by the dramatic increase in man-made greenhouse gases. Figure 1 shows the dramatic rise in global carbon dioxide (CO_2) emissions since 1750, including the relative contributions of the top ten producers of CO_2 in 2004.

The greenhouse effect is a natural warming process. CO_2 and other gases—primarily methane and nitrous oxide—are always present in the atmosphere. They create an effect similar to the warming inside a greenhouse, where energy from the sun passes through the greenhouse gases, is reflected back by the Earth's surface, and then is trapped by the various gases. Natural factors that affect the balance between the sun's energy warming the Earth and loss of energy into the atmosphere include clouds, water vapor, and

Figure 1. Historical CO_2 Emissions: 1750–2004

Historical emissions of CO_2 have grown exponentially over the last several decades. This figure shows the top 10 emitters of CO_2 emissions, with the United States, the Russian Federation, and China comprising the largest shares.



Source: Gregg Marland, Tom Boden, and Bob Andres. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory. Available at: http://cdiac.ornl.gov/trends/emis/tre_coun.html.
Note: The pre-1850 data are scarce. Data after 1850 are incomplete for some countries, but this has a negligible effect.

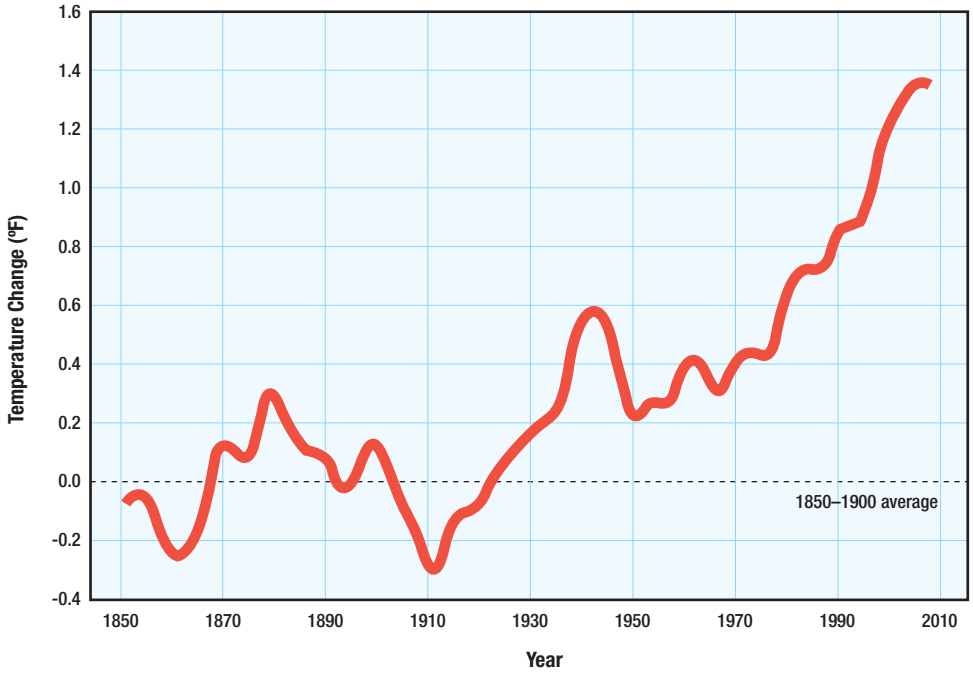
greenhouse gases. A number of different gases can contribute to global warming, and each has been assigned a global warming potential (GWP) to reflect the relative radiative forcing (see the Terms and Definitions section at the end of this report).

While there is natural variability in temperature cycles, the IPCC has concluded that *warming of the global climate is unequivocal* (IPCC 2007d). Over the last century, the accumulation of greenhouse gases in the atmosphere is estimated to have raised average global temperatures by more than 0.74°C (or 1.3°F) (Figure 2). Before industrialization, the amount of CO_2 released to the atmosphere by natural causes was in balance with the amount absorbed by plants, oceans, and other "sinks."

Scientists are observing and tracking the evidence of global warming. More rapid warming in higher latitudes in the Northern Hemisphere could have potentially devastating implications for coastal areas of the United States and around the world, due to sea level rise associated with melting polar sea and land ice (USCCSP 2008, Glick et al. 2008, Fahrenthold 2008). Over the second half of the 20th century, the global mean sea surface height increased at a rate of about 1.8 millimeters (mm) (0.7 inches) per year, and there is evidence that this rate is increasing (Figure 3). In addition to faster melting of polar ice caps, effects include changes in terrestrial ecology leading to the extermination of animal and plant species, extreme heat waves and drought, increased severity of hurricanes and other storms, and increased precipitation, ocean acidification, and flooding. Scientists warn that an additional 2°C (3.6°F) rise in average global temperature will result in dramatic and irreversible changes to the environment (IPCC 2007d).

Figure 2. Observed Global Warming

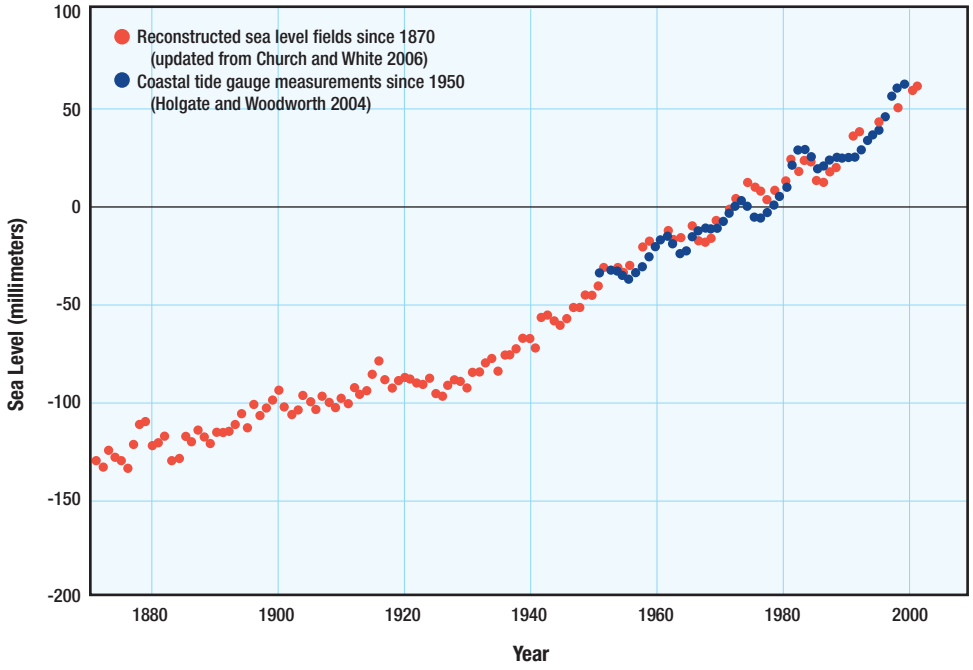
Warming of the climate system is *unequivocal* (IPCC 2007d), as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level. In the past century, global average warming was 0.74°C (1.3°F).



Source: Pew Center on Global Climate Change 2005.
Data: Crown © 2006.

Figure 3. Observed Global Sea Level Rise: 1870-2000

Over the second half of the 20th century, the global mean sea surface height increased at an annual rate of about 1.8 millimeters. There is evidence that this rate is increasing



Source: IPCC 2007d.
Note: The red and blue curves are deviations from their averages for 1961 to 1990.

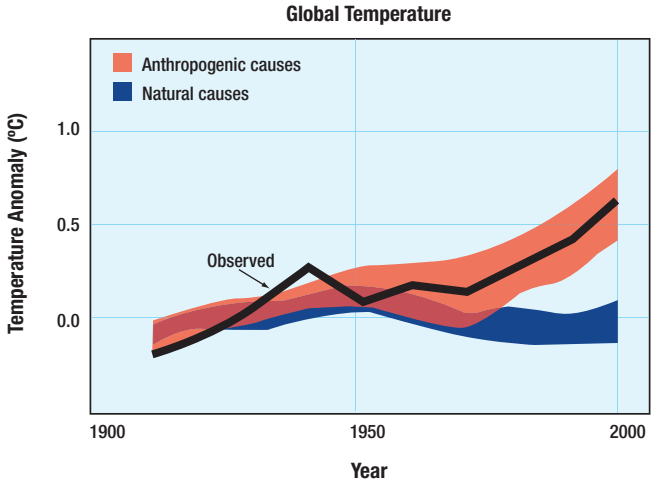
Much of this change in climate is attributable to human activities. The IPCC has concluded that "most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic (man-made) greenhouse gas concentrations" (IPCC 2007d). Figure 4 shows summaries of the analyses provided by the IPCC, illustrating the relationship between man-made emissions and climate change.

CO_2 from the combustion of fossil fuels from power plants and vehicles, loss of carbon "sinks" due to deforestation, and methane emissions from landfills are the major human activities contributing to climate change. Mitigating, or controlling, greenhouse gas emissions to reduce the risks of global warming to the economy and environment will require action at the international, national, state, and local levels, such as developing and applying alternative energy sources and technologies. In some circumstances, preparing for and adapting to the consequences of climate change will be necessary.

The greenhouse gas emission reduction goals in proposed federal legislation and adopted by many states and localities are based on what scientists say is needed to keep the global temperature increase to within 2.5–3°C (4.5–5.4°F) by 2050. Under different international growth scenarios, greenhouse gas emissions will grow to 50–75 gigatons of carbon dioxide-equivalents per year ($GtCO_2e/yr$) globally by 2030, an approximate 25–90 percent increase from 2000 levels. According to the IPCC's Fourth Assessment Report, *to stabilize greenhouse gas concentrations, carbon emissions will have to be reduced by at least 50 percent and as much as 85 percent by 2050 below 1990 levels* (IPCC 2007d).

Figure 4. Relationship Between Human Activities and Global Warming

Temperature predictions by climate change models match well with observations during 1920–2000. These models predict that global temperature does not change much due to natural causes. However, when anthropogenic (man-made) factors are added, the models correctly predict global temperature rise since the 1960s.



Source: IPCC 2007d.

Chapter 2

Recognizing the Risks: Potential Impacts of Climate Change on the Metropolitan Washington Region

Substantial effort has been devoted to assessing the potential impacts of climate change in the United States and Mid-Atlantic region (Glick et al. 2008, NSCT 2008, USCCSP 2008, Eilperin 2008a and 2008b, Fahrenthold 2008, MDE 2008b). The real challenge is assessing the risks of these impacts occurring and to what degree (MARA 2001, Fisher et al. 1999).

The basic drivers of any impacts are changes in CO_2, sea level, temperature, precipitation, and runoff. Accordingly, any risk assessment begins with projections of future conditions associated with each of these. Table 1 presents the projected range of change from various studies for five key parameters that may adversely affect the region's future, along with the levels of confidence in the projections—critical to any credible risk assessment. In addition, consideration must also be given to changes in CO_2, sea level, temperature, precipitation, and runoff that have already been documented over the last century.

There is a very high degree of confidence in the likelihood of substantial increases in global CO_2 concentrations in the coming decades. In the Mid-Atlantic region, this is expected to result in rising sea levels, higher air and water temperatures, and changes in precipitation patterns. It is also possible that storm intensity and associated wind damage will increase, including an increase in the frequency of tornadoes. Because these changes also are interconnected, they generally have synergistic impacts on water and environmental quality. The Mid-Atlantic Regional Assessment estimates are consistent with more recent estimates of the Chesapeake Bay Program Scientific and Technical Advisory Committee (STAC) in 2008.

HIGHER SEA LEVELS: Increased Flooding and Shoreline Loss, Degraded Water Quality

The shorelines of Chesapeake Bay and its tributaries, such as the Potomac River, are among the region's most threatened resources, subject to the combined impacts of climate and land-use change. Wetlands, such as coastal marshes, and shoreline

Table 1. Key Mid-Atlantic Projections for 2030 and 2095 Above 1990 Baseline Levels

There is a very high degree of confidence in the likelihood of substantial increases in global CO_2 concentrations in the coming decades. In the Mid-Atlantic region, this is expected to result in rising sea levels, higher air and water temperatures, and changes in precipitation patterns.

Parameter	2030	2095	Confidence in Projection
CO_2 change (%)	+20 to +30	+50 to +120	Very High
Sea level change (inches)	+4 to +12	+15 to +40	High
Temperature change (ºF)	+1.8 to +2.7	+4.9 to +9.5	High
Precipitation change (%)	–1 to +8	+6 to +24	Medium
Runoff change (%)	–2 to +6	–4 to +27	Low

Source: MARA 2001.

ecosystems provide important ecological functions, serving as nurseries and critical habitat, sources of dissolved organic carbon, modifiers of local water quality, protectors against storm surges and flooding, and stabilizers of global levels of available nitrogen, atmospheric sulfur, CO_2, and methane. The loss or submerging of wetlands would eliminate these important ecological functions, further degrading water quality and harming the bay's living resources and tributaries. Higher sea levels would also harm submerged aquatic vegetation, which is critical to the Chesapeake's shoreline ecosystems (Pyke et al. 2008).

The confidence level for sea level rise is high, with the 2095 projection ranging from a low of 38 centimeters (cm) (15 inches) to a high of 102 cm (40 inches). The 2008 STAC report projects a "Chesapeake Bay local" sea level increase of approximately 70–160 cm (27.5–62.9 inches) by 2100, including natural subsidence. As seen in Figure 5, low-lying areas in Washington, D.C., along the shores of the Potomac are at risk of flooding due to sea level rising. Even a rise of only a few feet would exacerbate the effects of storm-induced tides or floods and increase the potential damage in the core of the region along the rivers.

The impacts of rising sea levels on Chesapeake Bay and its tributary rivers include: (1) heightened risk of and vulnerability to inundation of wetlands and other low-lying lands by storm surges and coastal flooding; (2) saltwater contamination of fresh water used for drinking water and irrigation for some smaller communities utilizing water from the Potomac estuary; and (3) degraded water quality in the bay and its tributaries, potentially increasing the risk of harmful algal blooms that thrive from runoff, and harming fish and crab populations (Glick et al. 2008). The Chesapeake Bay crab population is an important part of the local culture and economy. These ecosystems exist in a naturally changing environment, but the current and forecast rates of change are likely to overwhelm their inherent resilience.

HIGHER AIR TEMPERATURES: Increased Pollution and Health Risks, Changing Plant and Animal Species, More Frequent Forest Fires

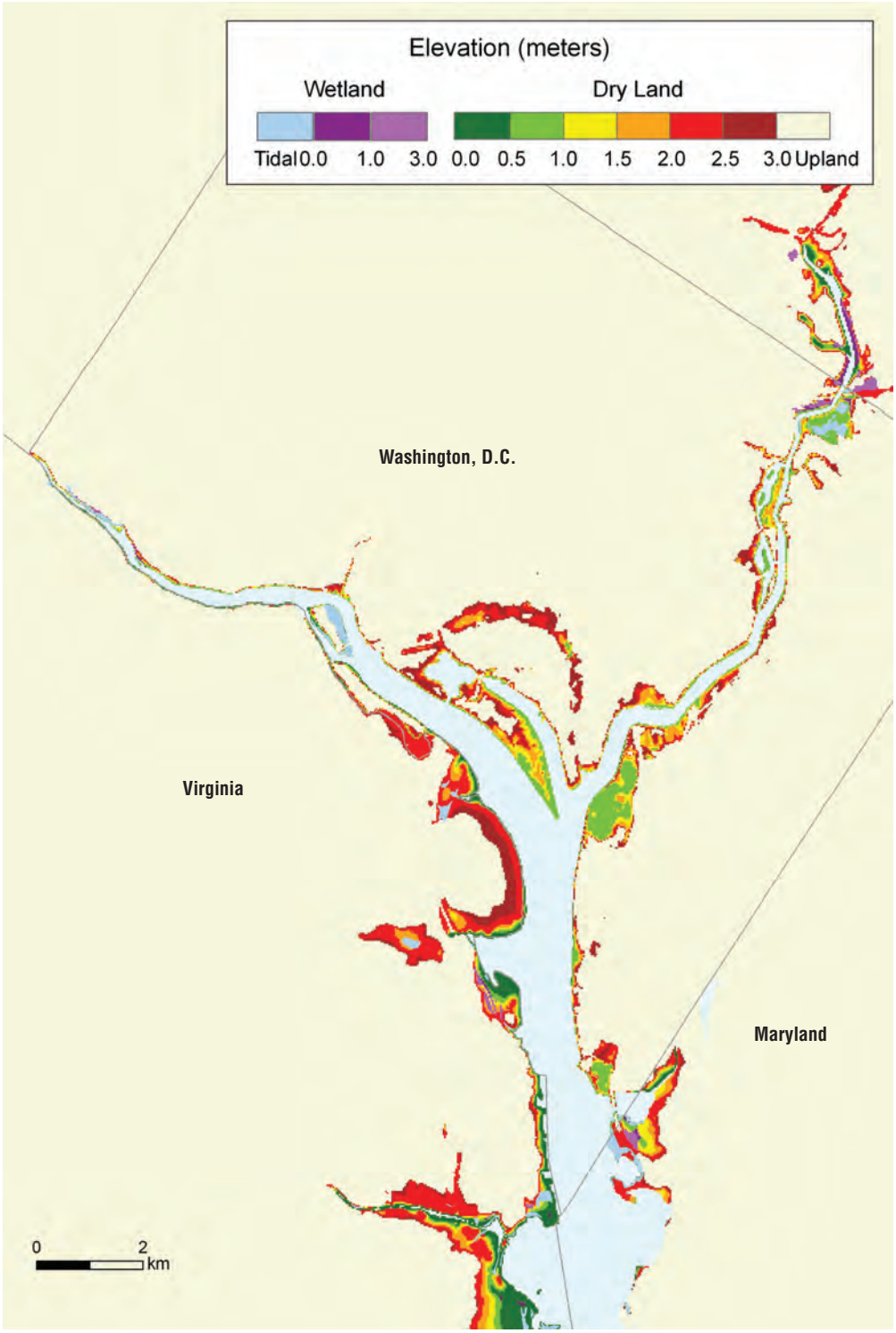
Temperature in the Washington region increased at a much faster rate in the last fifty years compared to the last hundred years. A comparison of trends in the average annual temperature during these two periods reveals that the rate of annual temperature increase of 0.027°F (0.015°C) in the last fifty years (1955–2005) is three times the annual rate of increase of 0.009°F (0.005°C) during 1893–2005 (Figure 6). Five of the last ten years have ranked as the top ten warmest in the United States, since record keeping began in the late 19th century.

A warmer climate could result in increased cases of vector-borne diseases, such as West Nile virus, and stronger, more frequent heat waves. Also, locally, there is a correlation between heat waves and the occurrence of high ozone days. Generally, the hotter the temperature, the more favorable the conditions are for ozone-producing chemical reactions in the air, which can lead to an increase in asthma cases and exacerbation of chronic respiratory diseases.

According to the Northeast Climate Impacts Assessment Synthesis Team, agriculture may experience a longer growing season, increased levels of CO_2 concentration, and increased variability in rainfall patterns. Agricultural production may increase because of the longer season and the "fertilizer effect" from increased CO_2 levels. There will likely

Figure 5. Areas Vulnerable to Sea Level Rise: Washington, D.C., Metropolitan Region

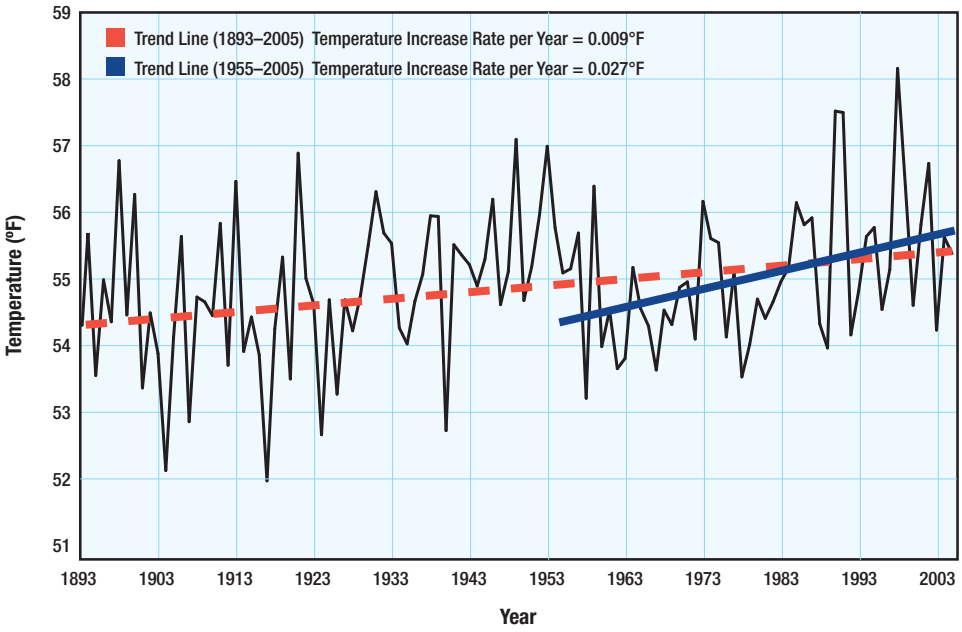
Coastal areas in the Washington, D.C., metropolitan region are at high risk of being inundated by sea level rise. Assuming a rise of 60–70 centimeters in sea level by 2100, a significant portion of both coastal tidal and dry land locations (shown in dark and light green, and dark purple) will be lost to the sea.



Sources: Map: Titus and Wang 2008; 60–70 cm. sea level rise assumption: STAC 2003.

Figure 6. Average Annual Temperature in the Washington Metropolitan Region: 1893–2005

Temperature in the Washington region increased at a much faster rate in the last fifty years compared to the last hundred years.



Source: Williams et al. 2007.

Note: The Washington region data are based on the average annual temperatures of the following stations: College Park, Laurel, Glendale, Fredericksburg, and Owings Ferry Landing. Original observed data at these stations were corrected for time of observation differences, instrument changes, instrument moves, station relocations, and urbanization effects that these stations experienced since they first started.

be a shift in varieties; however, plants that depend on a prolonged period of winter chill, such as apples and grapes, may be adversely affected. Longer drought periods will require more irrigation.

As temperatures rise, plants and animals currently in the southeastern United States may migrate north to the Mid-Atlantic. Today, more than half of the Mid-Atlantic region is covered by a maple-beech-birch deciduous forest. Over time, the southern pine and mixed oak-pine forests in the Southeast may become more dominant as they migrate north. Overall forest productivity may increase, but a shift in dominant forest types may detrimentally foster invasive species and reduce biodiversity. More frequent and more severe forest fires are expected, threatening ecosystems and human settlements.

Researchers at the University of Maryland Center for Environmental Science have projected temperature increases in Maryland based on models used by the IPCC. Currently, there are around 30 days above 90°F (32.2°C) and 3 days above 100°F (37.7°C) on average. Depending on future CO_2 emissions, there could be as many as 100 days above 90°F (32.2°C) and 30 days above 100°F (37.7°C) (see Figure 7). The temperature increases in urban areas would be even higher due to the urban heat-island effect. These increases could have significant economic impacts as well as devastating impacts on public health and the environment, leading to increases in ozone concentrations and resultant respiratory and health problems, as well as more severe droughts and increased electricity demand for air conditioning.

HIGHER WATER TEMPERATURES: Decrease in Some Living Resources, Increase in Harmful Algal Blooms, Degraded Water Quality

Long-term temperature records indicate that Chesapeake Bay waters are warming (see Figure 8). The close coupling of air and water temperatures in the bay is likely to be a signal of climate change. Submerged aquatic vegetation would be adversely affected by higher water temperatures (Pyke et al. 2008), and oysters, which historically have been a major factor in filtering the Chesapeake's waters and improving water quality, would become more vulnerable to disease.

Also, if coupled with both increased pollutant runoff in the spring (as a result of changes in precipitation patterns) and higher air temperatures during the summer, higher water temperatures will most likely lead to increased frequency and duration of algal blooms. Some of those blooms may be potentially harmful to human health (e.g., *Pfiesteria*—a single-celled toxic microorganism), and would definitely lead to degraded water quality (e.g., decreased dissolved oxygen levels).

CHANGES IN PRECIPITATION PATTERNS: Heavier Rainfall, Flooding, Erosion, Prolonged Droughts, Increased Pollutant Runoff, Degraded Water Quality

As global climate grows warmer, evaporation will increase due to warmer oceans. Because the world is a closed system, this will cause heavier rainfall, with more beach and land erosion as well as coastal flooding (USCCSP 2008). By the second half of the 21st century, precipitation in the Mid-Atlantic region is expected to increase overall.

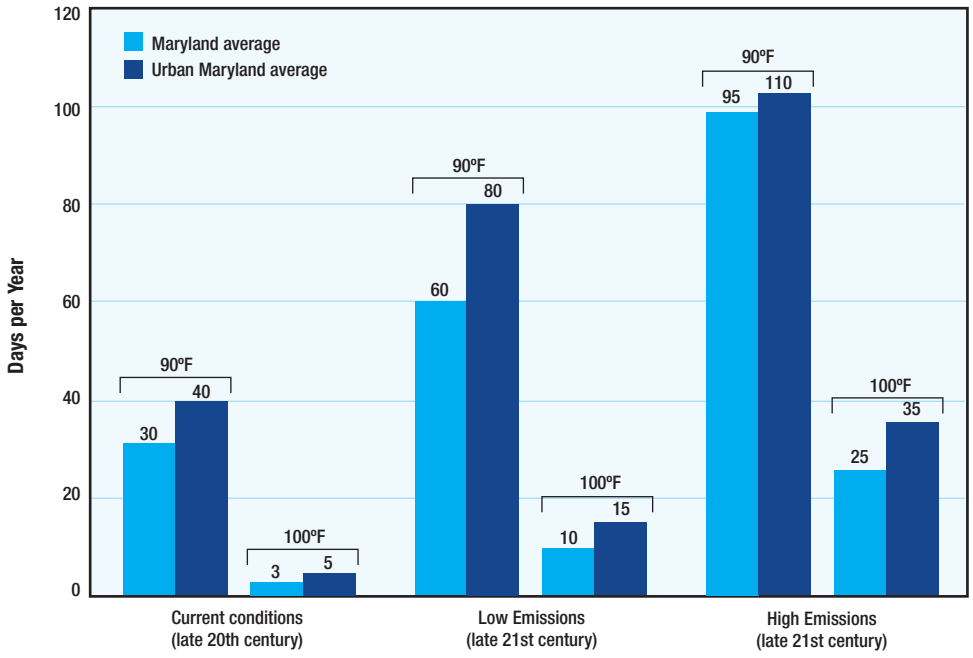
A National Center for Atmospheric Research report notes that climate changes consistent with the impacts of global warming are occurring now, such as significant changes in the seasonal timing of runoff in many mountainous areas (NCAR 2005). According to a report prepared for the Association of Metropolitan Water Agencies, the "humid East and Midwest" can expect more rainfall in the winter and late spring, and potentially less rainfall in late summer and fall, with more extreme droughts (Cromwell et al. 2007).

Such changes in precipitation patterns have both water quality and water supply implications, including lower base flows in surface waters and reservoir levels in the summer and fall. These impacts will also adversely affect groundwater levels, on which the region relies for meeting some of its drinking water needs. In addition, decreases in precipitation during the summer may lead to increased demands for water within the region, including irrigation water in the upper Potomac—which may impact the availability of downstream water supplies, and may cause difficulty in meeting all of the region's increased demands for water.

Higher storm intensity would also increase the flow of sediment and pollutants to Chesapeake Bay and its tributaries. This would especially be true due to stormwater runoff in areas that are not currently under stormwater management control. However, if precipitation patterns change significantly enough, the stormwater management controls currently in place throughout the region may also be operating at the maximum or exceeding their design capabilities (i.e., resulting in reduced performance and removal efficiencies) (Pyke et al. 2008). The combination of these two factors would lead to degraded water quality both within local streams as well as to in the bay and its tributaries, as increased sediment and nutrient runoff degrade water quality (i.e., excess nutrients lead to anoxic conditions/reduced levels of dissolved oxygen in water, and excess sediments smother submerged aquatic vegetation growing in shallow waters).

Figure 7. Increasing Number of Warmer Days in Maryland

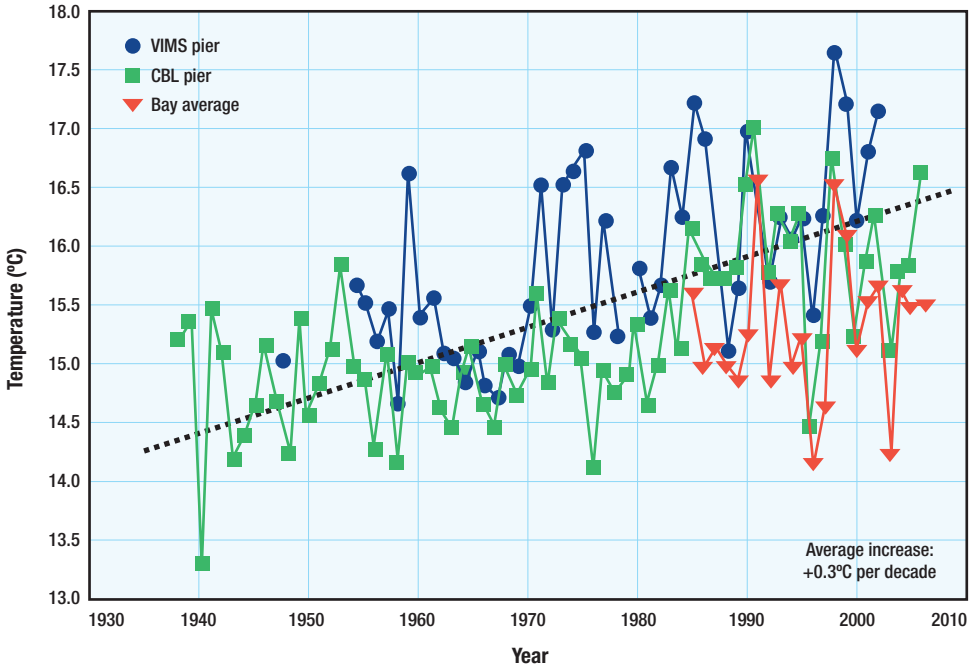
As the 21st century progresses, the average number of days with temperatures above 90ºF and 100ºF will increase in Maryland overall and in its urban centers if greenhouse gas emissions increase.



Source: Dr. Donald Boesch, University of Maryland.

Figure 8. Measured Temperature Changes in Chesapeake Bay Surface Waters: 1930–2005

Long-term temperature records indicate that Chesapeake Bay waters are warming.



Source: VIMS 2008.

Table 2 shows different levels of risk associated with natural severe weather events for different counties in the Washington, D.C., metropolitan area and adjoining region. As climatic change increases the intensity of these events, their associated costs will increase as well.

Table 2. Risks by Jurisdiction in Maryland Associated With Severe Weather Events Potentially Exacerbated by Climate Change

Several jurisdictions in Maryland are at medium-high and high risk associated with natural severe weather events. As climate change increases the intensity of these events, their associated costs will increase as well.

Event	High Risk	Medium-High Risk
Drought	Frederick, Montgomery, Howard, Carroll, Baltimore City and County, Harford	None
Extreme heat	Baltimore City	Frederick, Prince George's, Charles, Calvert, Howard, Anne Arundel, Harford
Flash/river flooding	Frederick	Montgomery, Carroll, Baltimore County, Anne Arundel
Thunderstorm	Frederick, Montgomery, Anne Arundel	Prince George's, Carroll, Howard, Baltimore County, Harford
Tornado	Frederick, Anne Arundel	Prince George's, Charles, Carroll, Baltimore County, Harford
Winter weather (snow and ice)		Frederick, Montgomery, Prince George's, Anne Arundel, Howard, Carroll
Tidal/coastal flooding		Anne Arundel, Calvert

Source: Koontz et al. 2000.

HEALTH IMPACTS ON REGIONAL POPULATIONS: Increases in Heat Stroke, Respiratory Problems, Asthma, Contamination of Food and Water, Pollen Allergies, and Vector-Borne, Rodent-Borne and Other Infectious Diseases

Climate change is anticipated to affect human health and well-being across the globe. Impacts are expected to be unevenly distributed globally, with developing countries predicted to be hit the hardest, especially small islands, mountain zones, and densely populated coastal regions (WHO 2008).

The IPCC has verified that climate change has contributed to widespread diseases and premature deaths. These impacts are due to drastic changing weather events and indirect impacts caused by water quality and quantity, and air and food quality. Scientific evidence shows climate change has increased distribution of infectious diseases (e.g., malaria), allergenic pollens (which start earlier in the season), and heat wave-related deaths. The risk groups hardest hit are the elderly, children, urban poor people, farmers, traditional societies, and coastal populations.

Climate change in the Washington region will be felt across an array of diverse sectors. The predicted rise in the frequency and intensity of heat waves will increase the rates of heat-related deaths and respiratory problems in the region. Increases in the region's temperature will also create more heat islands and higher ground-level ozone pockets, which can exacerbate asthma, heat strokes, and respiratory problems (MDE 2008b). More code orange and red days are expected with increased smog, ozone, and particulate matter levels. The increase in the intensity and frequency of storms will raise several health issues in the region and will increase deaths due to flooding (MDE 2008b). Table 3 summarizes the possible health effects of climate change.

Table 3. Potential Impacts of Climate Change on Human Health

Climate change is anticipated to affect human health and well-being across the globe. Impacts are expected to be unevenly distributed globally, with developing countries predicted to be hit the hardest (WHO 2008).

Event	Sample Health Impacts
Heat waves	Heat strokes, rashes Respiratory problems Premature deaths
Frequency and severity of storms	Flooding deaths Injury from debris Population displacement
Air quality	Greater frequency of or more severe respiratory problems, including asthma
Water quality	Water supply issues Increased drought
Drought/food supply	Increased food costs Food shortages
Allergies	Greater frequency of allergies Longer pollen season
Vector-, rodent-borne, and other infectious diseases	Increase in West Nile virus Increase in Lyme and tick diseases

Sources: IPCC 2007b, Gamble et al. 2008, MDE 2008b.

Chapter 3

Taking Stock: Current and Projected Regional Greenhouse Gas Emissions

Developing a greenhouse gas emission inventory is an important first step in reducing the region's contribution to global CO_2 levels (see Appendix B). The inventory provides a basis for developing an action plan and setting goals and targets for future reductions, helps to identify the largest sources of greenhouse gases, enables tracking of trends over time, and documents the impacts of actions taken to reduce emissions. A base year of 2005 was chosen because data were readily available, and 2005 was reasonably consistent with the base years selected by Metropolitan Washington Council of Governments (COG) member jurisdictions in the Cool Counties agreement and the surrounding states for their climate programs.[1]

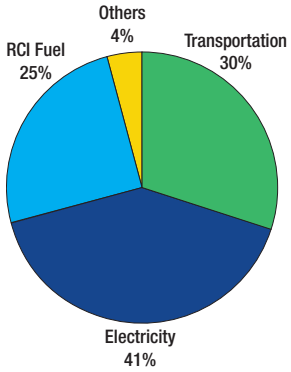
BASE YEAR REGIONAL GREENHOUSE GAS EMISSIONS

In 2005, greenhouse gas emissions in the metropolitan Washington region totaled 74 million metric tons (MMt). As shown in Figure 9, the inventory includes emissions from electricity generation; on-road motor vehicle transportation; residential/commercial/industrial (RCI) and commercial aviation fuel use; and other sources, including hydrofluorocarbons used as refrigerants and solvents, and methane from wastewater treatment plants and landfills. In 2005 two sectors, transportation and electricity use, were the sources of over 70 percent of regional CO_2 emissions. The electricity generation inventory is a consumption inventory associated with both imported electricity and electricity generated within the region.

Analysis is underway to assess the emission reductions associated with the 2007 federal energy efficiency standards. The inventory also does not account for the 4.1 MMt of CO_2e emissions that are absorbed (or "sequestered") by the metropolitan area's 1.3 million acres of undeveloped forests and grassland. As development increases, these areas are expected to decline, reducing the region's overall capacity to absorb and temporarily store greenhouse gas emissions. Further research is needed to better project the anticipated loss of forests and grassland in the region.

Figure 9. Metropolitan Washington Greenhouse Gas Emissions: 2005

In 2005, greenhouse gas emissions in the metropolitan Washington region totaled 74 million metric tons of CO_2e. Two sectors, transportation and electricity use, contributed over 70% of regional CO_2e emissions.



Notes:
RCI fuel includes residential, commercial, and industrial natural gas, home heating oil, nonroad diesel, and aviation fuel. Other sources include methane from wastewater treatment and landfills, as well as high global-warming-potential gases used as refrigerants and solvents.

FUTURE GROWTH IN EMISSIONS: BUSINESS AS USUAL PROJECTION

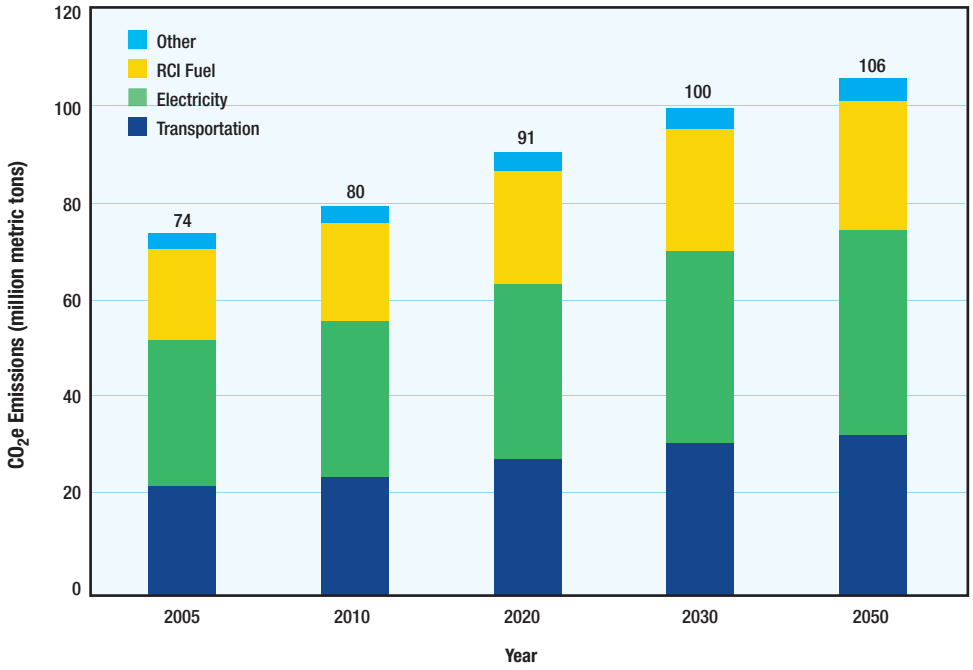
The Washington metropolitan region is growing. According to COG's Cooperative Forecast Round 7.1, between 2005 and 2030, the region will gain 1.6 million new residents and 1.2 million new jobs. The forecasted economic prosperity will be accompanied by a growing demand for new buildings, increased demands on the regional transportation system, and creation of new businesses. To a great extent, how the region grows will determine the new energy and fuel demands. Based on current business-as-usual (BAU)[2] projections of growth in population, housing, employment, and energy use, total emissions from energy consumption (electricity and fuel use) in

[1] The IPCC and others have used 1990 as a base year. Because detailed data were not available for the metropolitan Washington region, as noted, 2005 was chosen as the base year. Roughly speaking, 1990 emissions are estimated to be 10–20 percent lower than 2005.
[2] Business as usual (BAU) assumes that the policies and conditions in place in 2005 will continue under the future projection scenario. Programs adopted after 2005 will serve to reduce emissions from the projected BAU levels.

the region will increase by 35 percent by 2030 and 43 percent by 2050 (Figure 10). The inventory projections do not account for the 4.2 and 7.5 million tons of CO_2 reductions attributed to the recently adopted federal corporate average fuel economy (CAFE) standards in 2020 and 2030, respectively, nor the recent federal energy efficiency standards. The benefits of the new federal CAFE requirements are discussed later in this report.

Figure 10. Projected Growth in CO_2e Emissions for the Washington Metropolitan Area Under a BAU Scenario: 2005–2050

Based on current business-as-usual (BAU) projections of growth in population, housing, employment, and energy use, total emissions in the region will increase by 35 percent by 2030 and 43 percent by 2050.



Notes:

RCI fuel includes residential, commercial, and industrial natural gas, home heating oil, nonroad diesel, and aviation fuel.

Equivalent CO_2 (CO_2e) is the concentration of CO_2 that would cause the same level of radiative forcing as a given type and concentration of greenhouse gas, such as methane, perfluorocarbons, and nitrous oxide.

Other sources include methane from wastewater treatment and landfills, as well as high global-warming-potential gases used as refrigerants and solvents.

The inventory does not account for the 4.1 million metric tons of CO_2 emissions that are absorbed (or "sequestered") by the Washington metropolitan area's 1.3 million acres of undeveloped forests and grassland.

The business-as-usual projections do not account for new federal energy efficiency and corporate average fuel economy (CAFE) standards. The benefits of the new lower CAFE standards are 4.2 and 7.5 million tons of CO_2 in 2020 and 2030, respectively.

Chapter 4

Taking Aim: Setting Targets for Reducing Regional Emissions

The Climate Change Steering Committee (CCSC) is recommending goals to reduce regional greenhouse gases that are consistent with the climate science and with the goals adopted by state and local governments in the Washington region. The goals in proposed federal legislation and adopted by states and localities are based on what scientists say is needed to stabilize the projected rise in global surface temperatures to below 2.5–3°C (4.5–5.4°F) by 2050. Under different international growth scenarios, greenhouse gas emissions will grow to 50–75 $GtCO_2e$/yr globally by 2030, an approximate 25–90 percent increase from 2000 levels. A consensus of IPCC and U.S. scientists is that greenhouse gas emissions must be reduced by 50–85 percent by 2050 below 1990 levels to avoid the dire consequences of global warming.

In the metropolitan Washington region, state and local governments recognize the urgency of addressing climate change to protect their citizens and economies. The Maryland Commission on Climate Change recently recommended a statewide goal of reducing greenhouse gas emissions by 10 percent below 2006 levels by 2012, by 15 percent below 2006 by 2015, by 25–50 percent below 2006 levels by 2020, and by 90 percent below 2006 levels by 2050. The District of Columbia, a signatory to the U.S. Mayors Climate Protection Agreement, has pledged to reduce greenhouse gas emissions by 7 percent below 1990 levels by 2012. The District is also developing a new base year inventory and climate action plan to build upon this previous commitment. The Commonwealth of Virginia has a goal of reducing greenhouse gas emissions by 30 percent (relative to BAU levels) by 2025, approximately equating to year 2000 levels. And Fairfax, Arlington, Montgomery, and Prince George's counties have signed the Cool Counties agreement, committing to halt the growth of greenhouse gas emissions by 2010, and to reduce greenhouse gas emissions by 80 percent below 2006 levels by 2050.

Recommended Targets and Measures for Reducing Emissions in the Metropolitan Washington Region

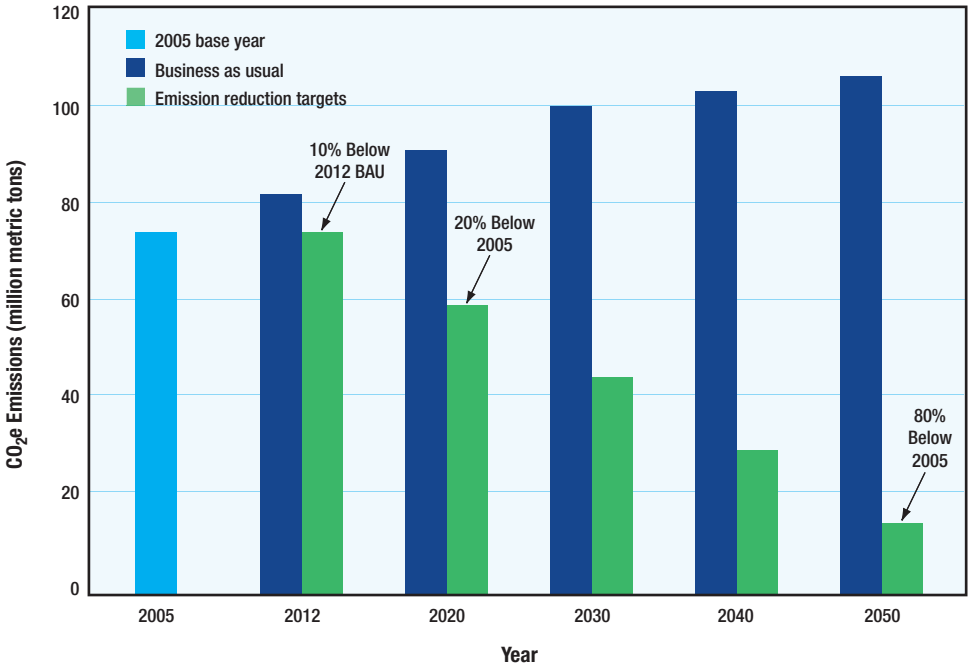
Figure 11 depicts CCSC's recommendations for reducing regional greenhouse gas emissions for the targeted years 2012, 2020, and 2050. CCSC studied the IPCC report (IPCC 2007a) recommendations and reviewed greenhouse gas reduction goals set by states, cities, and regions across the nation. As a compromise between IPCC-recommended reduction levels and those adopted by COG member local governments (Table 4), CCSC recommends near-term, interim, and long-term goals, and reassessing these goals every three years to reflect the best available science or significant changes in policy.

2012 TARGET: 10 PERCENT BELOW 2012 BAU EMISSION LEVELS

Early action is critical to reduce the buildup of greenhouse gases in the atmosphere. In 2005 the National Academy of Sciences called for prompt action, saying it is needed to "lessen the magnitude and rate of climate change." CCSC recommends a near-term

Figure 11. Recommended Regional Greenhouse Gas Emission Reduction Targets Compared to Regional Greenhouse Gas Emissions Under BAU: 2005–2050

As a compromise between IPCC recommended reduction levels and those adopted by COG member local governments, the Climate Change Steering Committee chose to set three targets for reducing greenhouse gas emissions: 10 percent below business as usual (BAU) levels by 2012, 20 percent below 2005 levels by 2020, and 80 percent below 2005 levels by 2050.



COG Targets

- 2012: 10% below BAU
- 2020: 20% below 2005 levels
- 2050: 80% below 2005 levels

Table 4. Targets for Reducing Greenhouse Gases in the Metropolitan Washington Region

Several jurisdictions in the metropolitan Washington region, along with the District of Columbia and the states of Maryland and Virginia, have set targets to reduce their greenhouse gas emissions by specific percentages within specific time frames.

Organization/Jurisdiction	Short-Term Target (2010–2015)	Medium-Term Target (2020–2025)	Long-Term Target (2050)
IPCC			**50–85% below 1990 levels**
District of Columbia	**2012: 7% below 1990 levels**	**In development**	**In development**
State of Maryland	**2012: 10% below 2006 levels** **2015: 15% below 2006 levels**	**2020: 25%–50% below 2006 levels**	**90% below 2006 levels**
Montgomery County*	2010: stop emissions growth		80% below 2006 levels
Takoma Park	2012: 7% below 1990 levels		
College Park	2012: 7% below 1990 levels		
Rockville	2012: 7% below 1990 levels		
State of Virginia		**2025: 30% below BAU**	**In development**
Arlington County*	2010: stop emissions growth		80% below 2006 levels
Fairfax County*	2010: stop emissions growth		80% below 2006 levels
City of Alexandria	2012: 7% below 1990 levels		
COG	**2012: 10% below BAU****	**2020: 20% below 2005 levels**	**80% below 2005 levels**

BAU = business as usual; COG= Metropolitan Washington Council of Governments; IPCC = Intergovernmental Panel on Climate Change.

* Arlington, Montgomery, and Prince George's counties have signed the Cool Counties agreement, committing to halt the growth of GHG emissions by 2010, and to reduce GHG emissions by 10% every five years thereafter until 2050, to achieve an 80% reduction goal between 2006 and 2050.

**Corresponding to returning regional emissions back to 2005 levels by 2012.

target of 2012 to promote early action. This goal aims to reduce emissions by 10 percent below projected 2012 BAU levels, corresponding to returning regional emissions to 2005 levels by 2012.

Meeting the short-term goal may require a number of voluntary actions by individuals, households, and businesses; new regional partnerships to bring about change. A regional 2012 Action Plan is recommended to identify the appropriate measures for achieving the 2012 target.

Voluntary Actions by Individuals, Households, and Businesses

Changing the energy-consuming behavior of individuals and households offers a potentially significant gold mine for greenhouse gas reductions. Opportunities for education and outreach efforts include persuading consumers to purchase more energy-efficient cars, appliances, and heating and air conditioning units, and to consider alternatives for commuting to work other than by driving alone. Many of the measures may be successfully promoted through incentives from utilities and local governments working together. Individual actions will also yield co-benefits, including cost savings, less congestion, and reduced air pollution.

Research performed by Vandenbergh (2007) indicates that individuals contribute to about one-third of U.S. greenhouse gas emissions through travel and household behaviors. Some of these carbon-emitting behaviors can be modified to generate emission reductions in the near term. The average American contributes about 20 metric tons of CO_2 (U.S. DOE 2007). According to Vandenbergh, most (63 percent) of the emissions are from personal car use, mass transit, and air travel, and the rest (37 percent) are from residential use of appliances, air conditioning, and heating.

Households can reduce their energy use, electric bills, and greenhouse gas emissions in a variety of ways, ranging from simple actions to larger investments. Businesses and institutions can also take action to reduce emissions, including locating near transit, purchasing green power and clean vehicles, turning off electronic devices, supporting employee telecommuting programs, reducing mowing, reducing use of fertilizers, and installing more energy-efficient equipment. As shown in Table 5, many near-term voluntary actions are no-cost or low-cost approaches to reducing emissions.

New Regional Partnerships to Bring About Change

A variety of new partnerships envisioned or under development could help the region achieve its near-term goals. For example, the Greater Washington Board of Trade's Green Committee and its partners are embarking on new programs to address climate change, including a local carbon offset program (Carbon Cut Initiative), and a new carbon footprint calculator from Noblis. Pepco, Virginia Tech, and Hannon Armstrong are also actively implementing an energy performance contracting program in the region to reduce building energy consumption. COG is currently partnering with the Greater Washington Board of Trade to develop and implement a program to improve the efficiency of streetlights in the region.

2020 TARGET: 20 PERCENT BELOW 2005 BAU EMISSION LEVELS

CCSC recommends an interim goal of 2020 to encourage expansion of recommended policies and programs. This goal aims to reduce emissions to 20 percent below 2005 BAU levels by 2020, which represents an approximate 35 percent reduction from 2020 BAU levels.

Table 5. Household/Business Actions to Reduce Greenhouse Gas Emissions

Households and businesses can reduce their energy use, electric bills, and greenhouse gas emissions in a variety of ways, ranging from simple actions to larger investments.

	High Greenhouse Gas Reduction Benefits			
Household/Business Actions	**Zero Costs**	**Low Costs (≤ $150)**	**Medium Costs ($151–$500)**	**High Costs (≥ $501)**
Recycle half of waste	•			
Control thermostat (2°F (1.1°C) higher summer, 2°F (1.1°C) lower winter)	•			
Set computer to energy-saving setting	•			
Drive 10 fewer miles per week	•			
Set water heater thermostat no higher than 120°F (48.9°C)	•			
Turn off lights in unoccupied rooms	•			
Wash clothes in cold water	•			
Wrap insulation blanket on water heater		•		
Carpool to work		•		
Buy power strip and turn off electronics daily		•		
Replace air conditioning unit filter every 30 days		•		
Install programmable thermostat		•		
Change incandescent lighting to compact fluorescent		•		
Switch to push mower when needed		•		
Use 100% post-consumer recycled printer paper		•		
Use public transportation to commute to work			•	
Have an energy audit			•	
Telecommute 3 days a week			•	
Purchase a hybrid or fuel-efficient car				•
Install a solar water heating system				•
Install wall and ceiling insulation				•
Weatherize home (replace windows and doors)				•
Install a green roof				•
Purchase ENERGY STAR®/WaterSense products				•

Source: Williams 2008.

Some of the reduction needed to meet the 2020 goal will be achieved by a combination of federal and state policies already adopted, such as the Energy Efficiency Act of 2007, the new federal CAFE requirements, and a regional cap-and-trade program for utilities, such as the Regional Greenhouse Gas Initiative (RGGI) in Maryland. Some of the more important programs to reduce emissions could also involve renewable energy initiatives.

To assess what would be involved in meeting the 2020 goal, CCSC prepared a preliminary analysis of current and potential future greenhouse gas reduction measures with an estimated reduction benefit by 2020. The measures, presented in Table 6 and Figure 12, result in 55–57 percent of the reductions needed to reach the 2020 target. CCSC believes that a plan for achieving the full reduction can be developed in the next one to two years.

2050 TARGET: REDUCE BAU EMISSIONS BY 80 PERCENT BELOW 2005 EMISSION LEVELS

CCSC recommends a long-range goal of 2050 to stimulate support for research into technologies and clean fuels needed to stabilize greenhouse gas emissions. This ambitious goal aims to reduce emissions to 80 percent below 2005 levels by 2050, which represents an approximate 85 percent reduction from 2020 BAU levels. It would place the region among national leaders calling for aggressive action to address climate change.

Meeting this goal would present a challenge to the region and would require substantial use of new technologies. One study suggests that reducing a rising BAU path to a flat path with no growth in CO_2 emissions would require cutting projected U.S. carbon emissions by 8 billion metric tons per year. A conceptual model of how this would work was proposed by Pacala and Socolow in 2004. They proposed dividing the total amount into eight wedges of 1 billion metric tons (1 gigaton) of carbon emissions avoided (Figure 13). The four categories of wedge strategies are energy efficiency and conservation, fuel switching and carbon capture and storage, renewable fuels and electricity/forest and soil storage, and nuclear fission. All of these strategies require a coordinated regional effort that involves individual actions, state and local government actions, business actions, federal and state policy and regulations, academic research and development, and new technology. To achieve the desired 80 percent reduction in emissions would require even greater and more concerted efforts.

Table 6. Potential Regional Impacts of Federal, State, and Local Actions on Meeting the 2020 Target for Reducing Greenhouse Gas Emissions

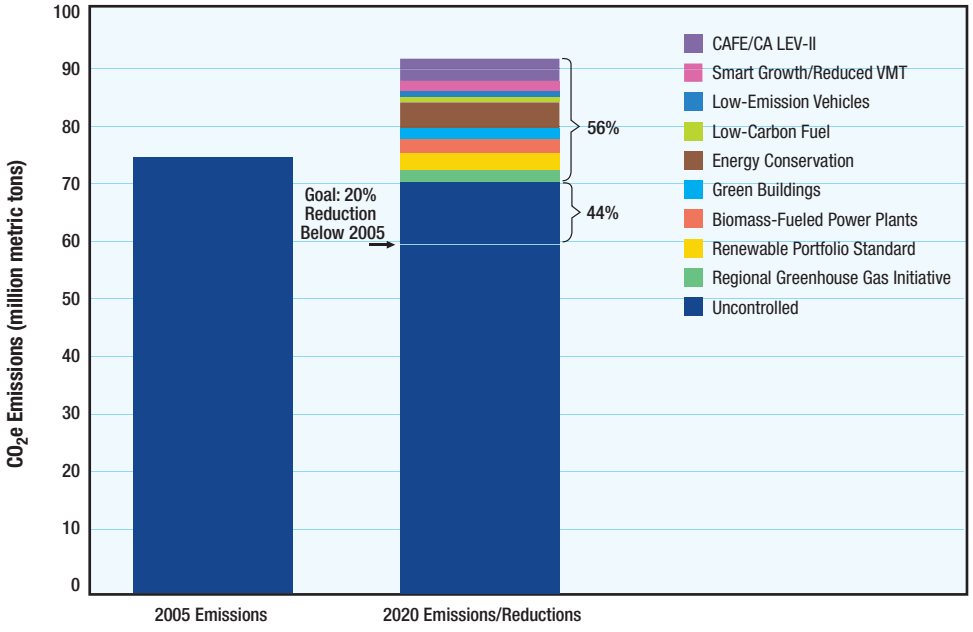
The combined measures presented here would result in a 23 percent reduction in greenhouse gases from the 2020 business-as-usual scenario, or 56 percent of the volume of reductions needed to reach the 2020 target.

Measure	% GHG Reduction	Assumption
RGGI	2%	Apply to DC/MD/VA (may double count VA and DC)
RPS	3%	10% RPS, applied to all electricity, including imports (may double count RGGI reductions)
Biomass-Fueled Power Plants	3%	8% of electricity generation in Maryland
Green Buildings	2%	40% of buildings achieve a 10–30% reduction; assume all adopt
Energy Conservation	5%	Empower Maryland, Virginia Energy Plan, assume 15% (may double count Green Buildings reductions)
Low-Carbon Fuel	1%	Displace 0.8–1.6% by 2012, guess 3% by 2020
Low-Emission Vehicles	1%	Above and beyond 2007 federal CAFE requirements
Smart Growth/Reduced VMT	2–4%	Between 2% and 10% (Kirby 2008 and Ewing et al. 2007)
CAFE/CA LEV-II	4%	14% for transportation sector = 4% for total GHG (DTP)
Total	**23–25%**	

GHG = greenhouse gas; RGGI = Regional Greenhouse Gas Initiative; RPS = renewable portfolio standard; VMT = vehicle miles traveled; CAFE = corporate average fuel economy; CA LEV-II = California Low-Emission Vehicle Phase II; DC = Washington, DC; MD = Maryland; VA = Virginia; DTP = Department of Transportation Planning, Metropolitan Washington Council of Governments.

Figure 12. Regional Opportunities for Reducing Greenhouse Gas Emissions: 2005–2020

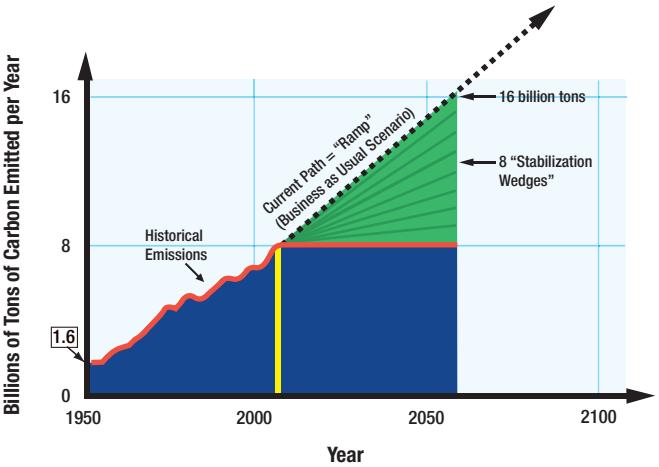
Current and potential future greenhouse gas reduction measures are projected to result in a 23 percent reduction from the projected 2020 business-as-usual greenhouse gas levels. That reduction is 56 percent of the reductions needed to reach the 2020 target.



Source: COG staff estimates.

Figure 13. "Wedge Concept" illustrating Approach for Stabilizing Greenhouse Gas Emissions by 2050

Reducing a rising business-as-usual path to a flat path with no growth in CO_2 emissions would require cutting projected U.S. carbon emissions by 8 billion metric tons per year. Socolow and Pacala propose dividing the total amount into eight wedges of 1 billion metric tons of carbon emissions avoided. The four categories of wedge strategies are energy efficiency and conservation, fuel switching and carbon capture and storage, renewable fuels and electricity/forest and soil storage, and nuclear fission.



Source: Adapted from Pacala and Socolow 2004.

Cost of Meeting the Recommended Targets

In the context of a growing metropolitan region, there are concerns about the cost of the measures needed to meet goals for reducing greenhouse gas emissions. McKinsey & Company and The Conference Board (2007) studied the cost of measures to reach a 2030 goal. Their report presents estimates of the net costs of and abatement benefits from more than 250 measures. Some of the options identified include more efficient commercial and residential lighting, more efficient residential water heaters, building retrofits, fuel economy packages for cars, and on-shore wind power. The abatement options analyzed are available at marginal costs of less than $50 per metric ton of avoided emissions. The authors chose a cost of $50 per metric ton as a reasonable cost and a measure of cost-effectiveness.

Plotted on an abatement curve, several options have negative costs—i.e., would provide savings—over their lifetime. The most cost-effective options are improving the energy efficiency of buildings (e.g., lighting and heating, ventilation, and air conditioning systems) and appliances, and increasing the fuel efficiency of vehicles (Figure 14). Such investment in energy-efficient technology can actually save consumers money. The most expensive options—but still less than $50 per metric ton of avoided emissions—involve shifting to less carbon-intensive energy sources, such as wind, solar, and nuclear power. The study concluded that the benefits of these measures outweigh the costs, and the measures can significantly abate greenhouse gas emissions.

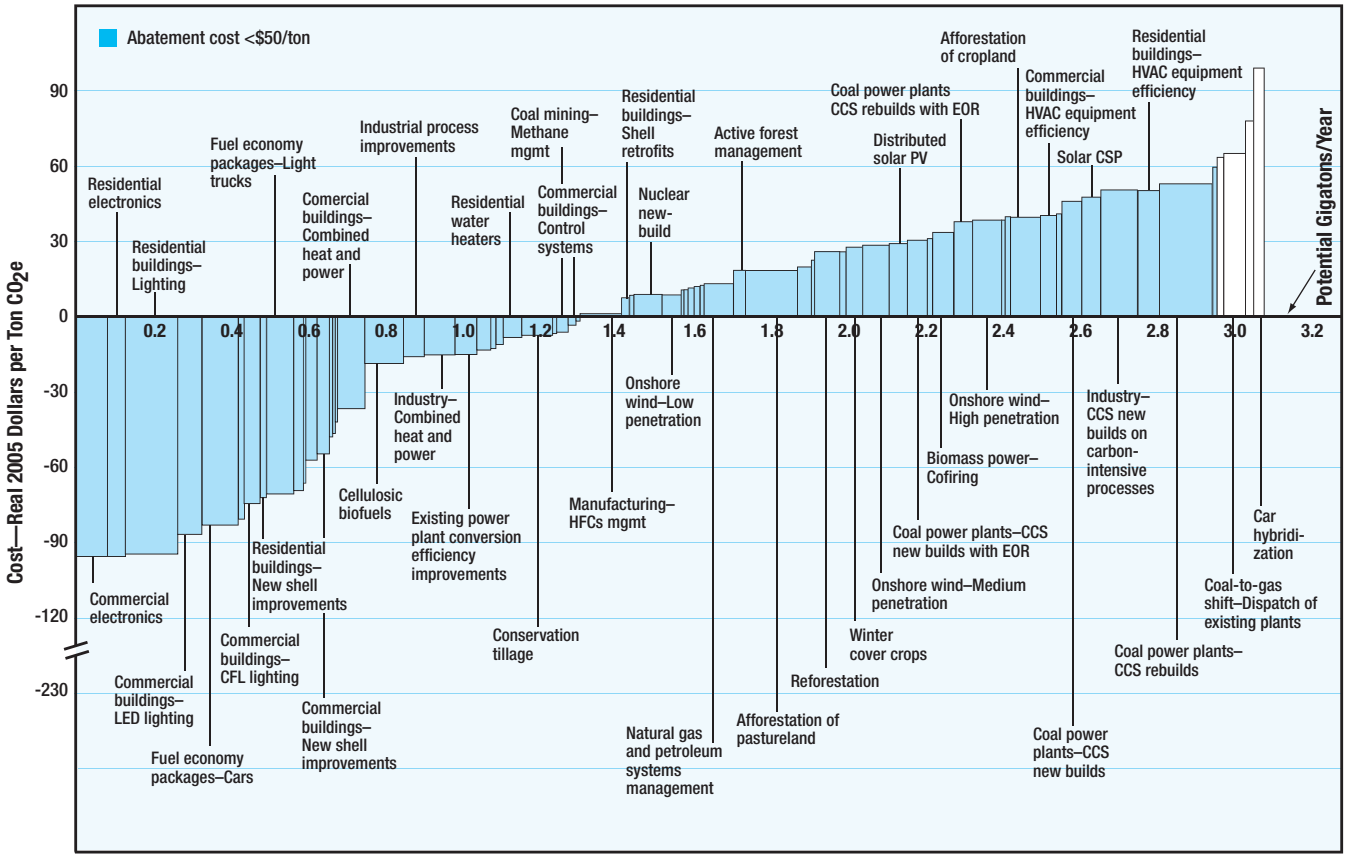
Further economic benefit analysis of the measures recommended in this report is needed to establish their feasibility and how they will be implemented. This analysis will need to include an assessment of how local governments, as well as wastewater and drinking water utilities, can most cost-effectively address these goals, given the many competing environmental priorities and permit/legal obligations, coupled with the limited financial and staff resources available to tackle these issues. This analysis will also need to evaluate the potential policy implications of competing environmental goals (e.g., increased competition for roof space on buildings to install green roofs to reduce stormwater runoff versus installing solar panels to reduce/offset greenhouse gas emissions), as well as the potential synergies between these activities.

Costs of Inaction

In addition to the costs associated with mitigating emissions of greenhouse gases, it is important to consider the potential costs associated with inaction. Science has continued to provide substantial evidence of the current and future impacts of climate change in the global community. These impacts have prompted immediate research and development of economic costs and benefits models, research, and future policies. The current and ongoing studies advise policymakers at all levels to create policies that will mitigate greenhouse gas emissions and create adaptive strategies to help society deal with the impacts of an ever-changing climate and what that means for future survivability. The United States has a significant range of potential climate change outcomes (Ruth et al. 2007). There are predictions of higher sea levels, more heat-related deaths, stronger and more frequent storms, and increased extreme weather temperatures (MDE 2008b, Ruth et al. 2007). These events in the climate will affect many economic sectors of the government. *The U.S. Economic Impact of Climate Change and the Costs of Inaction* report (Ruth et al. 2007) provides five key points:

Figure 14. U.S. Mid-Range Abatement Curve: 2030

A study by McKinsey & Company and the Corporation Board found that the most cost-effective options for reducing greenhouse gas emissions are improving the energy efficiency of buildings (e.g., lighting and heating, ventilation, and air conditioning systems) and appliances, and increasing the fuel efficiency of vehicles. The most expensive options—but still less than $50 per metric ton of avoided emissions—involve shifting to less carbon-intensive energy sources, such as wind, solar, and nuclear power. The study concluded that the savings of these measures outweigh the costs, and the measures can significantly abate greenhouse gas emissions.



Source: McKinsey et. al. 2007. Used with permission.

CCS = combined capture and storage; CFL = compact fluorescent lights; CSP = concentrating solar power; EOR = enhanced oil recovery; HFCs = hydrofluorocarbons; HVAC = heating, ventilation, and air conditioning; LED = light-emitting diode; PV = photovoltaic.

1. Economic impacts of climate change will occur throughout the country.
2. Economic impacts will be unevenly distributed across regions and within the economy and society.
3. Negative climate impacts will outweigh benefits for most sectors that provide essential goods and services to society.
4. Climate change impacts will place immense strains on public-sector budgets.
5. Secondary effects of climate impacts can include higher prices, reduced income, and job losses.

The United States has already begun to feel the effects of climate change through higher temperatures, flooding, and related health effects. These consequences will only worsen if action is not taken immediately. Climate change in the United States, and specifically

in the Mid-Atlantic region, may continue to worsen. There could be significant costs for repairs, maintenance, protection/preparedness, and health impacts. Effects could have a disproportionate effect on the elderly, children, urban communities, and homeless and underprivileged populations.

The *Maryland Climate Action Plan* report and *The U.S. Economic Impact of Climate Change and the Costs of Inaction* prepared by the University of Maryland's Center for Integrative Environmental Research have examined the potential economic losses and gains from a BAU (i.e., an inaction) scenario. Although there could be a temporary spike in some sectors that will produce increased revenues, the results suggest negative impacts for all sectors of society. Further, the economy may be less able to sustain and operate effectively and efficiently.

Taking Action

Local governments, the states, and regional planning agencies have a critical role in planning and preparing for a new low-carbon future. They have primary authority to plan, approve, and permit how and where land is developed, how the transportation system is built, and how localities operate on a daily basis. They also adopt planning documents that guide how they grow and meet the changing needs of their communities.

Local governments control land use and building standards in their community by using zoning authority, adopting building codes,[3] and issuing building permits. These functions can be used to promote transit-oriented development, preserve trees and green space, influence the location and density of residential and commercial buildings, and encourage the energy efficiency of and use of renewable energy in these buildings. Local governments, the states, and regional planning agencies also determine the availability of public transportation.

Local governments have direct control over their own operations, including purchasing; energy use in government buildings and facilities, fleets, and water and wastewater treatment plants; landscape management; solid waste disposal and recycling; and parking. Local governments and regional authorities are taking action to reduce greenhouse gas emissions resulting from these activities, providing leadership and local economic benefits.

The following sections on energy and transportation describe COG's current projections for the region in terms of population, employment, households, and transportation and land use. The current Round 7.1 Cooperative Forecast projections are the best information about the future based on known development and transportation projects. County and city planning offices provided the information for future projects in their jurisdictions to 2030. State and local transportation agencies provided information about transportation projects in the region's long-range transportation plan (Kirby 2008a and 2008b). There is significant uncertainty about the impact of energy prices on economic growth, housing, and transportation patterns in the region, which could have an effect on the projections in this report.

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[3] In Virginia, building codes are adopted by the state but administered by local governments.

Chapter 5
Mitigating Emissions From Energy Consumption

While local governments and the private sector are investing in energy efficiency and renewable energy, the region remains dependent on fossil fuel-powered energy sources to meets its growing demand for energy. The energy sector includes electricity consumption and RCI fuel use (i.e., residential, commercial, and industrial heating oil and natural gas use, nonroad diesel consumption, and aviation fuel). The sector accounts for approximately 66 percent of greenhouse gas emissions in the metropolitan Washington area (Figure 15). Any solution to reduce emissions in the region must address energy supply and demand into the future.

There are three ways to reduce emissions from energy consumption:

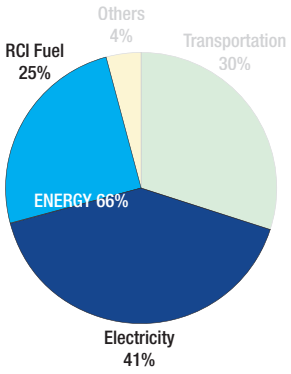
- *improve energy efficiency,*
- *reduce demand for energy, and*
- *develop clean (alternative) energy sources.*

The *COG 2006 Energy Strategic Plan* (MWCOG 2006c) promotes all three as goals to manage the region's energy resources. In the near term, energy efficiency is the cheapest, fastest, and cleanest way to reduce greenhouse gas emissions; therefore, this approach should receive priority attention. In fact, certain energy efficiency investments can actually provide cost savings to consumers.

There is not a single solution to reducing greenhouse gas emissions from the energy sector in the short or the long term. Cap-and-trade and/or carbon tax programs are being widely discussed as possible options for reducing overall U.S. greenhouse gas emissions. Cost-effective renewable energy technologies, such as wind power, offer substantial potential in the short term, and advances in solar energy technologies are expected to substantially reduce costs within the next five years (U.S. EPA 2007a, ACEEE 2008b). Some possible longer-term solutions, such as increased nuclear generation and carbon sequestration for coal-fired power plants, face significant hurdles to implementation. Such technologies as plug-in electric hybrids could also have implications for future electricity demand. A recent study suggests that plug-in hybrids could represent up to 80 percent of the new vehicle market in 2050, with associated increased electrical generation requirements in the Mid-Atlantic region of approximately 35 million megawatt-hours (MWh) per year (EPRI and NRDC 2007). Smart-grid technologies and new types of electricity transmission are also being considered.

As shown in Figure 16, emissions from government operations are a relatively small percentage (3–4 percent) of total community emissions. Local governments are already taking steps to reduce emissions from their operations, including efforts to reduce energy consumption. These governments are leading by example and are creating the framework, vision, and guidance to bring about changes in the community.

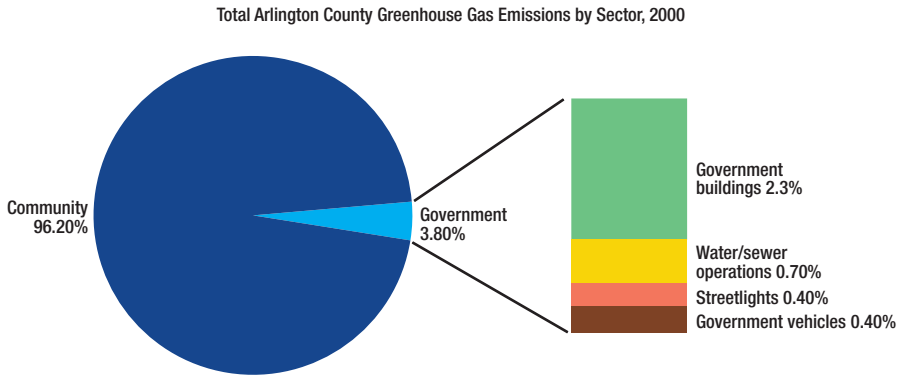
Figure 15. Energy Sector Share of Regional Greenhouse Gas Emissions: 2005
The energy sector accounts for approximately 66 percent of greenhouse gas emissions in the metropolitan Washington area.



Note: RCI fuel includes residential, commercial, and industrial natural gas, home heating oil, nonroad diesel, and aviation fuel.

Figure 16. Example of Local Government Greenhouse Gas Emissions

Greenhouse gas emissions from local government operations represent approximately 3–4 percent of total community emissions. Building, water/sewer, lighting, and government vehicles are the primary sources of government emissions, as shown in this greenhouse gas emissions profile of Arlington County during 2000.



Source: Morrill 2007.

The Energy Future: Challenges and Opportunities

The Washington metropolitan region is growing. COG Round 7.1 Cooperative Forecast projects that between 2005 and 2030, the region will gain 1.6 million new residents and 1.2 million new jobs. This economic prosperity will be accompanied by a growing demand for new buildings. How the region builds will to a great extent determine the extent of new energy demand. Based on current business as usual (BAU) projections of growth in population, housing, employment, and energy use, total emissions from energy consumption in the region will increase by 33 percent by 2030 and by more than 40 percent by 2050.

The energy future also involves concerns about energy prices. Regional energy prices increased significantly between 2000 and 2005: electricity, 14 percent; natural gas, 53 percent; gasoline, 68 percent; and diesel, 78 percent. Since 2005, price volatility has continued (U.S. DOE 2008a). Higher energy costs can reduce disposable incomes, making consumers more aware of their purchases as well as their energy consumption (Woolard 2008).

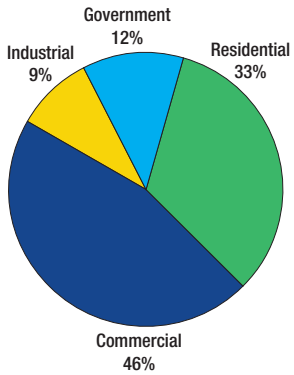
OPPORTUNITIES IN THE RESIDENTIAL SECTOR

The residential sector accounts for 33 percent of total energy demand in the region (see Figure 17). Energy is used for home heating, air conditioning, refrigeration, and water heating and to power a variety of electrical appliances, such as personal computers, televisions, and electric ranges.

There are significant opportunities for reducing energy demand in the residential sector in both new and existing buildings. Establishing strong green building standards region-wide through state or local actions will help to reduce energy demand from new buildings. Individual actions, such as weatherizing homes, purchasing efficient appliances, and installing programmable thermostats, high-efficiency lighting, and other energy-saving devices, can help to improve the energy efficiency of the existing building stock.

Figure 17. Sectoral Shares of Energy Use in the Metropolitan Washington Region: 2005

The residential sector accounts for 33 percent of total energy demand in the metropolitan Washington region. Energy is used for home heating, air conditioning, and refrigeration, and to power a variety of electrical appliances, such as personal computers, televisions, and electric ranges.



OPPORTUNITIES IN THE GOVERNMENT OPERATIONS AND LIGHTING SECTOR

Government operations and lighting account for approximately 12 percent of regional energy demand. Improving the energy efficiency of new and existing municipal and federal government buildings, including schools, represents a potentially large source of reductions in the region. Beyond building energy use, COG, in collaboration with the Greater Washington Board of Trade, is also working to develop a program to improve the efficiency of street lighting in the region.

OPPORTUNITIES IN THE COMMERCIAL AND INDUSTRIAL SECTORS

The commercial and industrial sectors respectively account for 46 percent and 9 percent of total energy demand in the region. In addition to energy use for heating, air conditioning, and commercial refrigeration, these sectors include such uses as water/wastewater treatment, which consume large amounts of electricity. Other significant consumers of electricity include large data centers, hospitals and universities, and big-box stores.

There are significant opportunities to reduce energy demand in the commercial sector. For example, improving the energy performance of commercial buildings can reduce building energy consumption by 10–30 percent.

Wastewater treatment and drinking water facilities consume significant amounts of electricity, so have an opportunity to take action to reduce emissions.[4] For example, the Washington Suburban Sanitary Commission has recently hired an Energy Manager, has begun to purchase electricity generated from a new wind farm developed near the region, and is beginning a formal inventory of indirect/direct sources of greenhouse gas emissions from all of its sites, including fleet composition, fuel purchase, employee commuting, water/wastewater treatment processes, and biosolids management. In addition, through methane capture and on-site utilization as well as reprocessing of wastewater biosolids into a fuel source, wastewater treatment facilities have the opportunity to significantly reduce their carbon footprint. Land application of biosolids also has the potential to sequester carbon. The District of Columbia's Water and Sewer Authority is planning to conduct similar inventories of its operations at the Blue Plains Wastewater Treatment Plant, the region's largest wastewater facility, and elsewhere. Other facilities in the region are considering similar efforts, and plan to work with COG and several national organizations to develop consistent protocols for assessing wastewater and drinking water emission inventories, as well as quantifying reductions/offsets.

OPPORTUNITIES FOR COMMUNITY ENERGY PLANNING

Community energy planning has the potential to bridge large-scale applications of green building, renewable energy, and transit-oriented development within defined geographic boundaries in the region (e.g., large-scale developments of 100–200 acres). In addition, district heating[5] and renewable heating and cooling systems have the potential to reduce greenhouse gas emissions. Guelph, Ontario, has developed a model community energy plan that reflects many domestic and international best practices

[4] An estimated 3 percent of national energy consumption, equivalent to approximately 56 billion kilowatt-hours (kWh), is used for drinking water and wastewater services. Assuming the average mix of energy sources in the country, this equates to adding approximately 45 million tons of greenhouse gases to the atmosphere (U.S. EPA 2008g).

[5] District heating is the supply of heat, in the form of steam or hot water, from a central source to a group of buildings (ETC/CDS 2000).

(Garforth International 2007). Such an approach has the potential to benefit the metropolitan Washington region.

OPPORTUNITIES FOR TECHNOLOGICAL INNOVATIONS

According to the Sierra Club, technological efficiency since 1970 has essentially equaled the amount of new energy production in the U.S. to meet increased demand. A comparison of per-capita electricity consumption between best-performing states and/or urban areas and the metropolitan Washington region illustrates how much can be achieved without sacrificing one's lifestyle (Martin 2008). For example, according to the California Public Utilities Commission, "California's per capita energy has remained relatively flat over the last thirty years. In perspective, energy use per capita in the rest of the country has surged by 50 percent" (CPUC 2008).

Current Initiatives for Reducing Greenhouse Gas Emissions From Energy Use

RGGI WILL CAP EMISSIONS FROM MARYLAND POWER PLANTS

In 2007, Maryland joined the Regional Greenhouse Gas Initiative (RGGI), an agreement among states in the Mid-Atlantic and Northeast that will cap emissions from coal-fired power plants in 2009. Each state receives allowances to emit CO_2, and allocates allowances to power plants through auctions or other means. The RGGI allowance cap will be lowered by 2.5 percent per year from 2015 to 2019, for a total reduction of 10 percent by 2020. The first allowance auction in Maryland was held in September 2008. Revenue generated from the sale of allowances may be used to fund energy efficiency programs.

STATES HAVE ADOPTED RENEWABLE PORTFOLIO STANDARDS

States in the region have adopted renewable energy portfolio standards (RPS), which establish a minimum percentage of electricity supply that must be derived from zero-emission renewable energy sources (Table 7). Examples of renewable energy sources include solar energy, wind, biomass, methane, geothermal, ocean, fuel cells, hydroelectric power other than pumped storage generation, and waste to energy. Currently, significantly less than one percent of the region's electricity is supplied from renewable energy sources. As the region begins to develop programs to meet the RPS requirements and to reduce carbon emissions, it will be important to expand the percentage of energy provided by renewable energy sources to displace the significant impact of reliance on fossil fuels.

Table 7. Renewable Portfolio Standards for the District of Columbia, Maryland, and Virginia

Governments in the region have adopted renewable energy portfolio standards that establish minimum percentages of electricity supply that must be derived from zero-emission renewable energy sources by 2022.

Regional Governments	Renewable Energy Portfolio Standards Established for 2022
District of Columbia	11% of electricity from zero-emission renewable energy sources (mandatory)
Maryland	20% of electricity from zero-emission renewable energy sources (mandatory)
Virginia	12% of electricity from zero-emission renewable energy sources (voluntary)

The RPS program displaces power generation from coal, oil, and/or gas-fired sources in the PJM Interconnection area[6] by requiring new renewable sources of energy, resulting in reduced greenhouse gas emissions, as well as other air pollutants, such as nitrogen oxide (NO_x) and sulfur dioxide (SO_2). The total annual consumption of electricity in the region is approximately 57 million MWh. A 10 percent renewable requirement will reduce greenhouse gas emissions by approximately 3.5 million metric tons of carbon dioxide ($MMtCO_2$) annually. More aggressive RPS requirements, such as a 20 percent RPS requirement for 2022 in Maryland, will provide additional benefits.

LOCALITIES ARE PURCHASING GREEN POWER

One of the recommendations of the *2006 COG Energy Strategic Plan* is to increase the share of regional energy provided by alternative and renewable sources of energy (MWCOG 2006c). Since 2004, local governments in the region have been expanding their purchase of wind power to satisfy a portion of their electricity demand and to help improve air quality in the region. The government agencies purchase wind energy directly from an electricity supplier or purchase renewable energy certificates (RECs) that ensure that such wind energy is placed on the electric grid. Many companies and individuals have also opted to purchase green power to satisfy their energy demands. Based on commitments in the region's air quality plans, the current renewable energy purchase program is expected to involve the purchase of 104,000 MWh of power or wind energy RECs annually, reducing greenhouse gas emissions by approximately 65,000 metric tons of CO_2 annually.

LOCAL JURISDICTIONS ARE IMPLEMENTING INCENTIVES TO PROMOTE GREEN ENERGY AND CONSERVATION

The Montgomery County Clean Energy Rewards Program provides incentives to residents, small businesses, and community organizations purchasing clean energy products certified by the county's Department of Environmental Protection. The county estimates the program will provide incentives for 31,900 MWh of clean energy, reducing consumption of electric power and production of NO_x emissions from coal, oil, and/or natural gas-fired generation. At current funding levels, this program could reduce greenhouse gas emissions by approximately 20,000 metric tons of CO_2 annually. Montgomery County has also adopted an energy tax and carbon surcharge.

STATES HAVE ESTABLISHED ENERGY EFFICIENCY GOALS

States in the region are taking action to reduce their energy consumption. EmPOWER Maryland was adopted in 2008 to reduce state per-capita energy consumption by 15 percent by 2015. The initiative is composed of six steps: improve building operations, expand use of energy service performance contracting, increase the state agency loan program, require energy-efficient buildings, purchase ENERG STAR® products, and expand the community energy loan program. The Virginia Energy Plan (2007) includes goals to reduce the rate of growth of energy use by 40 percent by 2017, and to reduce greenhouse gas emissions from energy use by 30 percent from BAU levels by 2025. The District of Columbia has also created a Sustainable Energy Utility, which will fund additional energy efficiency programs into the future.

[6] PJM Interconnection is a regional transmission organization that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia. Acting neutrally and independently, PJM operates the world's largest competitive wholesale electricity market and ensures the reliability of the largest centrally dispatched grid in the world.

UTILITY POLICIES TO ENCOURAGE ENERGY EFFICIENCY

A variety of utility policies are being considered nationally to encourage energy efficiency. For example, one of the goals in the U.S. Environmental Protection Agency's (EPA's) *National Action Plan for Energy Efficiency: Vision for 2025* is to develop processes to align utilities' incentives equally for efficiency and supply resources (U.S. EPA 2007d). EPA encourages states to:

- "Work with utilities to implement revenue mechanisms to promote utility and shareholder indifference to supplying energy savings, as compared to energy generation options;
- Consider how to remove utility disincentives to energy efficiency, such as by removing the utility throughput disincentive and exploring other rate-making ideas; and
- Ensure timely cost recovery is in place for parties that administer energy efficiency programs."

In 1982, California was the first state to decouple utility rates from sales volume, providing a strong incentive to implement conservation programs. The New England Independent System Operator (ISO-NE) developed a different approach to level the playing field between energy conservation and new generation, called the Forward Capacity Market, a concept now being considered in the Mid-Atlantic. In this case, in addition to traditional electrical generation, energy conservation and load response now qualify as "capacity" and can be bid into the electricity market.

States and utilities in the region are considering policies to remove the disincentive for investment in energy conservation. This will provide an incentive for utilities to focus on effective energy efficiency programs and invest in activities that reduce load.

LOCAL GOVERNMENTS ARE ADOPTING ENERGY-EFFICIENT GREEN BUILDING POLICIES

In December 2007, COG adopted a regional green building policy, including a vision of making the region a national leader in green building, with local governments leading in innovation and stewardship. A key component of the COG policy identifies the Leadership in Energy and Environmental Design Green Building Rating System™ (LEED) as the region's preferred green building system for rating commercial construction and high-rise residential projects. The region's green building policy includes meeting LEED silver standards for all new government buildings and LEED-certified-plus standards for all new commercial buildings. Local governments are embracing LEED standards in municipal buildings and other public buildings. To date, 13 COG members have adopted green building policies. Depending on the energy efficiency and renewable energy components of these programs,[7] green buildings will decrease demand for electricity (up to 50 percent improvement); displace power generation from coal-, oil-, and gas-fired sources; and reduce greenhouse gases and other air pollutants (MWCOG 2007b).

GOVERNMENTS AND BUSINESSES ARE BENEFITING FROM ENERGY PERFORMANCE CONTRACTING

Governments and businesses in the region conduct energy audits of buildings and operations (including fleets) to establish a performance baseline from which to measure future benefits from the energy efficiency measures they implement. Local governments

[7] The LEED point system is currently being revised and could include requirements for energy efficiency improvements.

are managing and analyzing data from utility bills to establish a baseline assessment of energy use. Energy managers use a variety of software tools to set up databases on energy consumption for municipal facilities. Beyond simply identifying the sources of energy use, an energy audit seeks to prioritize the energy uses according to the most and the least cost-effective opportunities for energy savings by reducing waste and improving energy efficiency. The Energy Efficiency Partnership for Greater Washington is an example of businesses using savings from energy efficiency improvements to pay for the building retrofits. The partnership's goal is to reduce greenhouse gas emissions and energy consumption in 500 targeted buildings by 20–50 percent in five years (Sweeney 2007).

LOCAL GOVERNMENTS HAVE ESTABLISHED SOPHISTICATED SOLID WASTE MANAGEMENT PROGRAMS

One way to reduce the region's carbon footprint is to use resources more wisely and to reduce the demand for new products through recycling. In the past twenty years, local governments have progressed from simple landfill disposal and incineration of municipal solid waste to options that help reduce greenhouse gas emissions. These strategies, such as recycling programs, waste reduction programs, waste-to-energy plants, and landfill gas capture, result in energy savings.

For over a decade, jurisdictions have required residents and businesses to have recycling service. These jurisdictions have expanded the program's convenience and list of materials accepted over time. Recycling saves energy by providing manufacturing feedstock that eliminates the need to mine new raw materials. National estimates from 2006 show 298.3 $MMtCO_2$-equivalent (CO_2e) emissions avoided by existing recycling activities, which is approximately 4 percent of the entire U.S. carbon inventory. Additionally, the Curbside Value Partnership has estimated that the common recyclables in the waste stream that are not currently captured total 99 $MMtCO_2e$. Also, waste reduction initiatives that encourage the wise use of resources and the reuse of materials help reduce energy consumption by limiting the creation of waste.

For waste that must be disposed of, the region has three waste-to-energy plants and five landfills with methane recovery for energy systems. Studies conducted using the EPA Decision Support Tool have determined: electricity produced by waste-to-energy plants displaces power produced from traditional fossil-fuel power plants, resulting in a net saving in CO_2 emissions; metals separated from waste at the plants for recycling result in a significant savings in energy and greenhouse gas emissions due to a reduced need to mine virgin materials; and processing waste at a waste-to-energy plant instead of a landfill avoids methane emissions from the landfill. Municipal solid waste landfills are the largest human-generated source of methane emissions in the United States. Landfill gas (LFG) for energy collection systems reduce emissions of carbon dioxide and methane. Additionally, energy produced with LFG as a primary fuel source offsets the use of non-renewable resources.

Further information on local jurisdiction initiatives and best practices in the Washington region is presented in the February 2008 report *National Capital Region: Best Practices and Policies to Reduce Greenhouse Gases* (MWCOG 2008a).

Recommendations for Mitigating Regional Greenhouse Gas Emissions From Energy Consumption

The Climate Change Steering Committee (CCSC) reviewed policies and initiatives in other states and regions of the country and identified initiatives that would help reduce greenhouse gas emissions from energy consumption in the region. This review yielded a number of recommendations that are within the control of COG member governments or could be accomplished through individual actions. Many other recommended steps would require federal or state action, or action by businesses or individuals, for the region to achieve its greenhouse gas reduction goals. In addition to the recommendations for local action presented in Table 8, CCSC recommends advocacy positions for state and federal action to achieve maximum regional greenhouse gas reductions from improved energy efficiency and reduced energy consumption and use of low-carbon fuels. Following are CCSC's recommendations for energy efficiency measures, reduced energy consumption/demand management, clean energy sources, and potential advocacy positions.

Table 8. Recommendations for Mitigating Regional Greenhouse Gas Emissions From Energy Consumption

Local/Regional Strategies for Government and Business

A. Improve Energy Efficiency in Buildings

1. Implement the COG Green Building Policy (LEED Silver for government buildings).
   - Implement the 2007 COG regional Green Building Policy requiring all new public-sector buildings to achieve LEED Silver levels and all private-sector commercial buildings to meet a regional LEED-certified-plus standard or equivalent.
2. Set energy performance goals for government buildings, new and existing.
   - Benchmark energy performance in all buildings using common metrics (such as kilowatt-hours per square foot or British thermal units per square foot) and readily available tools (such as Energy Star®'s Portfolio Manager).
   - Set a goal for improving the energy performance of existing public-sector buildings, to be achieved through retrofits for greater energy efficiency.
   - Develop educational campaigns for public-sector employees to encourage energy conservation as a smart business practice.
3. Identify best practices to reduce local government energy use by 15 percent by 2012.
4. Develop incentives for retrofitting existing buildings, commercial and residential.
5. Develop affordable energy efficiency programs for homeowners and businesses.
   - Develop a regional program for utilities to pay for home weatherization and other energy efficiency measures, and recoup investment costs through utility bills.
   - Explore provision of energy audits and energy retrofits for individuals and businesses through a regional cooperative effort.
6. Promote use of energy-efficient appliances.
   - Examine the feasibility of setting a regional percentage goal for incorporating Energy Star® standards in new buildings.
7. Revise state and/or local building codes to promote energy efficiency.
8. Develop green affordable housing policies/programs.
9. Identify best practices for improving efficiency for public and private buildings.
   - Collaborate with the Regional Greenhouse Gas Initiative (RGGI) to support implementation of energy conservation and renewable energy projects in the metropolitan Washington region.
   - Examine the potential for expanding regional energy performance contracting to reduce energy use in public buildings.
   - Develop a long-term goal for carbon neutrality for all government buildings.

B. Reduce Demand for Energy

1. Partner with electric, gas, and water utilities on regional energy conservation.
   - Develop regional energy conservation goals and timetables.
   - Develop a regional energy conservation and efficiency plan that supports meeting regional greenhouse gas emission reduction goals.
   - Partner with the Greater Washington Board of Trade Green Committee and Potomac Conference to assist businesses with taking action to reduce greenhouse gas emissions and implement best practices.
   - Identify regional environmental and community group partners.
   - Partner with electric, gas, and water utilities on regional energy conservation and energy efficiency program outreach.
   - Partner with schools, universities, and local governments to find and apply best practices to reducing energy use and greenhouse gas emissions.
   - Identify and consider leading models in European metropolitan regions to inform the region on effective application of renewable energy from solar, wind, and biomass sources.
2. Expand recycling programs.
3. Reduce energy use at area water and wastewater treatment plants and landfills.
4. Promote energy-efficient street lights across the region.
   - Examine options and develop plans for replacing street lights with energy-efficient lighting (LED [light-emitting diode] or other options) across the region. Consider addressing other related lighting issues, such as globe-type and ground-level lighting, and developing a regional street-lighting standard.
5. Promote regional energy performance contracting and cooperative purchasing.
6. Explore opportunities to remove the disincentive for utilities to invest in energy conservation. Develop incentives for utilities to focus on effective energy efficiency programs and invest in activities that reduce load.

C. Promote Clean Energy Sources

1. Adopt a regional goal of 20 percent purchase of renewable energy by local governments by 2015.
2. Evaluate regional cooperative purchase to meet the 20 percent local government renewable energy purchase goal.
3. Examine options for removing barriers to implementing renewable energy (e.g., solar panels).
   - Consider options to increase deployment of solar technology and other renewable energy throughout the region, including large flat roofs, parking lots/canopies, school and other municipal property. Consider cooperative purchasing to reduce the cost of acquiring the technology.
   - Consider promoting more equitable subsidies for different sources of energy (e.g., nuclear versus renewable).
4. Explore the possibility of implementing a community energy planning process in the region.
5. Develop a regional inventory of renewable energy capacity and production, including solar, geothermal, district heating/cooling, wind, and biofuels.

Table 8. Recommendations for Mitigating Regional Greenhouse Gas Emissions From Energy Consumption, *continued*

D. Reduce Greenhouse Gas Emissions
1. Identify and implement best practices to reduce methane and biosolids from wastewater treatment facilities. • In collaboration with local governments, as well as area wastewater and drinking water utilities, identify best practices and evaluate the potential for reducing greenhouse gas emissions through methane recapture, use of biosolids as a fuel as means for reducing energy requirements for operations, and overall process improvements that can reduce energy consumption at area wastewater and drinking water treatment plants and landfills.
2. In collaboration with local governments, as well as area wastewater and drinking water utilities, work with state and federal governments and national organizations to develop industry standard protocols to quantify greenhouse gas emissions and reductions.
Advocacy (State and Federal Levels)
A. Improve Energy Efficiency
1. Adopt energy performance goals for state and federal government buildings.
2. Develop state and federal financial incentives for renewable energy.
3. Support state and federal climate change legislation, including a cap-and-trade system, that would provide funds for local government energy efficiency programs.
4. Organize a consortium of local governments to apply for Energy Efficiency Block Grant funds as they become available.
B. Reduce Demand for Energy
1. Implement policies to remove the disincentive for utilities to invest in energy efficiency, demand management, and renewable energy.
2. Advocate for adoption of Cool Schools[1] or the equivalent by local school boards or local governments.
3. Support the establishment of and funding for programs designed to supply locally produced food to schools (e.g., statewide farms-to-schools program).[2]
4. Identify best practices for improving energy efficiency for public buildings.
C. Promote Clean Energy Sources
1. Adopt a 20 percent renewable portfolio standard in the District and Virginia by 2020.
2. Urge state public utility commissions to prioritize energy efficiency, demand reduction, and renewable energy sources.
3. Urge state and federal governments to establish new policies to remove the disincentive for utilities to invest in energy efficiency, demand management, and renewable energy.
4. Create federal and state financial incentives for energy efficiency and renewable energy, including federal tax subsidies for renewable energy production.
5. Urge federal support for technology development, including solar energy, battery technologies, and clean vehicles.
6. Expand the Regional Greenhouse Gas Initiative to the District of Columbia and Virginia.
7. Work with jurisdictions exporting electricity into the metropolitan Washington region to encourage investments in clean, low-greenhouse-gas-emitting energy sources.
8. Promote equitable subsidies for different sources of energy (e.g., nuclear versus renewable).

[1] Cool School programs are designed after Cool Cities or Cool Counties programs, with the goal of enlisting organizations to set and achieve greenhouse gas emission reduction goals.

[2] See: http://www.farmtoschool.org/index.php. Such programs connect schools with local farms with the objectives of serving healthy meals in school cafeterias, improving student nutrition, providing health and nutrition education opportunities, and supporting local small farmers.

Chapter 6
Mitigating Emissions From Transportation and Land Use

Emissions from transportation are approximately 30 percent of the overall 2005 regional CO_2 emission inventory (Figure 18). Thus, the ability of the transportation sector to reduce emissions will have a large bearing on the region's ability to meet its greenhouse gas emission reduction goals.

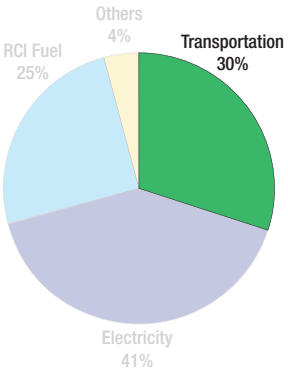
Greenhouse gas emissions from the transportation sector are caused by vehicle combustion of fossil fuels. According to the U.S. EPA Office of Transportation and Air Quality, in addition to CO_2, automobiles produce methane (CH_4) and nitrous oxide (N_2O) from the tailpipe, as well as hydrofluorocarbon (HFC) emissions from leaking air conditioners. On average, CH_4, N_2O, and HFC emissions represent roughly 5–6 percent of the GHG emissions from passenger vehicles, while CO_2 emissions account for 94–95 percent, accounting for the global warming potential of each greenhouse gas (U.S. EPA 2008f). Tailpipe emissions also vary with speed.

The region is growing by many measures, resulting in increases in transportation greenhouse gas emissions. Between 2002 and 2008, population, households, and employment have grown by approximately 11 percent each, increasing the number of vehicle trips from 20 million to 22 million per day and total vehicle miles traveled (VMT) from 146 million to 160 million miles per day. According to 2007 data from the COG Cooperative Forecasts, the fastest rate of growth in the region is occurring in the outer suburbs, leading to significant increases in VMT and congestion in these areas (MWCOG 2007c, MWCOG 2008b). Based on current BAU projections of growth in population, housing, and employment, total emissions from transportation in the region will increase by 38 percent by 2030 and 47 percent by 2050.

Note that population growth estimates and employment forecasts are based on historical trends and do not account for potential behavior change (travel behavior and demand for housing) due to increasing energy prices. Recent evidence suggests that due to higher prices in the first part of 2008, consumers dramatically changed lifestyles, including driving habits (Woolard 2008). To the extent that public transit use increases and VMT declines over time, there could be significant impacts on tax revenue, transit demand and funding, and land-use patterns. When COG compiles a plan for meeting the 2020 regional goal, it will include a review of the VMT reduction potential, including the effects of price on travel behavior.

Figure 18. Transportation Sector Share of Regional Greenhouse Gas Emissions: 2005

The transportation sector accounts for approximately 30 percent of greenhouse gas emissions in the metropolitan Washington area.



There are three ways to reduce transportation greenhouse gas emissions:

- *increase vehicle fuel efficiency,*
- *reduce the carbon content of fuel* (e.g., use alternative fuels, such as biofuels, lower-carbon gasoline, hybrid-electric vehicles, or advanced fuel cells run on hydrogen), and
- *reduce VMT.*

Each of these strategies will play a role in helping the region reduce greenhouse gas emissions from the transportation sector, and most also offer co-benefits, including

improved air quality, increased opportunity for walking and bicycling, and reduced traffic congestion. This chapter explores projected trends in transportation and land use in the region, discusses current initiatives for reducing VMT and greenhouse gas emissions, and offers recommendations for adopting new transportation and land-use guidelines that will help reduce greenhouse gases and the risk of climate change.

Projected Transportation and Land Use Trends in the Metropolitan Washington Region

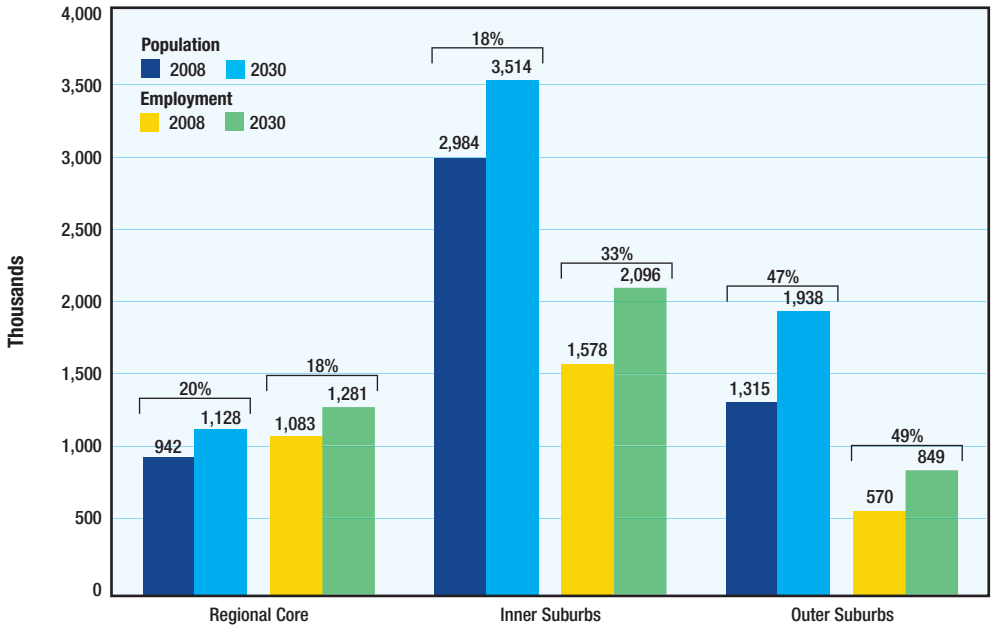
POPULATION AND EMPLOYMENT WILL INCREASE SIGNIFICANTLY

Between 2005 and 2030, according to COG's most recent Cooperative Forecast (Round 7.1), regional economic growth is projected to generate nearly 39 percent additional jobs, attracting approximately 64,000 new residents a year and fueling increased demand for transportation options. Most of the population growth will be in Fairfax, Loudoun, Montgomery, and Prince William counties. Population in the outer suburbs will experience the fastest growth rate—a 47 percent increase by 2030, compared to 18–20 percent in the regional core and inner suburbs (Figure 19) (MWCOG 2007c and 2008b).

The region is anticipating a population/employment imbalance by 2030, which is expected to increase traffic congestion and VMT. According to COG's report *Growth Trends to 2030: Cooperative Forecasting in the Washington Region*, between 2005 and 2030,

Figure 19. Projected Changes in Regional Population and Employment: 2008–2030

Between 2008 and 2030, regional economic growth will generate nearly 39 percent additional jobs, attracting approximately 64,000 new residents a year and fueling increased demand for transportation options. Most of the population growth will be in Fairfax, Loudoun, Montgomery, and Prince William counties. Population in the outer suburbs will experience the fastest growth—a 47 percent increase by 2030, compared to 18–20 percent in the regional core and inner suburbs.



Source: TPB and MWCOG 2008.

the regional shares of population and household growth for the outer suburbs will be 46 and 40 percent, respectively (MWCOG 2007c). However, local planners do not anticipate sufficient job growth within the outer jurisdictions to provide employment for all of the new residents located there. The regional share of employment growth in the outer suburbs during this period will be only 28 percent. This imbalance is expected to cause more commuter trips from the outer jurisdictions to jobs in the regional core and inner suburbs. This problem is likely to be exacerbated by the lack of adequate transit facilities servicing the outer suburbs.

VMT AND TRANSIT AND HIGHWAY CONGESTION WILL CONTINUE TO RISE UNDER BAU

VMT is a function of several different factors, including land-use patterns, access to and availability of alternative transportation choices, fuel prices, other fees and taxes that affect the cost of driving, congestion, and individual lifestyles and behavior. Only 30 percent of the region's employment growth and 20 percent of its household growth are expected to occur near Metrorail and commuter rail stations (TPB and MWCOG 2006). Transit work trips are forecast to increase by 31 percent, as a rising number of people commute to work, exacerbating current crowding problems on the Metrorail system. The assumptions of the COG forecasts may need to be revisited to better reflect the anticipated change in behavior of households in the region, given energy cost trends and the possible effects of the current financial crisis. As the region grows, traffic and transit congestion, vehicle trips, VMT, congested lane miles, and greenhouse gas emissions all will continue to rise in the absence of actions to reduce transportation emissions.

FUEL EFFICIENCY AND NEW FEDERAL STANDARDS WILL FALL SHORT OF THE REGIONAL REDUCTION TARGETS

The Washington metropolitan region ranks high in the purchase of hybrid vehicles, but has a fairly low average fleet fuel economy (approximately 17 miles per gallon [mpg] in 2005). The National Capital Region Transportation Planning Board (TPB) analyzed the 2007 federal corporate average fuel economy (CAFE) requirements contained in the Energy Independence and Security Act of 2007 to assess the impact on the region's efforts to achieve greenhouse gas reduction targets. The 2007 federal energy bill will improve overall new vehicle fleet fuel economy through 2020 to 35 mpg for cars and light trucks. TPB's analysis indicates that while the 2007 CAFE requirements will provide significant CO_2 emission reductions, they will be insufficient to achieve the 2020 regional greenhouse gas emission reduction goal. The analysis shows that mobile-source CO_2 emissions will still exceed 2005 levels by 7.8 percent in 2020 and 8.1 percent in 2030 (Table 9). This represents a large improvement over the baseline, but falls far short of the 20 percent decrease by 2020 and the 40 percent decrease by 2030 that would be consistent with the proposed regional targets.

Furthermore, the gradual increase in the fleet-wide mileage requirement for new vehicles under CAFE will end in 2020, so the beneficial effects between 2020 and 2030 will be due only to continuing turnover of the vehicle fleet. Also, the CAFE requirements apply only to light-duty vehicles, which account for about 80 percent of regional CO_2 emissions; heavy-duty vehicles, which contribute the remaining 20 percent, are unaffected.[8]

[8] The Energy Independence and Security Act of 2007 (EISA) states that the U.S. Department of Transportation must conduct a study on fuel efficiency standards for heavy-duty trucks. EISA also requires that fuel efficiency standards be raised beyond 35 mpg to the "maximum feasible" level after model year 2020. The TPB "What would it take?" scenario assessment, which is currently ongoing, will address this issue.

Table 9. CO_2 Emissions From Cars, Trucks, and Buses (in millions)

By themselves, the 2007 CAFE requirements will not reduce greenhouse gas emissions sufficiently to meet the region's targets for reducing greenhouse gas emissions. Mobile-source CO_2 emissions will still exceed 2005 levels by 7.8 percent in 2020 and 8.1 percent in 2030. This represents a large improvement over the baseline, but falls far short of the 20 percent decrease by 2020 and the 40 percent decrease by 2030 that would be consistent with the proposed regional goal.

Scenarios	2005	2020	2030
Baseline Emissions (BAU)	**24.89**	**31.02**	**34.45**
Absolute change from 2005 levels	—	6.13	9.56
% change from 2005 levels	—	24.6%	38.4%
Emissions With CAFE Reductions	**24.89**	**26.83**	**26.91**
Absolute change from 2005 levels	—	1.94	2.02
% change from 2005 levels	—	7.8%	8.1%
COG CCSC Proposed Regional Goal	**24.89**	**19.91**	**14.93***
Absolute change from 2005 levels	—	–4.98	–9.96
% change from 2005 levels	—	–20%	–40%*

BAU = business as usual CAFE = corporate area fuel economy; COG = Metropolitan Washington Council of Governments; CCSC = Climate Change Steering Committee.

*Interpolated from the 2050 goal of 80% reduction.

Note: All figures are million tons of CO_2 emissions in the metropolitan Washington 8-hour ozone nonattainment area.

Additional improvements will be needed to meet regional reduction targets. The analysis shows that the fleet average fuel economy would need to be significantly higher than the new CAFE requirements to achieve the regional reduction goal for the transportation sector, assuming no other actions to reduce VMT or fuel use. Clearly, it will take some combination of further increases in fuel economy, shifts to alternative fuels that generate less life-cycle CO_2 emissions (e.g., plug-in hybrids), and reductions in VMT to reach the CO_2 goals currently under discussion. If approved, the California Low-Emission Vehicle Phase II (CA LEV-II) program could provide further improvements in fleet fuel efficiency.

Current Regional Initiatives for Reducing Transportation Emissions

The metropolitan Washington region has been working to reduce VMT since the early 1970s, when the Commuter Club was formed. In 1996, the program became known as Commuter Connections. Commuter Connections promotes a variety of programs to reduce the number of single-occupancy vehicles on the road and to promote mass transit.

PUBLIC TRANSIT RIDERSHIP IS INCREASING

The Washington metropolitan region has a vast network of transit options, including Metrorail and Metrobus, local bus transit, commuter rail (VRE and MARC), and commuter bus. Energy price trends and employer incentives, coupled with improved transit access (including an increase in mixed-use and walkable community projects), have resulted in increased transit ridership. Also, employers are encouraging public transit by identifying employees' home locations served by public transit; keeping current transit schedules on hand and posted; arranging meetings with public transit operators to assist them in developing transit support programs (Guaranteed Ride Home, SmartBenefits, etc.) and transit use monitoring programs; and arranging for the implementation of SmartBenefits for employees.

BICYCLE/PEDESTRIAN INITIATIVES ARE GROWING

The bicycle/pedestrian plan adopted by the TPB in 2006 contains a list of projects designed to improve bicycle and pedestrian capacity throughout the region. Some large transportation projects, such as the Woodrow Wilson Bridge, include bicycle and pedestrian paths in their plans. In addition, higher priority is being placed on pedestrian safety and access. The District of Columbia and Arlington County have recently launched a bike-sharing program, and bike racks and lockers are now common features within the mass transit system.

TELEWORKING IS ON THE RISE

In 2004, COG and the Greater Washington Board of Trade announced an aggressive 20 percent telecommuting goal for the public and private sectors, toward which significant progress has been made. As a result of this and other initiatives, employers throughout the region are allowing their employees to work at home, at a telework center, or at an employer's satellite office during an entire workday, instead of traveling to their regular place of work. In 2007, more than 450,000 workers (>18%) in the region were teleworking at least one day a week, reducing traffic congestion and air pollution, increasing the area's economic vitality, and bolstering overall quality of life. According to COG estimates, for every 10 percent of employees who telework an average of 1.3 days a week, commuter trips are reduced by about 2–3 percent.

RIDE-SHARING SERVICES ARE GROWING IN POPULARITY

Ride-sharing services enable commuters to find other individuals who share similar commute routes and work hours. A free list of all alternative commuter options is available in the region through Commuter Connections at *http://www.commuter connections.org* or by calling 800-745-RIDE. Also, upon request, Commuter Connections can provide data to identify potential carpool and vanpool partners. Ride-sharing benefits include savings in fuel costs and overall expenses, reduced traffic congestion and wear and tear on roads, access to high-occupancy vehicle lanes, and reduced pollution and greenhouse gas emissions. Ride sharing with a guaranteed ride home component will reduce commuter trips by 0.5–3 percent.

TRANSIT-ORIENTED DEVELOPMENT IS INCREASINGLY BEING PROMOTED

State and local governments in the metropolitan Washington region are promoting transit-oriented development (TOD) in several ways. State governments are investing state funds in transit station area planning initiatives and assisting with infrastructure improvements that facilitate transit access. Local governments are also promoting TOD through targeted infrastructure improvements, as well as developer incentives in local zoning and permitting processes. These can include density credits, reduced parking requirements, and even financing collaboration. Such efforts encourage the efficient use of land around transit stations and stops, where residents and workers can access their homes and jobs without using a car.

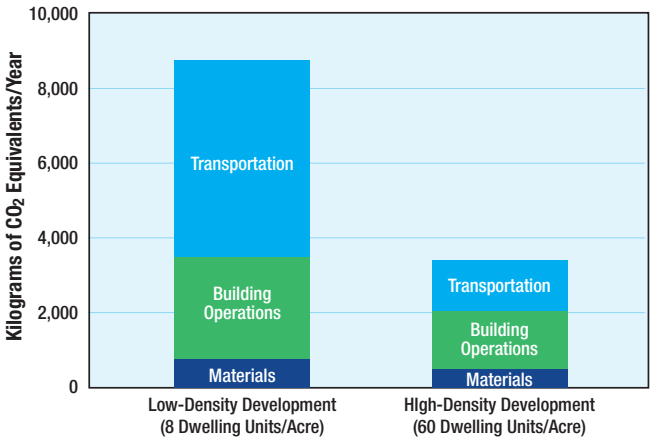
JURISDICTIONS ARE FACILITATING CONCENTRATED, MIXED-USE DEVELOPMENT

Localities in the metropolitan Washington region are facilitating concentrated, mixed-use development through comprehensive planning of activity centers and use of various tools and regulatory authority to steer growth to preferred locations. Although there may be a time lag in realizing the benefits of smart growth, pursuing a strategy of concentrated, mixed-use development around the region can significantly reduce the

region's development footprint, mitigating the environmental impacts of growth and decreasing reliance on automobile travel. Analysis in the recently published *Growing Cooler: The Evidence on Urban Development and Climate Change* suggests that 20-40 percent reductions in emissions are possible for individual mixed-use developments that are near transit options (Ewing et al. 2007). A 2006 Canadian study (Figure 20) suggested as much as a 50 percent reduction in emissions from compact high-density development compared to lower density (Norman et al. 2006, as presented by Schilling 2008).

Figure 20. Per Capita Greenhouse Gas Comparison for Low- and High-Density Development in Toronto, Canada

A strategy of concentrated, mixed-use development can significantly reduce the region's development footprint, mitigating the environmental impacts of growth and decreasing reliance on automobile travel.



Source: Norman et al. 2006 as presented by Schilling 2008.

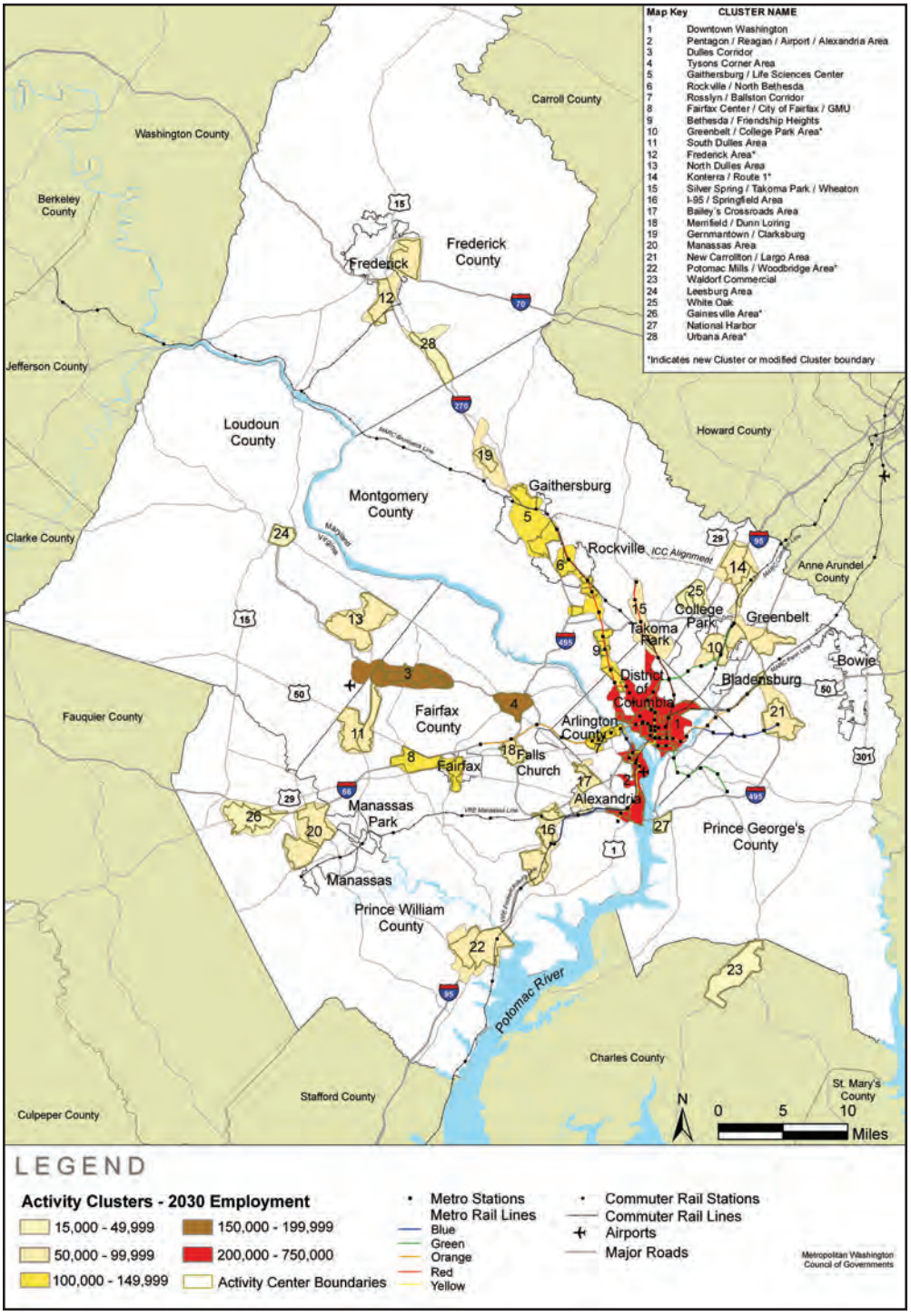
HOUSEHOLD AND EMPLOYMENT GROWTH WILL BE CONCENTRATED IN REGIONAL ACTIVITY CENTERS AND CLUSTERS

At the TPB's request, COG's Planning Directors Technical Advisory Committee developed the initial regional activity centers between January and July of 1999. The current set of revised activity center maps is based on COG's *Round 7.0a Cooperative Forecasts*—the adopted growth projections for the COG member jurisdictions—and *The Financially Constrained Long-Range Transportation Plan* (CLRP) (MWCOG 2005, TPB and MWCOG 2008).

Area governments are using the maps and tables to encourage land-use and transportation policies that promote more concentrated regional growth patterns and trends. They do not preclude development, but encourage "smarter" development by attempting to inform coordinated transportation and land-use decision making. According to COG estimates, the highest percentages of jobs and households in corridors of activity centers are in the central jurisdictions of Alexandria and Arlington, Virginia, and the District of Columbia. Between 2005 and 2030, 54 percent of household growth and 72 percent of employment growth will be concentrated in regional activity clusters (MWCOG 2007c) (Figure 21). Significant benefits could occur if much higher percentages of household and employment growth take place in the regional activity clusters.

Figure 21. Metropolitan Washington Regional Activity Centers and Clusters: 2030

According to COG estimates, the highest percentages of jobs and households in activity clusters (corridors of activity centers) are in the central jurisdictions of Alexandria and Arlington, Virginia, and the District of Columbia. Between 2005 and 2030, 54 percent of household growth and 72 percent of employment growth will be concentrated in regional activity clusters. Much higher percentages of growth in the regional activity clusters will result in significant greenhouse gas reduction benefits.



Transportation Planning Options for Meeting Regional Greenhouse Gas Emission Reduction Goals

The TPB is developing a "What would it take?" analysis, to assess what combinations of actions would achieve the regional targets for reducing greenhouse gas emissions. The TPB is considering strategies, including higher fuel efficiency and alternative fuel use; reducing VMT and congestion through compact growth, pricing, and greater transit mode choice; and evaluating the impacts of more infill and mixed-use development and supportive transit projects and policies. Based on the results of this analysis, which is expected to be concluded by February 2009, the TPB will identify regional policies and plans to meet regional greenhouse gas emission reduction goals for the transportation sector. This will be followed by public outreach and comment on the completed analysis until June 2009, a timeline that aligns with the four-year CLRP update cycle required under the Safe, Accountable, Flexible, Efficient Transportation Equity Act, which will occur next in 2010. This 2010 update will include several major changes to the CLRP and will provide a timely opportunity to incorporate the results produced by the "What would it take?" study and associated public comment in the regional long-range transportation plan. The results of this work will be factored into the 2012 plan.

Further information on local jurisdiction transportation initiatives and best practices in the Washington region is presented in CCSC's February 2008 report *National Capital Region: Best Practices and Policies to Reduce Greenhouse Gases* (MWCOG 2008a).

Recommendations for Reducing Regional Greenhouse Gas Emissions From Transportation and Land Use

Reducing greenhouse gas emissions from transportation and land use is a significant challenge in the face of anticipated growth in the region. The main strategies being considered, presented in Table 10, are increasing fuel efficiency, lowering the carbon intensity of fuels/vehicles, and reducing VMT through a number of strategies, including smart growth planning, shifting transportation modes for existing trips, and reducing the number or length of trips.

Table 10. Recommendations for Reducing Regional Greenhouse Gas Emissions from Transportation and Land Use

Local and Regional Strategies for Government and Business

A. Increase Fuel Efficiency and Use of Clean Fuel Vehicles

1. Promote clean-fuel vehicles (cars, trucks, buses).
   - Promote/accelerate the adoption of efficient clean-fuel vehicles, including hybrids (cars, trucks, and buses). Identify and implement incentive programs to promote purchase of new high-mileage vehicles.
   - Evaluate options for promoting California Low-Emission Vehicle Phase II (CA LEV-II) standards that reduce greenhouse gas emissions, or extending federal corporate average fuel economy (CAFE) requirements past 2020 and expand to cover heavy trucks.
   - Evaluate facilitating adoption of high-mileage vehicles through incentives and tax policies.
   - Assess the benefits from a "Cash-for-Clunkers" program and rebates or tax incentives for the purchase of hybrid vehicles.
2. Adopt a regional green fleet policy.
   - Establish a regional green fleet policy with measurable goals and timetables. Target public and private fleets, transit, tax cabs, rental cars, and refuse haulers. Evaluate the benefits of specific "green fleet" conversion percentages.
   - Evaluate a regional goal for public fleets of accelerating achievement of federal CAFE standards.
3. Promote the use of clean fuels.
   - Further explore alternative-fuel vehicles, such as biofuel-, electric-, or hydrogenpowered vehicles.
   - Strengthen financial and other incentives (e.g., tax rebates) to encourage residents to purchase alternative-fuel vehicles.
   - Conduct planning for alternative-fuel infrastructure needed to support alternative-fuel vehicle technology implementation (e.g., natural gas, hydrogen, electricity).
   - Strengthen financial and other incentives to encourage development of alternative-fuel infrastructure.
   - Explore a state or regional renewable fuels standard.

B. Reduce Vehicle Miles Traveled (VMT)

1. Adopt VMT reduction goals.
   - Collaborate with the TPB to develop cost-effective VMT reduction goals for 2012 and 2020 and associated options for meeting the goals that help achieve regional greenhouse gas emission reduction targets.
   - Evaluate the potential greenhouse gas emission reduction benefits and costs of using financial incentives (e.g., pay-as-you-travel insurance, tolling, or congestion pricing) to reduce VMT.
   - Identify the percentage of auto trips under 3, 2, 1, and ½ miles; develop a strategy to shift half of these trips to bike, pedestrian, or transit modes; and evaluate the benefits of such a shift.
2. Expand transit use (incentives, exclusive transit lanes).
   - Examine options to promote the increased use of existing transit capacity.
   - Evaluate funding requirements for transit incentives and an expanded metrocheck program.
3. Invest in expanding transit infrastructure.
   - With the Washington Metropolitan Area Transit Authority, MARC, VRE, and the local transit operators, evaluate the greenhouse gas reduction benefits of specific incremental expansion of transit capacity and commuter rail service.
   - Evaluate the greenhouse gas reduction benefits of expanding existing and establishing new exclusive bus transit routes, lanes, on-ramps, corridors, and intercity high-speed rail.
4. Expand commuter options (car sharing, bicycle/pedestrian, financial incentives).
   - Building on the accomplishments of Commuter Connections, develop specific targets for shifting modes from single-occupancy vehicles to transit, walking, and bicycling for commuting and noncommuting trips.
   - Expand existing and fund new programs to enhance access to transit and alternativemodes, Commuter Connections, guaranteed ride home, telework programs, bike/pedestrian access, and park/ride lots.
   - Fully fund the construction of bicycle/pedestrian paths in the region, as outlined in the regional bicycle/pedestrian plan. (See: *http://www.mwcog.org/transportation/activities/planning/*.
   - Provide incentives to developments that speed improvements in bicycle/pedestrian access, including improvements in sidewalks, curb ramps, crosswalks, and lighting.
   - Address the need for on-road bicycle accommodations and facilities.
   - Promote regional implementation of a SmartBike program similar to the Zipcar concept.
5. Promote transit-oriented development (TOD) and concentrate future growth in regional activity centers.
   - Evaluate the benefits from achieving a range of possible goals (up to 95 percent) for directing new residential and commercial growth to designated regional activity centers, including growth around transit as well mixed-use, higher-density development.
   - Encourage local governments to evaluate opportunities to provide incentives (including zoning changes) to encourage mixed-use development, including workforce housing at transit stations and hubs to reduce sprawl and VMT.
   - Encourage localities to revisit current land-use plans, in light of current shifts in the real estate market, coupled with high energy costs.
   - Establish TOD as the region's preferred growth strategy.
6. Examine parking policies to reduce VMT.
   - Examine parking policies and their relation to VMT, and implement new parking policies to reduce VMT.
   - Strengthen financial and other incentives (e.g., tax rebates, higher parking costs, and transit benefits) to encourage residents to drive less.
   - Advocate for federal income tax benefits for transit use that equal or exceed the benefits for employer-provided or -subsidized parking.

Table 10. Recommendations for Reducing Regional Greenhouse Gas Emissions from Transportation and Land Use, *continued*

C. Increase Travel Efficiency

1. Adopt best practices for traffic engineering improvements and road management to reduce VMT and congestion. Identify locations of significant recurrent congestion, and prioritize investments to reduce congestion.
2. Implement the Metropolitan Area Transportation Operations Coordination Program to improve coordination among transportation agencies for data sharing and incident management.
3. Enforce existing idling regulations.
4. Explore opportunities to reduce emissions from the aviation sector.
5. Explore opportunities to reduce emissions from the freight sector, including considerations of shifting freight from trucks to rail.

D. Improve Land Use

1. Prepare a tree canopy preservation plan to meet the goal of increased tree canopy.
   - Evaluate the associated benefits and costs.
   - Consider associated issues related to density and height requirements for buildings.
2. Evaluate Leadership in Energy and Environmental Design for Neighborhood Development (LEED-ND) standards for new development.
3. Carefully plan the location and design of new, infill, and redevelopment projects.
   - Promote regional policies that support walkable communities and affordable housing near transit, and that protect green infrastructure.
4. Integrate greenhouse gas analyses into comprehensive planning and new capital projects.
   - Quantify projected greenhouse gas emissions from major new transportation and other new capital projects.
   - Identify best practices enabling local governments to include greenhouse gas reduction and energy efficiency and conservation as elements in their local comprehensive planning.
   - Include practices in local comprehensive plans that address climate change risk reduction and guide local zoning, building codes, site planning, and review.
   - In cooperation with COG's Planning Directors Technical Advisory Committee and local government environmental and energy planners, convene a working group to devise a consistent, standard methodology for evaluating the greenhouse gas emissions from proposed individual development projects.
   - Encourage new commercial construction to include a "travel management plan."

E. Develop a Regional Metropolitan Planning Process

1. Develop a regional metropolitan planning process for addressing greenhouse gases.
   - Collaborate with the TPB to evaluate how a process modeled after the current regional metropolitan planning process for transportation and air quality planning might be adapted to address greenhouse gas emissions.
2. Make greenhouse gas reduction a stated goal of regional transportation planning activities, including the newly launched multi-stakeholder Greater Washington 2050 initiative,[1] poised to generate additional growth scenarios, a growth compact, and quality growth strategies.
3. Consult with other regions around the country to broadly evaluate options for regional approaches to greenhouse gas reductions that include cap-and-trade and other approaches that might be relevant to our region (e.g., California SB 375), or that might be under consideration in upcoming national climate, energy, or transportation legislation.

Advocacy (State and Federal Levels)

A. Increase Fuel Efficiency and Use of Clean-Fuel Vehicles

1. Promote CAL LEV-II.
2. Extend CAFE past 2020 and include heavy-duty trucks.
3. Support incentives for fuel-efficient and alternative-fuel vehicles.
4. Support incentives for early vehicle retirement.

B. Reduce VMT

1. Urge lawmakers to increase investment in transit.
2. Evaluate financial incentives, such as pay-as-you-travel insurance, and road management to reduce VMT and congestion.
3. Advocate for federal income tax benefits for transit use that equal or exceed the benefits of employer-provided or -subsidized parking.

[1] Available at: http://www.greaterwashington2050.org/.

Chapter 7

Positioning the Region for Green Economic Development

Employment in the metropolitan Washington region is projected to grow by 39 percent by 2030. What types of jobs will be created in the next 20–25 years? Are we adequately training our workforce to assume these positions? What is the potential for environmental protection, greenhouse gas reduction, and green energy development to become a major economic driver and job creator in the region? This chapter briefly discusses the types of green businesses and jobs being created and recommends how the region might take advantage of the economic and employment opportunities they present (Table 11).

The Region Leads the Nation in Environmental Services Employment

Currently the Washington region has the largest environmental services employment pool in the country, with nearly 14,000 environmental workers, according to the Greater Washington Board of Trade. As the location of the headquarters of EPA and hundreds of environmental consulting firms and organizations, the region has a plethora of environmental scientists, biologists, lawyers, lobbyists, and other professional staff. Increasingly, however, policymakers are recognizing the opportunity to create "green collar" jobs at all skill levels.

Green Businesses Can Provide Entry-Level and Transitional Employment

The Center for American Progress views green job creation as an opportunity to create middle-skill jobs that serve as entry-level or transitional jobs for urban residents (CAP 2008). This may include jobs in manufacturing, construction, and operations and maintenance (e.g., wind turbine manufacturing, solar panel installation, energy efficiency retrofits, and green building construction). In 2007, 6,000 new jobs were created nationally in the field of solar energy, with many in construction and manufacturing (Resch 2008). The American Wind Energy Association estimates that 500,000 new jobs (both direct and induced) have been created in the wind power industry (U.S. DOE 2008b). According to industry estimates, in 2006, there were 8.5 million jobs nationwide in renewable energy and energy efficiency (ASES 2007).

Public Policy Can Stimulate the Green Economy and Green Employment

Public policy plays an important role in stimulating the green economy and creating new green jobs. The passage and expansion of renewable portfolio standards and increased purchases of renewable energy, for instance, have been important drivers for new investments in renewable energy, drawing major companies to the industry, including British Petroleum, General Electric, Sharp, and Shell Oil Company. Europe has experienced tremendous growth in green jobs as a result of accelerated investments in renewable energy. The looming threat of peak oil, coupled with potential federal and

state climate change legislation, is shifting the economics of the green sector, and it appears we are on the brink of a major green economic explosion, both nationally and regionally.

The District of Columbia Office of Planning has recently evaluated the employment needs of emerging and existing environmental industries and has determined how they can create career ladders for unemployed or underemployed residents of Washington, D.C. The analysis could be expanded to the entire region, and would most likely demonstrate a huge economic opportunity.

The Delaware Valley Regional Planning Commission conducted an economic analysis in 2006 of new economic development opportunities for the Philadelphia region. The analysis concluded the commission needed to develop "eco-industry clusters," promote location efficiency and smart growth, and "eco-brand" the Delaware Valley. The commission is currently working on a green jobs inventory, to evaluate the different categories and classes of potential jobs. An economic analysis of this type would be beneficial for the Washington region.

Based on recommendations from stakeholders in the region, it is envisioned that COG could draw on its economic development expertise to identify appropriate private-sector actors (e.g., chambers of commerce, (local) trade associations, (local) labor unions, D.C. Business Improvement Districts, neighborhood business associations, and (local) professional associations), and convene a meeting under the auspices of the COG Climate Change Program to identify green job goals and criteria.

Table 11. Recommendations for Promoting Green Jobs and Green Economic Development in the Metropolitan Washington Region

Economic Development
1. Promote green businesses and jobs. • In collaboration with the business community, support and identify programs to promote green businesses and green-collar job development in the region, including a green jobs inventory. • Examine incentives for promotion of green businesses, and develop an information database.
2. Promote eco-business zones. • Develop best practices or model regional policies to promote local government implementation of eco-business or green business zones.
3. Promote cooperative green purchasing.
4. Promote local vendors and suppliers. • Identify best practices to promote local vendors. • Promote local vendors and suppliers to reduce transportation-related emissions associated with imports of goods and services. • Promote local food production options to reduce emissions. Coordinate with the statewide farm-to-school programs.
5. Promote green jobs analysis. • Evaluate the potential for expanding the District of Columbia's green jobs analysis to the region. • Identify green job goals and criteria.

Chapter 8
Preparing for the Impacts of Climate Change

The full scope of the impacts of climate change on the Washington region is yet to be analyzed. Risks and costs are critical to any set of decisions that will require an investment of substantial resources. That said, it's not too early for the region to begin a systematic investigation of high-priority program areas and initiate early planning. Table 12 presents recommendations for adapting to the risks of climate change in the region.

Maryland has been actively addressing adaptation priorities and opportunities, but so far has focused mainly on coastal areas, which are particularly vulnerable. Virginia has also begun to assess the potential damage climate change could have on its coastal areas, agriculture, and recreational resources.

Jurisdictions across the nation are undertaking a variety of actions to adapt to the impacts of climate change (Box 1). In the Washington metropolitan region, local governments and water and wastewater utilities are taking steps to quantify and reduce their carbon footprint, and are beginning to face choices to directly address the current and potential impacts of climate change.

Research is needed on the potential impacts of climate change on the Washington region. Several universities in the area have expertise in the subject and could assist in analyzing impacts and risks to the region's transportation infrastructure, buildings, and populations in low-lying areas. The university partners could research adaptation strategies leading to developing regional adaptation policies. In addition, a series of Regional Adaptation Workshops would be useful in sharing the findings of the adaptation research. Some suggested topics for the workshops follow.

Box 1. Adaptation Planning Across the Nation

A substantial amount of adaptation planning is already underway elsewhere in the nation. Following are some examples from a recent survey of the types of impacts and areas of adaptation being addressed (Heinz 2007).

BOSTON is examining bridge scour, energy use, public health, flooding, sea level rise, wind damage to buildings, transportation, and water quality and supply.

CHICAGO is looking at climate change impacts on aviation, buildings, energy demand, lake level increase, public health, transportation, and water supply.

FORT COLLINS, COLORADO, is planning to address flooding and water supply.

KING COUNTY, WASHINGTON, is focusing on biodiversity and ecosystems, climate science, economic impacts, land use, buildings and transportation, public health, safety, and emergency preparedness.

A **LOS ANGELES** climate change action plan emphasizes massive tree planting to counteract heat-island effects and acknowledges the need to address drought, wildfires, sea level rise, and public health.

NEW YORK is addressing air quality, flooding, heat waves, sea level rise, and heat islands.

Workshop 1: Capacity of the Regional Water Supply to Withstand a Prolonged Drought

Explore the long-term (2030 and beyond) prospects for sufficient water supply in the event of an unprecedented drought, coupled with the anticipated regional population growth-related rise in demand.

Workshop 2: Vulnerability of Infrastructure, Residences, and Other Buildings to Increased Wind and Flood Risks

Assess the risk that current building codes may be inadequate for future conditions. (Site-planning regulations generally prohibit development in flood-prone areas, as delineated by Federal Emergency Management Agency floodplain maps.)

Workshop 3: Vulnerability to Spikes in Heat and Air Pollution

Assess the capacity of the region's emergency response and health care systems to respond to acute increases in heat and air pollution.

Workshop 4: Opportunities for "No Regret Actions"[9] That Provide Benefits Beyond Climate Change

Drawing on the experience of other locales, explore opportunities to take actions (such as reducing demand for energy and water and expanding tree cover) that generally align with other program priorities, and also provide mitigation and/or adaptation benefits.

Table 12. Recommendations for Adapting to the Risks of Climate Change in the Region

Adaptation
1. Research best practices to prepare for effects of climate change.
2. Develop a regional climate adaptation plan to assist localities with vulnerability assessments, adaptation planning, and emergency preparedness.
3. Partner with universities to research climate change and adaptation strategies. • Review analysis of the expected changes in the region prepared by area universities. • Prepare a report on the expected changes to the region between now and 2050 as a result of climate change and possible adaptation strategies.
4. Analyze impacts on and risks to the region's transportation infrastructure, buildings, and populations in low-lying areas.
5. Develop regional adaptation policies. • Inventory academic resources and develop partnerships with area universities and others to develop recommendations for possible adaptation strategies based on the results of the adaptation research efforts, including policies for infrastructure, land use, and emergency response planning.
6. Conduct adaptation workshops. Partnering would include insurance companies and the area's major infrastructure agencies (wastewater, water supply, storm water, transit).

[9] This term was coined by Dr. Robert Wilkinson, University of California–Santa Barbara. It is descriptive of such initiatives as Los Angeles's massive tree-planting campaign.

Chapter 9

Establishing Mechanisms for Financing the Up-Front Costs of Reducing Regional Emissions

While no study has yet been completed on the economic implications of reducing greenhouse gas emissions in the metropolitan Washington region, national and international studies indicate the cost of reducing emissions is far less than the cost of responding to changes anticipated to occur as a result of global warming. A review of the economics of climate change, written by the British Chancellor, indicates that dealing comprehensively with climate change would cost about 1 percent of the gross domestic product (GDP), but the failure to address climate change would cost 20 percent of the GDP, or more (Stern 2006). EPA projects the Lieberman-Warner climate bill would affect U.S. regional GDP by less than 3 percent, with the greatest impact on the Plains States (U.S. EPA 2008b). EPA did not evaluate economic benefits.

Reducing greenhouse gases in the Washington region presents significant economic growth opportunities and many co-benefits. A national study performed by McKinsey Global Institute for Ceres, an organization devoted to enhancing corporate responsibility, concluded that investments in energy efficiency of $170 billion would yield a profit of 17 percent, or $29 billion a year (McKinsey 2008, Ceres 2008). Energy efficiency investments, to date, already support 1.6 million jobs nationally (ACEEE 2008a). Local greenhouse gas reduction actions can help the region stabilize energy demand, diversify energy supply, lower utility bills, improve air quality, create more walkable community designs, and provide the region the chance to develop its impressive transit system, green collar workforce, and green building and technology base.

Nevertheless, there will be up-front costs and growing pains associated with the shift to cleaner energy sources and greener technologies and practices. The Congressional Budget Office, for instance, has indicated a greenhouse gas cap-and-trade program could disproportionally affect people at the lower end of the economic scale and industries that use energy intensively. Government, at all levels, will be called upon to buffer the up-front costs associated with the transition to a low-carbon future. From a local government perspective, new staff positions may have to be created, new capital costs may be incurred, and tax revenue may be lost in rebates, tax breaks, and grants to businesses and residents to assist the transition to a cleaner energy economy.

Sample Mechanisms for Financing Local Climate Change Efforts

Area governments have several options for covering the costs associated with climate change activities, some of which follow. COG can play an important role in keeping local governments well informed about alternative financing mechanisms, in creating economies of scale, and in helping local governments take advantage of the clean energy economy. Table 13 presents recommendations for evaluating alternative financing mechanisms for local governments.

REDIRECT UTILITY SAVINGS INTO NEW MITIGATION EFFORTS

When energy prices rise, the savings a local government can incur through energy efficiency improvements and the installation of renewable energy could be considerable. Instead of crediting the general fund, savings on local government utility bills could be redirected to new climate change mitigation activities.

FUND UP-FRONT IMPROVEMENTS THROUGH A THIRD-PARTY CONTRACTOR

Using energy performance contracting and the energy savings, for example, an energy services company can supply up-front financing for local government energy efficiency/renewable energy improvements, with the associated benefits shared between the contractor and the local government to repay the initial investment.

CREATE A DEDICATED FUND FROM A VARIETY OF SOURCES

The District of Columbia is considering a measure that would create a Sustainable Energy Utility, funded by an assessment on the electric and natural gas utilities, to incentivize and help fund energy efficiency and renewable energy improvements on the consumer level. Maryland has established a Strategic Energy Fund to support energy enhancements (including "early action items"), which will be supported by proceeds from RGGI, a cap-and-trade system for electricity-generating plants in participating states in the Northeast and Mid-Atlantic regions.

CREATE PARTNERSHIPS WITH LOCAL UTILITIES

Pepco, in conjunction with Hannon Armstrong and the Virginia Polytechnic Institute and State University, has created the Energy Efficiency Partnership of Greater Washington, which has dedicated $500 million to finance energy efficiency improvements in buildings over the next five years. Expanding this partnership and creating other innovative financing partnerships with utilities to implement energy efficiency improvements and demand management activities show tremendous promise for reducing greenhouse gas emissions and saving energy.

Table 13. Recommendations for Evaluating Alternative Financing Mechanisms for Local Governments

Financing Mechanisms
1. Evaluate financing mechanisms for energy efficiency projects (energy fee, tax, other). • Redirect savings from energy efficiency to further reduce greenhouse gas emissions. • Establish an energy fee/carbon tax. • Use performance contracting. • Help localities access federal and state climate change funding. • Develop a financing seminar on creative financing mechanisms, such as energy performance contracting, incentives, subsidies, rebates, tax breaks, and cap-and-trade systems.
2. Establish a clean energy fund.
3. Participate in cap-and-trade program revenues.
4. Develop a regional carbon offset fund for preserving tree canopy.
5. Secure additional financing for public transit.
6. Establish funding for building retrofits, building on the Energy Efficiency Partnership of Greater Washington. • Conduct a study of regional green economic development opportunities. • Evaluate a regional program for providing funding for residential energy efficiency and demand reduction retrofits.

INTEGRATE CLIMATE CHANGE INTO JOB RESPONSIBILITIES

Some jurisdictions might view climate change as such an important priority that it warrants integration into existing job responsibilities or reassignment of existing staff to new activities. Greenhouse gas reduction objectives could serve as an overlay on the existing work plans of environmental specialists, public works professionals, facility managers, and land-use planners. A central coordinator might be needed to help oversee these activities.

CREATE ECONOMIES OF SCALE

By working together, area local governments may get reduced prices for new energy technologies and services. Montgomery County has a cooperative wind purchase, open to area local governments, which could be expanded. COG recently conducted a reverse energy auction to optimize the price of purchasing natural gas, a model that could be investigated for application to renewable energy.

COG also coordinates a cooperative purchasing program on behalf of its member jurisdictions, as well as school boards, local governments, commissions, and agencies throughout the region, including the Washington Metropolitan Area Transit Authority, the Metropolitan Washington Airports Authority, and a number of the region's water and sewer authorities. The primary purpose of the program is to provide an opportunity for the approximately 50 participating organizations to save money on purchasing commodities and services through economies of scale and reduced administrative costs. The jurisdictions can cooperatively purchase through a single solicitation issued by one of the participating jurisdictions on behalf of all of the other participating jurisdictions, or a jurisdiction can "ride" another jurisdiction's contract that has the COG Rider Clause. Cooperative purchasing is always voluntary, and is most successfully used for purchasing commodities in large volumes.

SECURE STATE AND FEDERAL ASSISTANCE

Localities in Maryland will most likely benefit from the proceeds accumulated through the state's participation in the RGGI cap-and-trade program. The federal Energy Independence and Security Act of 2007 authorized Energy Efficiency Block Grants to fund a variety of local government activities related to greenhouse gas reduction. COG has worked to help secure passage of and funding for these local grants.

ESTABLISH A CARBON FEE OR UTILITY TAX

Local governments may want to consider creating a new carbon tax or local utility fee that could support new greenhouse gas reduction activities. For example, in 2007 Arlington County adopted a local residential utility tax that is expected to raise $1.5 million. Montgomery County has also adopted an energy tax and carbon surcharge.

DEVELOP A REGIONAL CARBON OFFSET PROGRAM

COG could consider developing a regional carbon offset program, whereby local governments or businesses could support greenhouse gas reduction activities in other parts of the region. In some cases, a locality or business may determine that purchasing a regional offset is cheaper than establishing a greenhouse gas reduction program. COG could also help localities identify opportunities for supporting local offset projects, such as preserving or increasing the region's tree canopy. The Greater Washington Board of Trade is also evaluating a promising carbon offset program called "Carbon Cut."

Voluntary carbon offset programs are growing rapidly, with sales reaching $91 million in 2006, and are projected to grow over 10 times by 2010 (Gillenwater et al. 2007). High-quality carbon offsets could play a role in providing cost-effective greenhouse gas emission reductions in the near to medium term in the region. However, as climate change has become a higher national priority, voluntary carbon offset markets have become more popular and valuable, which has led to renewed scrutiny from consumers, environment advocates, state and federal regulators, and Congress, largely due to quality-control concerns. As a result, these concerns may reduce support for using offsets to reduce greenhouse gas emissions.

The main problem with the existing voluntary offset market is that there is no standardized regulation of offsets. Ensuring the quality of offsets will most likely be a more important issue than setting the price of offsets. The issues that determine the quality of offsets include additionality, permanence, third-party certification and verification standards, and avoidance of double counting (M.J. Bradley 2008). In short, any voluntary carbon offset program that the region develops should be very transparent, should result in real and high-quality greenhouse gas emission reductions, and should be independently audited or verified routinely. Also, to avoid double counting of emission reductions, the region's supply needs to be clearly separate from its voluntary climate targets.

The nonprofit Clean Air-Cool Planet has extensive experience with offset programs. In 2006, it developed the following list of questions that consumers should ask when purchasing offsets, and that the metropolitan Washington region should keep in mind as it develops any offset programs:

- Do current voluntary carbon reduction commitments impede the ability to generate "additional" offsets?
- Do your offsets result from specific projects?
- Do you use an objective standard to ensure the additionality and quality of the offsets you sell?
- How do you demonstrate that the projects in your portfolio would not have happened without the greenhouse gas offset market?
- Have your offsets been validated against a third-party standard by a credible source?
- Do you sell offsets that will actually accrue in the future? If so, how long into the future, and can you explain why you need to "forward sell" the offsets?
- Can you demonstrate that your offsets are not sold to multiple buyers?
- What are you doing to educate your buyers about climate change and the need for climate change policy?

PROVIDE FUNDING FOR PUBLIC TRANSIT

The recent increase in gasoline prices experienced in the first part of 2008, among other factors, has led to increased transit ridership. To provide a reliable, timely public transit service, the region's public transit must be funded sufficiently to maintain the system and to expand the system as ridership and demand increase. The cities and counties in the region need to advocate for federal support of transit funding to guarantee a continuing high level of service for the region's growing needs.

Chapter 10

Launching a Regional Outreach and Education Initiative

Addressing the challenge of climate change will require changing individual and institutional lifestyles and behaviors to consume less energy and to prepare for the effects of climate change. A sustained outreach and communications effort will be essential to achieving the region's greenhouse gas reduction targets by changing government, commercial, and residential energy consumption and promoting alternatives to motor vehicles for personal transportation.

The Public Is Concerned

Studies of American public opinion indicate a growing concern about climate change. A Massachusetts Institute of Technology comparative study of national opinion found a dramatic shift in concern between 2003 and 2006. In 2003, global warming was ranked sixth on a list of ten environmental problems; in 2006, it was ranked first (Curry 2007). A 2007 Pew Center study found a majority of people interviewed said that global warming is a problem that requires immediate government action (Pew 2007). However, despite the evidence of concern, the studies show a lack of public understanding of the causes and nature of climate change, and confusion about how actions and technologies contribute to global warming.

Consumers Can Help Achieve the 2012 Target

Consumer choices and actions offer potential for reducing emissions to achieve the near-term regional reduction target of 10 percent below business as usual by 2012. Individual and household behavior patterns ranging from home heating to daily commuting are largely responsible for much of the emissions in the region from energy and transportation use. Taking steps as simple as turning off lights or installing a compact fluorescent light bulb can reduce energy use and electric bills (see Table 5). Save the Planet.org, the Environmental Defense Fund, the Natural Resources Defense Council, the Sierra Club, and other organizations offer advice for reducing energy in the home and office and while traveling.

Partnerships with regional stakeholders, businesses, and institutions will be necessary to implement most of the recommendations to achieve the regional greenhouse gas emissions targets. An outreach and communication effort is needed to improve public understanding and encourage collaborative efforts to reach the region's goals.

Commuter Connections, Clean Air Partners, Go Recycle, and Wise Water Use are four of COG's social marketing programs. These programs were designed by professional marketing consultants appealing to a defined audience to produce a specific outcome. With the help of consultants, COG measures the success of the marketing programs and periodically revises messages, timing, or media based on measured performance. Social marketing research provides substantial evidence for the type of audience, the message, and the medium that are most effective in producing the desired behavior. COG is currently partnering with George Mason University to explore the potential for encouraging individual behavior changes to reduce greenhouse gas emissions.

The recommendations in Table 14 address the need to improve public understanding and encourage collaborative efforts to address climate change in the region.

Table 14. Recommendations for Regional Outreach and Education

Outreach and Education
1. Implement a regional public education campaign. • Encourage participation in Cool Capital Challenge, Cool Counties, Cool Cities, Local Governments for Sustainability, and Climate Communities. • Develop a "Top 10 Things You Can Do" list that encourages individual energy efficiency activities; alternative commuting; retiring older, less efficient vehicles; replacing old appliances; replacing incandescent light bulbs with compact fluorescent or LED bulbs; etc. • Partner with Clean Air Partners greenhouse gas emission reduction campaign and other regional campaigns. • Partner with Commuter Connections on promotion of alternative commuting options. • Establish a regional "Climate Action Week" to coincide with September "Car Free" activities or other appropriate events. • Host a community outreach event at the COG offices that would be televised to help promote the region's climate change initiative.
2. Develop regional partnerships with private-sector and other organizations. • Partner with the Greater Washington Board of Trade Green Committee and the Potomac Conference to assist businesses with taking action to reduce greenhouse gas emissions and implement best practices. • Identify regional environmental and community group partners. • Partner with electric, gas, and water utilities on regional energy conservation and energy efficiency outreach. • Partner with schools, universities, and local governments to establish the region as a leader in green teaching. • Partner with schools, universities, and local governments abroad to find and apply innovative lessons about climate mitigation, renewable energy, and energy efficiency.
3. Support COG member outreach efforts. • Assist COG members with education and information on climate change, best practices, and related technical assistance. • Create a "Regional Climate Leaders" annual awards program to recognize public- and private-sector leadership. • Maintain and enhance the COG Climate Change Web site.

Moving Forward

Chapter 11

Establishing an Organizational Structure for COG's Climate Change Initiative

The Climate Change Steering Committee Has Successfully Responded to Its Board Charge

Part of the COG Board Resolution R31-07 included a charge to the Climate Change Steering Committee (CCSC) to provide a recommendation on "any need for a long-term organizational structure for the regional climate change initiative" (see Appendix A).

CCSC has been meeting regularly since May 2007. As provided in this report, CCSC has completed the following major assignments from the Board:

- Prepare a report cataloging best practices and greenhouse gas reduction activities already underway in the region.
- Prepare an inventory of greenhouse gas emissions in the region for 2005 through 2050.
- Recommend greenhouse gas emission reduction goals for 2012, 2020, and 2050.
- Examine local impacts of climate change on the region and conduct an initial review of adaptation strategies.
- Prepare regular advocacy recommendations for consideration by the Board, including recommendations on federal energy and climate change legislation, Maryland and Virginia energy legislation, and endorsement of the grassroots greenhouse gas reduction campaign "Cool Capital Challenge," and send a letter of concern regarding a proposed coal-fired power plant in Wise, Virginia.
- Track the work of the Maryland and Virginia climate commissions.

COG's Regional Climate Change Initiative Should Continue

This report contains a series of recommendations that may be classified as policy principles, policy positions, specific or quantitative action proposals, and proposals requiring further analysis or research that could lead to specified action in the future. CCSC believes that, while it has satisfied the essential elements of its assignments under Resolution R31-07, a regional climate change initiative (Table 15) should continue indefinitely at COG for the following reasons:

- The region's climate is already changing. Even with aggressive action nationally and globally, significant change is likely to occur at least through the middle of this century. There is a clear need for a regional program to be in place as the climate evolves, to help shape policy, address impacts, formulate adaptation strategies, and analyze options for mitigating climate change.

- Climate change remains a very high-profile issue for COG's members, the District of Columbia, the state of Maryland and Commonwealth of Virginia, the U.S. Congress, the business community, the majority of the states, and internationally. It clearly is very high on the regional agenda; therefore, it appropriately must remain a high priority for COG.
- Climate change is a cross-cutting issue that affects all of COG's major program areas: environment, transportation, metropolitan development and regional planning, public health, public safety, and human services. An ongoing climate change program is and can be an integrative and synergistic force to help achieve COG's overarching goal of supporting initiatives to enhance the region's quality of life.
- CCSC is recommending regional greenhouse gas emission reduction goals for 2012, 2020, and 2050. While CCSC has identified a number of initiatives that will help meet the recommended goals, preparation of detailed recommendations for achieving these goals, including the associated analysis required for many of the goals, warrants continuation of the regional climate change initiative.
- Tracking progress and refining the regional climate action plan warrant continuation of the regional climate initiative.
- Successful advocacy on behalf of the interests of COG's members necessitates an active climate change program at COG.
- The Greater Washington 2050 Coalition has identified climate change as a central driver that will shape the region and regional policies for years to come. A supporting structure for climate change is essential for assisting the coalition's work.

COG Should Create a Climate and Energy Policy Committee

CCSC considered several options for continuing COG's climate change initiative:

- Establish a Regional Climate Action Public-Private Partnership housed at COG.
- Incorporate climate change into the Metropolitan Washington Air Quality Committee.
- Merge climate change with the Greater Washington 2050 Coalition.
- Incorporate climate change into a regional COG Environmental Policy Committee.
- Incorporate climate change into a regional COG Climate and Energy Policy Committee.

CCSC concluded that the last option above, formalizing the creation of a COG Climate and Energy Policy Committee reporting to the COG Board, is the preferred option at this time (Table 16). Membership on the Climate and Energy Policy Committee should be broader than the current CCSC membership and should be open to elected and senior policy officials from all COG member governments. In addition, state and federal agencies, the business, environmental, and civic communities, and other potential stakeholders, including liaisons from other COG policy committees, should be invited to participate. The Climate and Energy Policy Committee would be assigned oversight for COG's existing technical committees on energy (the Energy Advisory Committee) and green building (the Intergovernmental Green Building Group), and would be supported by COG's Alternative Fuels Partnership.

The fundamental roles of the Climate and Energy Policy Committee would be to (1) supervise and facilitate the implementation of the recommendations contained in this report, (2) direct the design and development of a regional climate change outreach program, (3) provide ongoing recommendations on advocacy positions on climate and energy policy, and (4) assist other COG policy committees and the Greater Washington 2050 Coalition as required.

Several Other Recommendations May Warrant Consideration

CCSC believes that several of the other recommendations are also potential options for future consideration as regional and national policy evolves.

- A public-private partnership may very well be an outgrowth of this effort, given the huge role the community and private sector must play to achieve the regional climate change goals recommended in this report.
- If federal law and regulation require preparation of regional greenhouse gas reduction plans analogous to regional air quality implementation plans, the responsibility might appropriately be assigned to the Metropolitan Washington Air Quality Committee, perhaps with somewhat augmented representation.
- Once the work of the Greater Washington 2050 Coalition is completed, further consideration of the structure would be appropriate.
- While not the recommended approach at this time, the possibility of creating an overarching regional environmental policy committee or other entity that integrates across the various environmental programs should be reconsidered in the future. As of now, the nature of the work programs for COG's Chesapeake Bay and water resources, air quality, climate and energy, and aviation policy have required dedicated committees to address the significant number of policy and technical issues. However to facilitate effective communication, coordination, and programmatic efficiency, periodic forums or leadership meetings should be considered as a means of ensuring better integration of cross-cutting policy development across the various committees.
- The Climate and Energy Policy Committee should consider and recommend actions to help individual jurisdictions meet the regional goals, including:
  - A regional standardized reporting mechanism for baseline emissions data, on a jurisdictional basis;
  - Voluntary agreement by individual jurisdictions on targeted reductions; and
  - An annual report to the COG Board on progress toward the regional reduction targets.

Table 15. Recommendations for COG Climate Change Initiative

COG Climate Change Initiative
1. Create a permanent COG Climate Change Initiative.
2. Establish a COG Board Climate and Energy Policy Committee to provide oversight and direction for the initiative, with a broad membership from COG members, and participation from state and federal representatives, and broad business and stakeholder representation.

Chapter 12

Guiding COG's and the Region's Future Climate Change Program

This report contains a series of analyses and recommendations that provide a framework and structure to guide COG's and the region's climate change program. Three science-based but, nevertheless, aggressive regional greenhouse gas reduction goals will be established as a major outcome from CCSC's work during the past year. The analytical work, consensus building, and associated plan for achieving these goals and related initiatives will be the central focus for work over the coming months and years. Crafting a regional outreach effort, tracking progress, and continuing to advocate regional positions on national, state, and local policies are also integral to the success of the regional climate initiative. In some areas of the work during the past year, such as the examination of likely climate impacts on the region and potential adaptation strategies, CCSC only had time for an initial examination. It is essential that such work be carried out as part of the next phase of the effort.

Governments, Organizations, Businesses, and Individuals Are Taking Action

COG's climate change initiative is not being conducted in isolation, but rather in a rapidly changing political and technical environment. In January 2009, there will be a new President. The U.S. Congress will soon be actively considering national climate change cap-and-trade legislation that may result in national climate policy guidance and funding authorizations shaping U.S. climate programs for at least several decades. Putting a price on carbon will almost certainly accelerate efforts to reduce greenhouse gas emissions.

Maryland has already taken a number of far-reaching steps toward reducing greenhouse gas emissions, including publishing a *Climate Action Plan* (MDE 2008b). Virginia's Commission on Climate Change is scheduled to make recommendations in December 2008. In both states, actions are probable in the next legislative session. The District of Columbia is actively considering creating a Sustainable Energy Utility, and has state-of-the-art green building requirements in place that will dramatically change the landscape for energy efficiency. The District of Columbia is promoting green jobs and pedestrian- and bicycle-friendly communities that may become regional and national models. Many of COG's local government members are leading by example by actively pursuing cutting-edge policies on energy efficiency and conservation, smart-growth development, building conservation improvements, fleet enhancements, use of green power (i.e., renewable energy), and other actions. The National Capital Region Transportation Planning Board is actively assessing a range of policies and measures focused on meeting the regional greenhouse gas reduction goals that could profoundly change transportation planning in the region. Continuing volatility in gas prices and more broadly energy prices that seem likely to persist, leading to changes in behavior as well as hopefully leading to new and much more efficient and environmentally friendly technology.

COG's Greater Washington 2050 initiative is looking broadly at regional growth and development policies, many of which are likely to be driven by climate change considerations. Continued work on the regional climate program will help inform the

Greater Washington 2050 Coalition's efforts to craft a new regional compact to guide the region's growth and development in the years ahead.

After holding its October 2007 "Green as a Competitive Advantage" conference, the Greater Washington Board of Trade's created a "Green Committee" of 30 leaders from the top companies in the region. The committee is now actively working with the region's business community to take action to reduce regional greenhouse gas emissions and support environmentally friendly policies. A partnership between government and the private sector is critical to achieving the regional greenhouse gas emission reduction goals.

Creating green jobs, implementing energy- and climate-friendly patterns of growth and development, and investing in new energy-efficient technology represent exciting business opportunities that are expected to contribute greatly to the continued vitality of the regional economy. In a region with the most educated workforce in the country, the Washington metropolitan area will undoubtedly be in the forefront of addressing the imperatives associated with climate change and helping shape national policy.

Individuals are also taking action. One mechanism CCSC has endorsed, the "Cool Capital Challenge," has provided a way for individuals as well as public and private entities to commit to steps to reduce their contribution to greenhouse gas emissions. People are purchasing energy-efficient light bulbs and appliances, conserving energy at home, and changing their travel modes and vehicles. That the Washington region is a leader in ownership of hybrid-electric vehicles is just one indicator of individual commitment across the region.

Given that approximately 96 percent of the greenhouse gas emissions in the region come from the daily activities of individuals and businesses, participation in the regional effort to reduce greenhouse gas emissions is fundamental to its ultimate success. Through a combination of new technology, new patterns of growth, and changes in transportation modes and in the way we do business as individuals and in our places of work, the region can move forward toward achieving its collective climate change goals.

Near-Term Recommendations Will Be the Focus in the Coming Year

The recommendations contained in this report fall broadly into several categories. Certain recommendations, such as the regional greenhouse gas emission reduction goals, are quantitative and time-specific. A significant number of the recommendations set the direction for regional policy, but require further analysis to support a definitive and quantifiable proposal—for example, setting a regional green power purchase goal or VMT reduction goal. Other recommendations reflect policy principles to guide the region and COG's members as the climate change program moves forward.

A number of the recommendations can be carried out in the near term, while others will take more time. Most of the recommendations will be best achieved in partnership with regional stakeholders.

The emission reduction benefits and costs also vary greatly, as well as the economic co-benefits associated with many of the initiatives. The financial feasibility and priority rankings of many of the recommendations are still to be determined.

To help define the work program in the coming year and beyond, CCSC has developed the matrix presented in Table 17, which contains, classifies, and analyzes all of the recommendations included in this report. The matrix provides a sense of implementation timing, with many of the initiatives listed as having an immediate time frame. The

initiatives identified as immediate necessarily will be the focus in the next year. In addition, a list of recommendations for local governments leading by example is provided in Appendix D, and advocacy positions in Appendix E.

Implementation Plans and Tracking and Reporting Progress Will Be Necessary

The establishment of regional greenhouse gas emission reduction goals for 2012, 2020, and 2050 creates an imperative to develop detailed plans for achieving the goals, as well as tracking progress toward the goals.

In the coming year, as the climate change initiative proceeds with implementing actions that can move ahead or are moving ahead now, coupled with evaluating and quantifying additional emission reduction efforts, a plan or building blocks of a plan can be developed that demonstrate how the region is moving toward achieving its goals. Actions by the states as well as by COG's members will need to be enumerated, in some cases reconciled, and incorporated into a regional progress report and ultimately a regional plan. A system for quantitatively tracking progress, through updating the regional greenhouse gas emissions inventory, will need to be devised. CCSC recommends periodic reviews of progress, at least once every three years during the initial phase of the program.

Additional Financing Will Be Necessary for COG's Climate Change Initiative

There is a need for additional funding support to fully execute the work tasks identified in the recommendations. Significant funding exists in COG's fiscal year (FY) 2009 and proposed FY 2010 environmental and transportation planning work programs and budgets to support much of the staff work required to advance the regional climate change initiative and carry out many of the recommendations contained in this report. However, more resources are needed. Additional funding will be sought from foundation sources and government agency grants to enable earlier action and more complete implementation of the program covered in this report. A detailed work program and funding plan should be crafted by early 2009 to help target potential funding sources to support the initiative. In-kind contributions from partners and stakeholders could help carry out some of the work; these opportunities need to be identified. Consultant support may also be needed to supplement the capacity of the COG staff.

Table 16. Recommendations for the COG Climate Change Program

COG Climate Change Program
1. Establish a COG Climate and Energy Policy Committee. Seek additional resources and funding.
2. Develop work program priorities, schedule, staffing plan, and budget.
3. Prepare regional plans to achieve the 2012 and 2020 reduction goals. Prepare the 2012 plan by Fall 2009. Initiate preparation of the 2020 plan by December 2009.
4. Evaluate the cost-effectiveness of the proposed measures.
5. Design an outreach and education program.
6. Track state and federal climate and energy initiatives, and develop and advance regional advocacy positions.
7. Develop a system for tracking progress toward greenhouse gas emission reduction goals and periodically review targets.
8. Develop a regional standardized analytical methodology for use by individual local governments in developing their greenhouse gas emission inventories.
9. Prepare an annual progress report to the COG Board of Directors on implementation progress for COG's Climate Change Initiative.

Table 17. Recommendations: Summary and Qualitative Assessment

Recommendations	Emission Impact	Implementation Timing	Cost	Economic Co-Benefits	Potential Partners
I. Regional Greenhouse Gas Reduction Goals					
1. 2012: Reduce 10 percent below BAU	Medium	Immediate	Low	Medium–High	COG members; fleet, energy, and building managers; general public; boards of trade; procurement officers; water and wastewater utilities, electric utilities, PUCs; state legislatures; federal government; private sector; others
2. 2020: Reduce 20 percent below 2005	High	Mid-range–Long-term	Low–Medium	Medium–High	COG members; fleet, energy, and building managers; general public; boards of trade; procurement officers; water and wastewater utilities, electric utilities, PUCs; state legislatures; federal government; private sector; others
3. 2050: Reduce 80 percent below 2005	High	Mid-range–Long-term	Medium–High	Medium–High	COG members; fleet, energy, and building managers; general public; boards of trade; procurement officers; water and wastewater utilities, electric utilities, PUCs; state legislatures; federal government; private sector; others
II. Energy					
Local/Regional Strategies for Government and Business					
A. Improve Energy Efficiency in Buildings					
1. Implement a COG Green Building Policy.	High	Immediate–Mid-range	Varies	Medium–High	COG members, IGBG, facilities managers, GSA, USGBC, private sector
2. Set energy performance goals for new and existing govt. buildings.	High	Immediate–Mid-range	Varies	Medium–High	COG members, IGBG, facilities managers
3. Identify best practices to reduce local govt. energy use by 15 percent by 2012.	Medium–High	Immediate–Mid-range	Low–Medium	High	COG members, COG Energy Advisory Committee, state energy offices, utilities, universities, businesses, general public, ACEEE
4. Develop incentives for retrofitting existing commercial and residential buildings.	High	Immediate–Mid-range	Varies	Medium–High	COG members, IGBG, facilities managers, GSA, USGBC
5. Develop affordable energy efficiency programs for homeowners and businesses.	Medium–High	Immediate–Mid-range	Low-Medium	High	COG members, utilities, state energy offices
6. Promote use of energy-efficient appliances.	Medium–High	Immediate-Mid-range	Medium–High	Low-Medium	COG, Clean Air Partners, Commuter Connections, Wise Water, COG Recycling Committee, IGBG
7. Revise state and/or local building codes to promote energy efficiency.	Medium–High	Immediate–Mid-range	Low–Medium	High	COG members, COG Energy Advisory Committee, state energy offices, utilities, universities, businesses, general public, ACEEE
8. Develop green affordable housing policies/programs.	Medium–High	Immediate–Mid-range	Varies	Medium–High	COG members, IGBG, facilities managers, housing directors, MDPC, planning directors, GSA, USGBC
9. Identify best practices for improving efficiency for public and private buildings.	High	Immediate–Mid-range	Varies	Medium–High	COG members, IGBG, facilities managers, GSA, USGBC
B. Reduce Demand for Energy					
1. Partner with electric, gas, and water utilities on regional energy conservation.	Medium–High	Immediate–Mid-range	Low–Medium	Medium–High	COG members, EPA ENERGY STAR®, USGBC, boards of trade, utilities
2. Expand recycling programs.	Low–Medium	Immediate–Mid-range	Varies	High	COG members, COG Recycling Committee

Table 17. Recommendations: Summary and Qualitative Assessment, *continued*

Recommendations	Emission Impact	Implementation Timing	Cost	Economic Co-Benefits	Potential Partners
B. Reduce Demand for Energy, continued					
3. Reduce energy use at area water and wastewater treatment plants and landfills.	Medium–High	Mid-range–Long-term	Medium–High	Medium–High	COG members, wastewater treatment facilities, landfills, EPA
4. Promote energy-efficient street lights across the region.	Low–Medium	Immediate	Medium–High	Medium	COG members, energy managers, utilities, boards of trade, private sector
5. Promote regional energy performance contracting and cooperative purchasing.	Low–Medium	Immediate–Mid-range	Medium–High	Medium	COG members, energy managers, state energy offices, utilities, private sector
6. Explore opportunities to remove the disincentive for utilities to invest in energy conservation.	Medium–High	Immediate–Mid-range	Low–Medium	High	State energy offices, state PUCs, utilities, state legislatures
C. Promote Clean Energy Sources					
1. Adopt a goal of 20 percent renewable energy purchase by local governments by 2015.	Medium–High	Immediate–Mid-range	Medium–High	Medium	COG members, COG Energy Advisory Committee, EPA Green Power Partnership, energy managers, utilities, procurement officers
2. Evaluate regional cooperative purchase to meet the 20 percent local government renewable energy purchase goal.	Low–Medium	Immediate–Mid-range	Medium–High	Medium	COG members, COG Energy Advisory Committee, EPA Green Power Partnership, energy managers, utilities, procurement officers
3. Examine options for removing barriers to implementing renewable energy (e.g., solar panels).	Low–Medium	Immediate–Mid-range	Medium–High	Medium	State legislatures, county leadership, state PUCs, utilities, COG Energy Advisory Committee, DOE
4. Explore the possibility of implementing a community energy planning process in the region.	Medium–High	Mid-range–Long-term	Medium	Medium–High	COG Energy Advisory Committee, utilities, energy managers
5. Develop a regional inventory of renewable energy capacity and production, including solar, geothermal, district heating/cooling, wind, and biofuels.	Low	Immediate–Mid-range	Low	Medium	COG Energy Advisory Committee, utilities, energy managers
D. Reduce Greenhouse Gas Emissions					
1. Identify and implement best practices to reduce methane and biosolids from wastewater treatment facilities.	Medium–High	Mid-range–Long-term	Medium–High	Medium–High	COG members, water and wastewater treatment facilities, landfills, EPA
2. Develop industry standard protocols to quantify greenhouse gas emissions and reductions for drinking water and wastewater utilities.	Medium–High	Mid-range–Long-term	Medium–High	Medium–High	COG members, water and wastewater treatment facilities, landfills, EPA, ICLEI, WRI
III. Transportation and Land Use					
Local and Regional Strategies for Government and Business					
A. Increase Fuel Efficiency and Use of Clean-Fuel Vehicles					
1. Promote clean-fuel vehicles (cars, trucks, buses).	High	Immediate–Mid-range	Medium–High	High	COG members, state legislatures, fleet managers, auto manufacturers, AFV partnerships
2. Adopt a regional green fleet policy.	Medium–High	Immediate–Mid-range	Medium–High	Medium–High	COG members, state legislatures, fleet managers, auto manufacturers, AFV partnerships
3. Promote the use of clean fuels.	Medium–	Immediate–Mid-range	Medium–High	Medium–High	COG members, state legislatures, fleet managers, auto manufacturers, AFV partnerships

Table 17. Recommendations: Summary and Qualitative Assessment, *continued*

Recommendations	Emission Impact	Implementation Timing	Cost	Economic Co-Benefits	Potential Partners
B. Reduce Vehicle Miles Traveled (VMT)					
1. Adopt VMT reduction goals.	Medium–High	Mid-range–Long-term	Medium–High	Low–Medium	COG members, TPB, DOTs, local govt., transit authorities
2. Expand transit use.	Low–Medium	Immediate–Mid-range	Low–Medium	Medium–High	COG members, Commuter Connections, TPB, DOTs, local govt., transit authorities
3. Invest/expand transit infra-structure.	Medium–High	Mid-range–Long-term	Medium–High	Medium–High	COG members, transit authorities, TPB, DOTs
4. Expand commuter options.	Low–Medium	Immediate–Mid-range	Medium–High	Low–Medium	COG members, local govt., Zipcar, Flexcar
5. Promote transit-oriented development.	Low–Medium	Immediate–Mid-range	Medium–High	Medium–High	COG members, TPB, DOTs, local govt., transit authorities
6. Examine parking policies to reduce VMT.	Low–Medium	Immediate–Mid-range	Medium–High	Low–Medium	COG members, state/local govt.
C. Increase Travel Efficiency					
1. Adopt best practices for traffic engineering improvements and road management to reduce VMT and congestion.	Low–Medium	Mid-range–Long-term	Varies	High	COG members, DOTs, TPB
2. Implement the Metropolitan Area Transportation Operations Coordination Program.	Low	Immediate	Medium	High	COG members, DOTs, TPB
3. Enforce existing idling regulations.	Low–Medium	Immediate	Low–Medium	Low–Medium	COG members, local govt., police
4. Explore opportunities to reduce emissions from the aviation sector.	Medium	Immediate–Mid-range	Medium–High	Medium–High	Airlines, MWAA, fleet managers
5. Explore opportunities to reduce emissions from the freight sector.	Medium	Immediate–Mid-range	Medium–High	Medium–High	Railroads, American Trucking Association, shippers, TPB, DOT
D. Improve Land Use					
1. Develop plan to meet goal of increased tree canopy.	Low–Medium	Mid-range–Long-term	Low–Medium	High	COG members, state and local forestry agencies, U.S. Forest Service, Casey Trees, Center for Chesapeake Communities
2. Evaluate LEED-ND standards for new development.	Medium–High	Immediate–Mid-range	Medium	Varies	COG members, planning directors, MDPC, TPB, boards of trade, DOTs, WMATA
3. Carefully plan the location and design of new, infill, and redevelopment projects.	Low–Medium	Midrange–Long-term	Medium–High	Varies	COG members, MDPC, planning directors, local planning agencies, local developers
4. Integrate GHG analyses into comprehensive planning and new capital projects.	Low–Medium	Immediate–Mid-range	Low–Medium	Medium–High	COG members, MDPC, planning directors, local planning agencies, local developers
E. Develop a Regional Metropolitan Planning Process					
1. Develop a regional metropolitan planning process for addressing greenhouse gases.	Medium–High	Mid-range–Long-term	Medium–High	Medium–High	TPB, MWAQC, DOT, EPA, state air agencies, state legislatures, Congress
2. Make greenhouse gas reduction a stated goal of regional trans-portation planning activities.	Medium–High	Mid-range– Long-term	Medium–High	Medium–High	TPB, DOTs, boards of trade, NVTC, WMATA
3. Consult with other regions around the country to broadly evaluate options for regional approaches to greenhouse gas reductions.	Medium–High	Mid-range– Long-term	Medium–High	Medium–High	TPB, DOTs

Table 17. Recommendations: Summary and Qualitative Assessment, *continued*

Recommendations	Emission Impact	Implementation Timing	Cost	Economic Co-Benefits	Potential Partners
IV. Economic Development					
Local and Regional Strategies for Government and Business					
1. Promote green businesses and green jobs.	Low	Immediate–Mid-range	Medium–High	Medium–High	COG members, boards of trade, universities, Sustainable Business Alliance
2. Promote eco-business zones.	Low	Immediate–Mid-range	Medium–High	Medium–High	COG members, boards of trade, universities
3. Promote cooperative green purchasing.	Low–Medium	Immediate–Mid-range	Low–Medium	Medium–High	COG members, procurement officers, boards of trade
4. Promote local vendors and suppliers.	Low–Medium	Immediate–Mid-range	Low–Medium	Medium–High	COG members, state/local govt., farmers' cooperatives, economic development authorities, COG Regional Agricultural Workgroup, community-supported agriculture, Freshfarm Markets
5. Promote regional green jobs analysis.	Low	Immediate	Low–Medium	Medium–High	COG members, boards of trade, universities, Sustainable Business Alliance
V. Adaptation					
Local and Regional Strategies for Government and Business					
1. Research best practices to prepare for effects of climate change.	Low	Immediate–Mid-range	Medium	Medium	COG members, universities, NOAA
2. Develop a regional climate adaptation plan to assist localities with vulnerability assessments, adaptation planning, and emergency preparedness.	Low	Mid-range–Long-term	Medium	Medium	COG members, utilities, state and federal govt., NOAA, private sector, universities
3. Partner with universities to research climate change and adaptation strategies.	Low	Immediate–Mid-range	Medium	Medium	COG members, universities, NOAA
4. Analyze impacts on and risks to the region's transportation infrastructure, buildings, and populations in low-lying areas.	Low	Immediate–Mid-range	Medium	Medium	COG members, universities, NOAA
5. Develop regional adaptation policies.	Low	Mid-range–Long-term	Medium	Medium	COG members, utilities, private sector, state and federal govt.
6. Conduct adaptation workshops.	Low–Medium	Mid-range–Long-term	Medium	Medium	COG members, universities, NOAA
VI. Financing Mechanisms					
Local and Regional Strategies for Government and Business					
1. Evaluate financing mechanisms for energy efficiency projects (energy fee, tax, other).	Medium–High	Immediate–Mid-range	Low–Medium	High	COG members, Chicago Climate Exchange, MD Strategic Energy Fund, block grants, Energy Efficiency Partnership of Greater Washington
2. Establish a clean energy fund.	Medium–High	Immediate–Mid-range	Low–Medium	High	COG members, Chicago Climate Exchange, MD Strategic Energy Fund, block grants, Energy Efficiency Partnership of Greater Washington
3. Participate in cap-and-trade program revenues.	Medium–High	Immediate–Mid-range	Low–Medium	High	COG members, Chicago Climate Exchange, MD Strategic Energy Fund, block grants, Energy Efficiency Partnership of Greater Washington
4. Develop a regional carbon offset fund for preserving tree canopy.	Medium	Immediate–Mid-range	Medium	Medium	COG members, state and local forestry agencies, U.S. Forest Service, Casey Trees, Center for Chesapeake Communities

Table 17. Recommendations: Summary and Qualitative Assessment, *continued*

Recommendations	Emission Impact	Implementation Timing	Cost	Economic Co-Benefits	Potential Partners
VI. Financing Mechanisms, Local and Regional Strategies for Government and Business, *continued*					
5. Secure additional financing for public transit.	Medium–High	Immediate–Mid-range	High	High	COG members, state and federal govt., WMATA
6. Establish funding for building retrofits.	Medium–High	Immediate–Mid-range	High	High	COG members, state and federal govt., ESCOs
VII. Regional Outreach and Education					
Local and Regional Strategies for Government and Business					
1. Implement a regional public education campaign.	Medium–High	Immediate–Mid-range	Medium–High	Low-Medium	COG members, Clean Air Partners, Commuter Connections, Wise Water, Recycling Committee, IGBG
2. Develop partnerships with private-sector and other organizations.	Medium–High	Immediate–Mid-range	Medium–High	Low-Medium	COG members, boards of trade, federal government, WMATA, MWAA, Cool Capitol Challenge
3. Support COG member outreach efforts.	Low–Medium	Immediate–Mid-range	Low–Medium	Low-Medium	COG members, Cool Capitol Challenge, EPA, ICLEI, Sierra Club
VIII. COG Climate Change Program					
Local and Regional Strategies for Government and Business					
1. Establish a COG Climate and Energy Policy Committee.	—	Immediate	Low–Medium	—	COG members, state/local govt.
2. Develop work program priorities, schedule, staffing plan, and budget.	—	Immediate	Low–Medium	—	COG members, state/local govt.
3. Prepare regional plans to achieve the 2012 and 2020 goals.	—	Immediate	Low–Medium	—	COG members, state/local govt.
4. Evaluate the cost-effectiveness of the proposed measures.	—	Immediate	Low–Medium	—	COG members, state/local govt.
5. Design an outreach and education program.	—	Immediate	Low–Medium	—	COG members, state/local govt.
6. Track state and federal initiatives, and develop and advance regional advocacy positions.	—	Immediate	Low–Medium	—	COG members, state/local govt.
7. Develop a system for tracking progress toward GHG goals and periodically review targets.	—	Immediate–Mid-range	Low–Medium	—	COG members, state/local govt., EPA, ICLEI, WRI, state air agencies, state energy offices, state PUCs, utilities
8. Develop a regional standardized analytical methodology for use by individual local governments in developing their greenhouse gas emission inventories.	—	Immediate–Mid-range	Low–Medium	—	COG members, state/local govt., EPA, ICLEI, WRI, state air agencies, state energy offices
9. Prepare an annual progress report to the COG Board of Directors on implementation progress for COG's Climate Change Initiative.	—	Immediate–Mid-range	Low–Medium	—	COG members, state/local govt.

Abbreviations: ACEEE = American Council for an Energy Efficient Economy; AFV = alternative-fuel vehicle; COG = Metropolitan Washington Council of Governments; DOE = U.S. Department of Energy; DOTs = state departments of transportation; ESCO = energy service company; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; govt. = government; GSA = General Services Administration; ICLEI = Local Governments for Sustainability; IGBG = Intergovernmental Green Building Group; LEED-ND = Leadership in Energy and Environmental Design for Neighborhood Development; MD = Maryland; MDPC = Metropolitan Development Policy Committee; MWAA = Metropolitan Washington Airports Authority; MWAQC = Metropolitan Washington Air Quality Committee; NOAA = National Oceanic and Atmospheric Administration; NVTC = Northern Virginia Transportation Commission; PUC = public utility commission; TPB = National Capital Region Transportation Planning Board; USGBC = United States Green Building Council; WMATA = Washington Metropolitan Area Transit Authority; WRI = World Resources Institute.

Timing: Immediate = present to June 2009; Mid-range = 3 years; Long Term = more than 3 years.

Emission Impact: Low = minimal emission reduction expected; Medium = some emission reduction anticipated; High = significant emission reduction anticipated.

Cost: Low = relatively low cost; Medium = moderate financial costs; High = expensive option to implement.

Economic Co-Benefits: Low = action will have limited impact on other areas of the economy; Medium = some economic synergies are anticipated; High = significant enhancements to the economy or sector are possible.

Reference Information

Terms and Definitions

ACEEE—American Council for an Energy Efficient Economy.

adaptation—Actions taken to prepare for and respond to the effects of climate change. Examples include building sea walls, constructing facilities at higher elevations, and expanding reservoirs.

AFV—Alternative-fuel vehicle.

AIA—American Institute of Architects.

BAU—Business as usual. A scenario assuming no additional new measures to reduce emissions.

BMP—Best management practice.

CA LEV-II—California Low-Emission Vehicle Phase II.

CAFE—Corporate average fuel economy.

CCS—Carbon dioxide capture and storage.

CCSC—Climate Change Steering Committee (Metropolitan Washington Council of Governments).

CFL—Compact fluorescent lighting.

climate change—Any long-term significant change in the "average weather" that a given region experiences. Average weather may include average temperature, precipitation, and wind patterns. It involves changes in the variability or average state of the atmosphere over durations ranging from decades to millions of years. These changes can be caused by dynamic processes on Earth and by external forces, including variations in sunlight intensity and, more recently, human activities. In recent usage, especially in the context of environmental policy, the term climate change often refers to changes in modern climate (see global warming). Current studies indicate that radiative forcing by greenhouse gases is the primary cause of global warming. Greenhouse gases are also important in understanding Earth's climate history. According to these studies, the greenhouse effect, which is the warming produced as greenhouse gases trap heat, plays a key role in regulating Earth's temperature. (Accessed at: http://en.wikipedia.org.)

CLRP—*The Financially Constrained Long-Range Transportation Plan* is a regional transportation plan prepared by the National Capital Region Transportation Planning Board. (Accessed at: http://www.mwcog.org/clrp/.)

CO_2—Carbon dioxide.

CO_2e—Carbon dioxide equivalent. Emissions of any greenhouse gas (methane, nitrous oxide, hydrofluorocarbons) can be expressed in terms of its equivalent emissions of CO_2 through adjustments using the respective global warming potential (see GWP).

COG—Metropolitan Washington Council of Governments.

Cool Counties—On July 16, 2007, at the National Association of Counties Annual Conference in Richmond, Virginia, 12 pioneering counties representing 17 million people launched Cool Counties. The initiative seeks to marshal the resources of all 3,066 counties across the nation to address the challenges climate change poses to U.S. communities. Participating counties commit to four smart actions:

- reducing our own contributions to climate change through our internal operations;
- demonstrating regional leadership to achieve climate stabilization and protect our communities;
- helping our communities become climate resilient; and
- urging the federal government to support our efforts.

CSP—Concentrating solar power.

DC—District of Columbia.

DOTs—Departments of transportation.

DTP—Department of Transportation Planning (Metropolitan Washington Council of Governments).

eGRID—Emission & Generation Resource Integrated Database (U.S. Environmental Protection Agency).

EIA—Energy Information Administration (U.S. Department of Energy).

EOR—Enhanced oil recovery.

EPA—U.S. Environmental Protection Agency.

ESCO/Energy Performance Contract—Energy service company. Firms offer up-front capital to complete energy projects and use energy cost savings as repayment.

FY—Fiscal year.

GDP—Gross domestic product.

GHG—Greenhouse gas. A gas, such as water vapor, carbon dioxide, methane, perfluorocarbons, and hydrofluorocarbons, that absorbs and re-emits infrared radiation, warming Earth's surface and contributing to climate change (see http://www.unisdr.org/eng/ library/lib-terminology-eng home.htm).

global warming—The increase in the average temperature of the Earth's near-surface air and oceans since the mid-twentieth century, and its projected continuation. The Intergovernmental Panel on Climate Change concludes "most of the observed increase in globally averaged temperatures since the mid-twentieth century is very likely due to the observed increase in anthropogenic (man-made) greenhouse gas concentrations" via the greenhouse effect. Natural phenomena, such as solar variation combined with volcanoes, probably had a small warming effect from pre-industrial times to 1950 and a small cooling effect from 1950 onward. (Accessed at: http://en.wikipedia.org/wiki/ Global_warming.)

green power—Electricity generated through non-fossil fuel sources, such as wind, solar, and geothermal energy.

GSA—General Services Administration.

$GtCO_2e$—Gigaton of carbon dioxide-equivalent.

GtC/yr—Gigaton of carbon per year.

GWP—Global warming potential is a measure of how much a given mass of greenhouse gas is estimated to contribute to global warming. It is a relative scale that compares the gas in question to that of the same mass of carbon dioxide (whose GWP is by definition 1). (Accessed at: http://en.wikipedia.org.)

HFCs—Hydrofluorocarbons.

HVAC—Heating, ventilation, and air conditioning.

ICLEI—Local Governments for Sustainability is an international association of local governments and national and regional local government organizations that have made a commitment to sustainable development. ICLEI was founded in 1990 as the International Council for Local Environmental Initiatives.

IGBG—Intergovernmental Green Building Group, a COG work group.

IPCC—The Intergovernmental Panel on Climate Change is a scientific body tasked to evaluate the risk of climate change caused by human activity. The panel was established in 1988 by the World Meteorological Organization and the United Nations Environment Programme, two organizations of the United Nations. (Accessed at: http://en.wikipedia.org.)

Kyoto Protocol—The Kyoto Protocol is an international agreement reached in 1997 in Kyoto, Japan, to address the problems of climate change. Currently 137 developing countries, including industrialized countries, have ratified the agreement. It commits 38 industrialized countries to reduce their greenhouse gas emissions, and has a target of reducing emissions to 6 percent below 1990 levels by 2012.

LED—Light-emitting diode.

LEED—Leadership in Energy and Environmental Design Green Building Rating System™.

LEED–ND—Leadership in Energy and Environmental Design–Neighborhood Development.

MARA—Mid-Atlantic Regional Assessment.

Mayor's Agreement—On February 16, 2005, the Kyoto Protocol, the international agreement to address climate disruption, became law for the 141 countries that have ratified it to date. On that day, Seattle Mayor Greg Nickels launched the U.S. Mayors Climate Protection Agreement to advance the goals of the Kyoto Protocol through leadership and action by at least 141 American cities. By the 2005 U.S. Conference of Mayors Annual Meeting in June, 141 mayors had signed the agreement. In May 2007, Tulsa Mayor Kathy Taylor became the 500th mayor to sign on. Under the agreement, participating cities commit to take following actions:

- Strive to meet or beat the Kyoto Protocol targets in their own communities, through actions ranging from anti-sprawl land-use policies to urban forest restoration projects to public information campaigns;
- Urge their state governments and the federal government to enact policies and programs to meet or beat the greenhouse gas emission reduction target suggested for the United States in the Kyoto Protocol—a 7% reduction from 1990 levels by 2012; and
- Urge the U.S. Congress to pass the bipartisan greenhouse gas reduction legislation, which would establish a national emission trading system.

MD—Maryland.

MDPC—Metropolitan Development Policy Committee, a COG committee.

mitigation—Actions taken to reduce the probability and risk of future climate change, including all measures to reduce emissions of greenhouse gases.

MMt—Million metric tons.

MMtCO_2e—Million metric tons of carbon dioxide equivalent.

mpg—Miles per gallon.

MPO—A metropolitan planning organization is a federally required planning body responsible for transportation planning and project selection in its region.

MWAA—Metropolitan Washington Airports Authority.

MWAQC—Metropolitan Washington Air Quality Committee.

MWCOG—Metropolitan Washington Council of Governments.

MWh—Megawatt-hour.

NACAA—National Association of Clean Air Agencies.

NCAR—National Center for Atmospheric Research.

NOAA—National Oceanic and Atmospheric Administration.

NSCT—National Science and Technology Council.

NVTC—Northern Virginia Transportation Commission.

PJM—The regional electricity grid operator for the Mid-Atlantic region.

PUC—Public utility commission.

PV—Photovoltaic.

RECs—Renewable energy certificates.

RGGI—The Regional Greenhouse Gas Initiative is a cooperative effort by ten northeastern and Mid-Atlantic states to reduce carbon dioxide (CO_2) emissions from electricity generating plants. RGGI includes Maryland, Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.

RPS—Renewable portfolio standards establish a minimum percentage of electricity supply that must be derived from renewable energy sources, such as solar energy or wind energy.

STAC—Scientific and Technical Advisory Committee (Chesapeake Bay Program).

TOD—Transit-oriented development.

TPB—The National Capital Region Transportation Planning Board serves as the metropolitan planning organization for the metropolitan Washington region.

UNFCCC—The United Nations Framework Convention on Climate Change is an international environmental treaty produced at the United Nations Conference on Environment and Development, informally known as the Earth Summit, held in Rio de Janeiro in 1992. The treaty is aimed at stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (or man-made) interference with the climate system. The treaty as originally framed set no mandatory limits on greenhouse gas emissions for individual nations and contained no enforcement provisions; it is therefore considered legally nonbinding. Rather, the treaty included provisions for updates (called "protocols") that would set mandatory emission limits. The principal update is the Kyoto Protocol, which has become much better known than the UNFCCC itself.

USCCSP—U.S. Climate Change Science Program.

U.S. DOE—U.S. Department of Energy.

U.S. EPA—U.S. Environmental Protection Agency.

USGBC—United States Green Building Council.

VA—Virginia.

VMT—Vehicle miles traveled.

WMATA—Washington Metropolitan Area Transit Authority.

WRI—World Resources Institute.

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Appendices

Appendix A

Resolution R31-07

Resolution R31-07
Adopted April 11, 2007

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS
777 North Capitol Street, NE
Washington, DC 20002-4290

RESOLUTION SUPPORTING DEVELOPMENT OF COG CLIMATE CHANGE INITIATIVE

WHEREAS, a growing number of local governments, including localities in the Metropolitan Washington region, are adopting strong policy resolutions calling for cities, communities and the federal government to take collective actions to reduce greenhouse gases to protect the local and global environment; and

WHEREAS, local actions can help encourage national leadership, by providing working models of greenhouse gas reduction initiatives that reinforce other high-priority policy objectives and stimulate private actions, by businesses and citizens; and

WHEREAS, the Metropolitan Washington Region has a history of supporting a clean and sustainable environment through efforts such as the Green Building Program, Energy Star, the Strategic Energy Plan, Alternative Fuels Clean Cities Partnership, Clean Air Partners, Wise Water Use Program, the Environmentally Preferable Purchasing Program, the Clean/Green Fleet Program, Commuter Connections, and others; and

WHEREAS, the failure to reduce greenhouse gases can undermine the quality of life in our region and its economic and environmental sustainability.

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS THAT:

1. The Metropolitan Washington Region, building upon existing priorities and programs, commits to developing a regional climate change initiative including implementation of best practices to reduce emissions of greenhouse gases.

2. The COG Board Chair shall appoint an interdisciplinary "Climate Change Steering Committee" to advise the Board on the development of a regional climate change program; including a recommendation on any need for a long term organizational structure for the regional climate change initiative. Elements of the regional climate change program to be considered by the steering committee shall include:

    a. Preparing a catalogue of greenhouse gas reduction activities already underway in the region.
    b. Preparing an inventory of greenhouse gas emissions in the region and the establishment of a regional greenhouse gas reduction goal or target based on an appropriate baseline.
    c. Identification of specific activities and best practices to achieve greenhouse gas reduction and a method for measuring progress in meeting reduction targets.
    d. Examination of local impacts of climate change on the Washington region.
    e. Examination of the feasibility of establishing a carbon offset fund, or other appropriate carbon reduction funding mechanism, for the Washington region.
    f. Recommendations on regional climate change policy and potential advocacy positions on federal, state and local climate change actions and proposals.

3. The Climate Change Steering Committee shall have tenure for one year from the date of its first meeting and it shall report at least bi-monthly to the COG Board on its activities and progress. It shall be further charged with development of a climate change work program and identification of resources and funding to support its mission. To ensure its initial success, the Board shall provide up to $100,000 from the FY 2007 COG contingency fund as seed money for this initiative to cover staff support, and for match to federal, state, local, and private foundation grants.

Appendix B

Regional Greenhouse Gas Emissions Inventory Methodology

Emission estimates were derived using available activity data for a 2005 base year and standard emission factors consistent with best practices. The 2005 base year was chosen for the inventory because necessary data to complete the inventory were readily available, and 2005 was reasonably consistent with the base years selected by COG member jurisdictions and the states for their climate programs. Data availability for years prior to 2005 was deemed to be problematic. Projections for 2020 and 2030 were developed by applying U.S. Department of Energy (DOE) *Annual Energy Outlook 2007* growth factors and COG Cooperative Forecasts to the 2005 base year emissions by sector (MWCOG 2008b, U.S. DOE 2006) (see Table B-1). Projections of growth between 2030 and 2050 were developed by applying an overall regional growth factor of 6 percent (DesJardin 2008). COG's projections for population, households, and employment are also provided for comparison purposes.

ELECTRICITY

Local utilities provide annual electricity consumption information, and the U.S. Environmental Protection Agency's (EPA's) Clean Air Markets Division reports annual carbon dioxide (CO_2) emissions from local power plants. Emissions associated with imported power are based on net electricity imports and regional emission factors for electricity generation (0.528–0.62 metric tons of CO_2 per megawatt-hour) provided by DOE's Energy Information Administration.

FUEL USE

CO_2 emissions from fuel use were developed using data on commercial, residential, and industrial consumption of natural gas, distillate oil, and residual oil by state and emission factors for each fuel type, scaled to the region using population data (U.S. DOE 2006, MWCOG 2008b, U.S. Census Bureau). CO_2 emissions from aviation were based on total U.S. aviation emissions, scaled to the region's share of total flight miles (U.S. EPA 2008c, U.S. DOT 2005).

TRANSPORTATION

Transportation networks for 2020 and 2030 were from the air quality analysis of the *2006 Financially Constrained Long-Range Plan [CLRP] and the FY 2007–2012 Transportation Improvement Plan (TIP)* (MWCOG 2007d). The travel demand component for this work was based upon execution of the COG/Transportation Planning Board (TPB) travel forecasting process (MWCOG 2004). Inputs to the process include Round 7.0a cooperative forecasting land activity assumptions, and CLRP and TIP network inputs contained in the conformity report adopted by the TPB on October 18, 2006 (MWCOG 2006a, MWCOG 2006b). COG/Department of Transportation Planning staff developed emission factors using EPA's Mobile6.2 vehicle emissions factor model, dated September 24, 2003 (U.S. EPA 2007c), using locality-specific inputs, such as vehicle registration data. Emission factors were developed using inputs from the conformity analysis of the 2006 CLRP and FY 2007–2012 TIP for major road networks, local roads, auto access to transit, transit, and school buses.

OTHER DATA SOURCES

Estimates were developed by scaling total U.S. emissions of hydrofluorocarbons (HFCs) to the region using regional and national employment data. HFC emissions from wastewater were developed using EPA's State Inventory Tool with the default inputs, including biological oxygen demand and regional population. Methane from landfills was based on information provided by the Maryland Department of the Environment (MDE 2008a).

INVENTORY UNCERTAINTY

The current inventory estimates for some source categories, such as for CO_2 emissions from power plants, have a relatively high level of certainty, given that EPA reports the data for each power plant. However, for some other source categories, the inventory emission estimates are considered less certain. In particular, state-level fuel consumption data were scaled to the region using population data, so may not precisely characterize emissions from the metropolitan region. In addition, aviation emissions were developed using national emissions scaled to the region based on relative total flight miles. Given the qualitative comparisons performed by the Metropolitan Washington Airports Authority, emissions estimated in this report are likely +/–30 percent of actual emissions from aircraft flying into and out of the airports in the metropolitan Washington region.

Table B-1. Growth Factors for the Projection Inventory

Emission Source	2020	2030	Growth Factor
Energy/Electrical Generating Units and Electricity Import	20%	33%	EIA Total Electric Power
Transportation Combustion	25%	38%	COG DTP
Residential Fuel Use	22%	31%	COG Population
Commercial Fuel Use	25%	39%	COG Employment
Industrial Fuel Use	10%	19%	EIA Total Industrial Energy
Other Fuel Use	18%	31%	EIA Total Energy Consumption
Commercial Aviation	35%	40%	EIA Jet Fuel
Hydrofluorocarbons	25%	39%	COG Employment
Wastewater	22%	31%	COG Population
Landfills	22%	31%	COG Population
Others:			
Population	22%	31%	COG
Households	25%	33%	COG
Employment	35%	39%	COG

COG = Metropolitan Washington Council of Governments; DTP = Department of Transportation Planning; EIA = Energy Information Administration.

Appendix C
National Capital Transportation Planning Board Vision

Table C-1. National Capital Transportation Planning Board (TPB) Vision

The Washington metropolitan region has established objectives and strategies for developing a transportation system that enhances and protects the region's natural environmental quality, cultural and historic resources, and communities.

Objectives
The Washington region becomes a model for protection and enhancement of natural, cultural, and historical resources.
Reduction in reliance on the single-occupant vehicle by offering attractive, efficient, and affordable alternatives.
Increased transit, ride sharing, bicycling, and walking mode shares.
Compliance with federal clean air, clean water, and energy conservation requirements, including reductions in 1999 levels of mobile source pollutants.
Reduction of per-capita vehicle miles traveled.
Protection of sensitive environmental, cultural, historical, and neighborhood locations from negative traffic and developmental impacts by focusing development in selected areas, consistent with adopted jurisdictional plans.
Strategies
Implement a regional congestion management program, including coordinated regional bus service, traffic operations improvements, transit, ride sharing, telecommuting incentives, and pricing strategies.
Develop a transportation system supportive of multiple use and higher density (commercial and residential) in the regional core and regional activity centers as a means of preserving land; natural, cultural, and historic resources; and existing communities.
Support regional, state, and federal programs that promote a cost-effective combination of technological improvements and transportation strategies to reduce air pollution, including promoting use of transit options, financial incentives, and voluntary emission reduction measures.
Develop a regional tourism initiative to encourage air and train arrival in the region, and additional transit access and automobile parking at the termini of Metrorail/rail services.
Provide equivalent employer subsidies to employees with the intent of "leveling the playing field" between automobile and transit/ride sharing.
Plan and implement transportation and related facilities that are aesthetically pleasing.
Implement a regional bicycle/trail/pedestrian plan, and include bicycle and pedestrian facilities in new transportation projects and improvements.
Reduce energy consumption per unit of travel, taking maximum advantage of technology options.

Appendix D

Recommendations for Local Governments to Lead by Example

Table D-1. Recommendations for Local Governments to Lead by Example

Local governments are taking steps to reduce emissions from their operations and are creating the framework, vision, and guidance to bring about changes in the community.

Energy
Increase Energy Efficiency
Implement the 2007 Metropolitan Washington Council of Governments (COG) Regional Green Building Policy: All new government buildings meet the Leadership in Energy and Environmental Design (LEED) Silver standard, ENERGY STAR®, or equivalent.
Identify best practices to support reducing overall local government energy use by 15% by 2012.
Examine options and develop plans for replacing street lights with energy-efficient lighting (LED [light-emitting diode] or other options) across the region.
Promote regional energy performance contracting to reduce energy use in public buildings.
Consider a regional cooperative purchase approach to facilitate cost-effective implementation.
Develop a long-term goal for carbon neutrality for all government buildings.
Enhance and expand existing recycling programs.
Encourage provision of energy audits and energy retrofits for individuals and businesses through a regional cooperative effort.
In collaboration with local governments and area wastewater utilities, identify best practices and evaluate the potential for reducing greenhouse gas emissions through methane recapture and use of biosolids as a fuel as means for reducing energy requirements for operations at area wastewater treatment plants and landfills.
Reduce Energy Consumption/Demand Management
Partner with electric, gas, and water utilities on regional energy conservation and energy efficiency program outreach.
Partner with the Greater Washington Board of Trade Green Committee and Potomac Conference to assist businesses with taking action to reduce greenhouse gas emissions and implement best practices.
Expand Use of Clean Energy Sources
Establish a 2015 regional goal of having renewable energy comprise 20% of the energy purchased by local governments.
Evaluate regional cooperative purchase and/or reverse auctions to facilitate green power implementation among COG membership.
Work with jurisdictions exporting electricity into the metropolitan Washington region to encourage investments in clean low-emitting energy sources.
Transportation and Land Use
Increase Fuel Efficiency
Establish a regional green fleet policy with measurable goals and timetables.
Promote transit-supportive street designs.
Increase enforcement of existing idling regulations to prevent extended vehicle idling.
Promote Low-Carbon "Clean" Fuels
Promote adoption of CA LEV-II (California Low-Emission Vehicle Phase II) standards for all jurisdictions in the region.
Promote/accelerate adoption of efficient clean-fuel vehicles, including hybrids (cars, trucks, buses).
Evaluate the benefits of specific "green fleet" conversion percentages. Provide incentives for purchase of clean-fuel vehicles.
Assess benefits from a "Cash-for-Clunkers" program and rebates or tax incentives for the purchase of hybrid vehicles.
Reduce Vehicle Miles Traveled (VMT)
Expand existing and fund new programs to enhance access to transit and alternative modes, Commuter Connections, guaranteed ride home, telework programs, bike/pedestrian access, park-and-ride lots.
Evaluate the greenhouse gas reduction benefits of expanding existing and establishing new exclusive bus transit routes, lanes, on-ramps, and corridors.
Promote equalization of transit and parking benefits.
Promote car sharing.
Examine parking policies and their relationship to VMT. Implement new parking policies to reduce VMT.
Fully fund construction of bicycle/pedestrian paths in the region, as outlined in the regional bicycle/pedestrian plan. Provide incentives to developments that speed improvements to bicycle/pedestrian access, including improvements to sidewalks, curb ramps, crosswalks, lighting, etc.
Design a regional program to promote bike sharing.
Land-Use Planning
Establish a goal and develop a program and plan to increase the region's tree canopy.
Research and develop specific regional goals (up to 95%) to significantly increase the percentage of new development located in regional activity centers.
Promote regional policies that support walkable communities and affordable housing near transit.
Identify best practices for local governments to include greenhouse gas reduction and energy as an element in their local comprehensive planning. Such efforts should include practices that address climate change risk reduction to guide local zoning, building codes, site planning, and review.

Appendix E
Advocacy Positions

Table E-1. Advocacy Positions

CCSC recommends a number of advocacy positions for state and federal action to achieve maximum regional greenhouse gas reductions from improved energy efficiency, reduced energy consumption, use of low-carbon fuels, and improved vehicle efficiency.

Energy
A. Improve Energy Efficiency
1. Adopt energy performance goals for state and federal government buildings.
2. Develop state and federal financial incentives for renewable energy.
3. Support state and federal climate change legislation, including a cap-and-trade system, that would provide funds for local government energy efficiency programs.
4. Organize a consortium of local governments to apply for Energy Efficiency Block Grant funds as they become available.
B. Reduce Demand for Energy
1. Implement policies to remove the disincentive for utilities to invest in energy efficiency, demand management, and renewable energy.
2. Advocate for adoption of Cool Schools or the equivalent by local school boards or local governments.
3. Support the establishment of and funding for programs designed to supply locally produced food to schools (e.g., statewide farms-to-schools program).
4. Identify best practices for improving energy efficiency for public buildings.
C. Promote Clean Energy Sources
1. Adopt a 20 percent renewable portfolio standard in the District of Columbia and Virginia by 2020.
2. Urge state public utility commissions to prioritize energy efficiency, demand reduction, and renewable energy sources.
3. Urge state and federal governments to establish new policies to remove the disincentive for utilities to invest in energy efficiency, demand management, and renewable energy.
4. Create federal and state financial incentives for energy efficiency and renewable energy, including federal tax subsidies for renewable energy production.
5. Urge federal support for technology development, including solar energy, battery technologies, and clean vehicles.
6. Expand the Regional Greenhouse Gas Initiative to the District of Columbia and Virginia.
7. Work with jurisdictions exporting electricity into the metropolitan Washington region to encourage investments in clean, low-greenhouse-gas-emitting energy sources.
8. Promote equitable subsidies for different sources of energy (e.g., nuclear versus renewable).
Transportation and Land Use
A. Increase Fuel Efficiency and Use of Clean-Fuel Vehicles
1. Promote the California Low-Emission Vehicle Phase II (CA LEV-II) program.
2. Extend corporate average fuel economy requirements past 2020 and include heavy-duty trucks.
3. Support incentives for fuel-efficient and alternative-fuel vehicles.
4. Support incentives for early vehicle retirement.
B. Reduce Vehicle Miles Traveled (VMT)
1. Urge lawmakers to increase investment in transit.
2. Evaluate financial incentives, such as pay-as-you-travel insurance, and road management to reduce VMT and congestion.
3. Advocate for federal income tax benefits for transit use that equal or exceed the benefits of employer-provided or -subsidized parking.

Appendix F
Resolution R60-08

Resolution R60-08
ADOPTED November 12, 2008

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS
777 North Capitol Street, NE
Washington, DC 20002-4290

RESOLUTION ADOPTING AND PROMOTING IMPLEMENTATION OF THE *NATIONAL CAPITAL REGION CLIMATE CHANGE REPORT*

WHEREAS, on April 11, 2007, COG's 50th Anniversary, the COG Board of Directors adopted Resolution R31-07 that created COG's Climate Change Initiative and established a Climate Change Steering Committee (CCSC); and

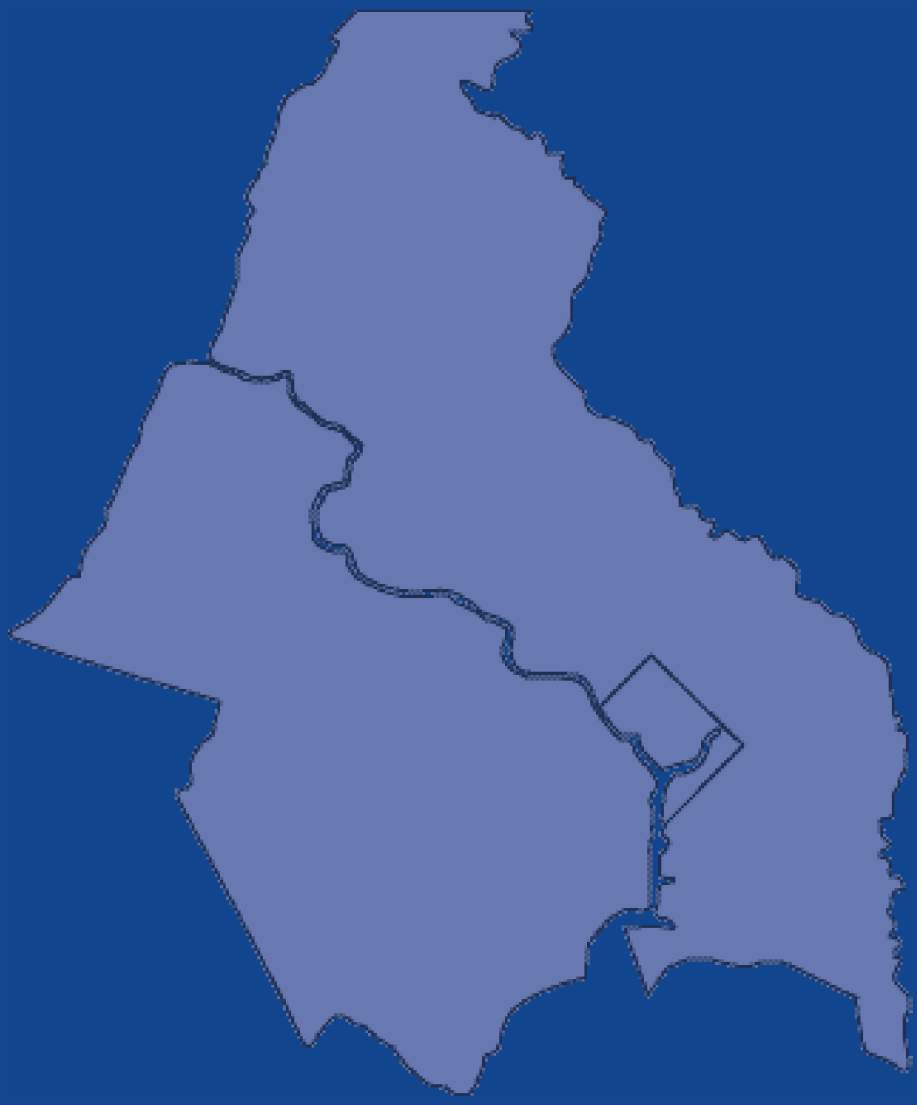
WHEREAS, the Board charged the CCSC with cataloguing greenhouse gas emission reduction best practices of COG's members, preparing a regional greenhouse gas emission inventory, recommending regional greenhouse gas emission reduction targets, evaluating regional impacts of climate change, recommending advocacy positions on local, state and federal climate change proposals, and recommending a long-term structure for the regional climate change initiative; and

WHEREAS, the CCSC presented its draft report to the Board in July, 2008 and the Board circulated the report for review and comment by COG members and stakeholders, and the draft report was presented to nearly all COG member local elected official governing bodies and COG policy committees; and

WHEREAS, the CCSC received and assessed more than 200 comments on the draft report and has prepared an enhanced final report for consideration and action by the COG Board of Directors that contains more than 40 recommendations for action.

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS THAT IT:

1. Adopts the *National Capital Region Climate Change Report* and its recommendations as COG's regional climate change policy, specifically including adoption of the recommended regional greenhouse gas emission reductions goals for 2012, 2020, and 2050.
2. Commends the Climate Change Steering Committee for its outstanding leadership and groundbreaking report on this critical regional and national issue.
3. Authorizes the Chair of the COG Board of Directors to transmit the report to:
    - COG's member local governments, strongly encouraging their endorsement and implementation of the report recommendations.
    - The Governors of Maryland and Virginia, Mayor of the District of Columbia, as well as state legislative delegations in Maryland and Virginia.
    - The President of the United States and members of the regional congressional delegation,
    - COG's policy committees including the National Capital Region Transportation Planning Board and Metropolitan Washington Air Quality Committee;
    - COG's stakeholders including utilities, business, environmental, civic and other interested associations and organizations.
4. Directs the Executive Director or his designee to recommend a committee structure to coordinate and facilitate implementation of the recommendations by March, 2009.
    - Until such time as successor committee structure is approved by the Board, the CCSC shall remain in place. Its charge will be to prepare a work program and budget to guide implementation of the report recommendations, develop advocacy positions for consideration by the COG Board, and initiate development of the regional plan for achieving the 2012 regional emission reduction goal in coordination with other COG policy committees and stakeholders.



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