Interim Report
to the Governor
and the
Maryland General Assembly

CLIMATE ACTION PLAN

Maryland Commission on Climate Change

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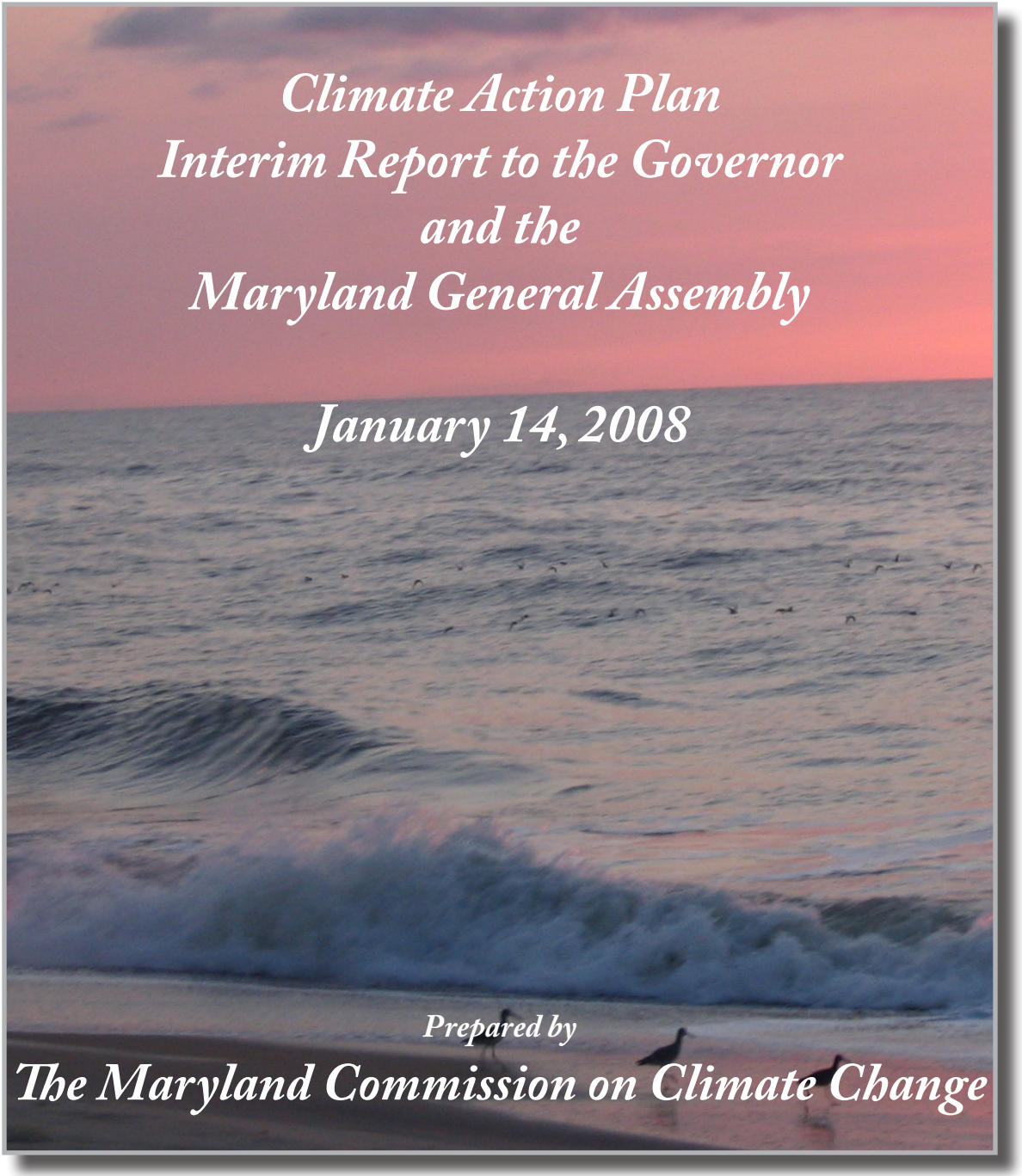

Climate Action Plan
Interim Report to the Governor and the Maryland General Assembly

January 14, 2008

Prepared by

The Maryland Commission on Climate Change

The Maryland Department of the Environment published this report on behalf of the Commission

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Executive Summary

On April 20, 2007, Governor Martin O'Malley signed Executive Order 01.01.2007.07 (the Order) establishing the Maryland Commission on Climate Change (the Commission). Sixteen State agency heads and six members of the General Assembly comprise the Commission. The principal charge of the Commission is to develop a Plan of Action (the Climate Action Plan) to address the drivers of climate change, to prepare for its likely impacts in Maryland, and to establish goals and timetables for implementation. The Plan is to be submitted to the Governor and General Assembly by April 20, 2008.

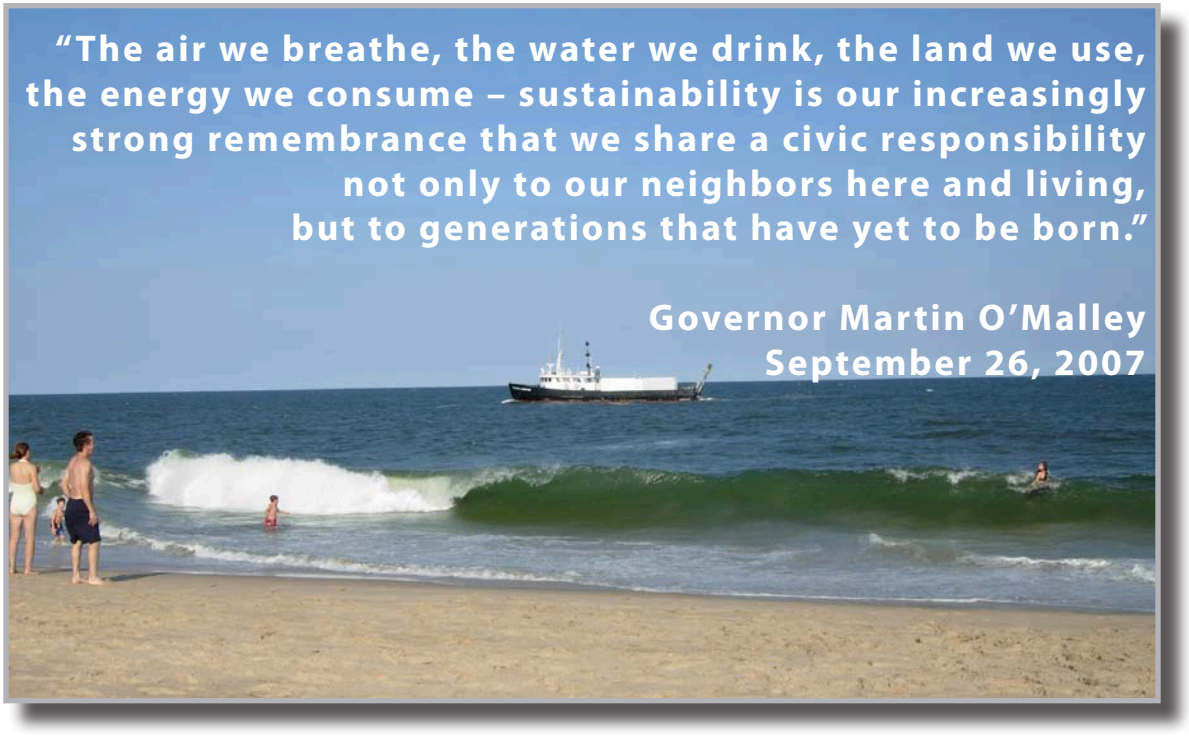
The Order emphasized Maryland's particular vulnerability to climate change impacts of sea level rise, increased storm intensity, extreme droughts and heat waves, and increased wind and rainfall events. It recognized that human activities such as coastal development, burning of fossil fuels, and increasing greenhouse gas (GHG) emissions are contributing to the causes and consequences of climate change. While noting Maryland's recent climate initiatives, the Order emphasized that continued leadership by example by Maryland State and local governments is imperative.

Governor Martin O'Malley Signs The Executive Order Creating The Maryland Commission on Climate Change

The Commission is supported by three Working Groups whose members were appointed by the Commission Chair, Shari Wilson, Secretary, Maryland Department of the Environment (MDE): Scientific and Technical Working Group (STWG), chaired by Donald Boesch, President, University of Maryland Center for Environmental Science; Greenhouse Gas and Carbon Mitigation Working Group (MWG), chaired by George (Tad) Aburn, Director of MDE's Air and Radiation Management Administration, and co-chaired by Malcolm Woolf, Director, Maryland Energy Administration (MEA); and Adaptation and Response Working Group (ARWG), chaired by John R. Griffin, Secretary of Maryland's Department of Natural Resources (DNR), and co-chaired by Richard Eberhart Hall, Secretary, Maryland Department of Planning (MDP). These Working Groups and the technical working groups (TWGs) that support them

represent diverse stakeholder interests and bring broad perspective and expertise to the Commission's work. The Commission's work is facilitated by a consultant, The Center for Climate Strategies (CCS).

This Interim Report to the Governor and General Assembly fulfills a requirement in the Order to provide a Plan update. The Report includes timetables and benchmarks for reducing Maryland's GHG emissions (Goals) and preliminary recommendations for legislation and executive actions (Early Action Items). It also includes general support for legislative or other actions on several initiatives, should these develop, without making specific recommendations (Other Recommendations). Finally, the Report contains a list of approximately 50 priority policy options the Commission has chosen for more detailed analysis in the months ahead, and references catalogs of additional policy options for possible consideration, in preparation for submission of its Climate Action Plan in April 2008.



Recommended Goals

GHG reduction goals are a critical element of state Climate Action Plans.

The key themes used by the Commission in the Maryland goal setting process were:

- Build from the best and most current science available
- Demonstrate leadership and be aggressive - Maryland has a tremendous amount at risk because of climate change
- Place a high priority on cost-effective implementation strategies to achieve goals
- Incorporate innovative funding mechanisms as much as possible to limit the need for new public funding to implement new programs
- Maryland is in a unique position to become a national leader in terms of goal setting
- Push for the earliest possible reductions

Mid Course Reviews: ***Conduct a science-based review of the goals at least every four years***

Maryland should set early, aggressive GHG reduction goals with specific time frames as follows:

2012

- ***10% below Maryland's 2006 GHG emission levels (using a consumption-based approach) by 2012***
- ***To be used as a reduction goal for Maryland's Climate Action Plan***

2015

- ***15% below 2006 levels by 2015***
- ***To be used as a reduction goal for Maryland's Climate Action Plan***

2020

- ***25% to 50% below 2006 levels by 2020***
- ***25% used as the "minimum" enforceable, regulatory driver for the Global Warming Solutions legislation***
- ***50% used as a science-based, non-regulatory reduction goal for Maryland's Climate Action Plan***
- ***Programs to implement the legislation would reward market-based reductions above 25%***

2050

- ***90% below 2006 levels by 2050***
- ***A science-based regulatory goal in the Global Warming Solutions legislation***
- ***A driver for research and development of climate neutral technology / programs / innovations***

Recommendations For 2008 Legislation

The Commission recommends that the Governor and the Maryland General Assembly work in partnership to develop and adopt legislation in 2008 for the following initiatives:

Mitigation Initiatives

1. **Adopt legislation requiring the State to develop and implement programs to reduce GHG emissions by 25% by 2020 and by 90% by 2050.** Recommended legislative features include the following:

   - Build from Maryland's Global Warming Solutions Bill introduced in 2007
   - Require development of economy-wide or other market-based programs as tools to help achieve goals as cost-effectively as possible
   - Include both emission reduction efforts and sequestration projects in the trading programs developed to implement the legislation
   - To address the fiscal impact on State agencies, include a self-sustaining fee provision in the legislation to fund staff and programs necessary to implement the legislation
   - Establish an Office of Climate Change
   - Support research and development of climate-neutral technologies, programs and innovations to reach the 2050 reduction goal

2. **Adopt or amend legislation to increase energy efficiency.**

   This recommended initiative is being coordinated with the development by the Maryland Energy Administration (MEA) of a comprehensive State Strategic Electricity Plan. Several options have been discussed by the MWG, including:

   - An Energy Efficiency Performance Standard provision requiring electricity suppliers to reduce a portion of their peak demand by implementing programs to reduce consumption
   - A Publicly Administered Energy Investment Fund using a designated revenue stream that the State can use to fund energy efficiency programs

STEPS IN THE RIGHT DIRECTION

In 2006 and 2007 Maryland took several major steps to begin the process of reducing GHG emissions.

The **Healthy Air Act** - Adopted as State Law in 2006 - includes a provision for Maryland to join the Regional Greenhouse Gas Initiative (RGGI), a GHG reduction program for power plants. The Maryland budget in RGGI is designed to reduce CO_2 emissions by 3.7 million short tons between 2015 and 2018.

The **Clean Cars Act** - Adopted as State Law in 2007 - will reduce GHG emissions by more than 7.7 million metric tons/year by 2025.

The ***EmPOWER Maryland*** program, announced by Governor O'Malley on July 2, 2007, is designed to reduce per capita energy consumption by 15% in 2015 and could reduce GHG emissions by around 17 million tons/year.

- Provisions to strengthen building codes and inspections to improve energy efficiency in structures and systems
- Provisions to improve appliance and lighting efficiency standards
- An excise tax on new motor vehicles with the lowest fuel economy ratings.

3. **Amend Maryland's Renewable Portfolio Standards (RPS) law to encourage more investment into renewable energy sources.**
   - Several options have been discussed by the Commission's MWG, including a higher renewable percentage for each company's portfolio and a smaller geographic area for eligible renewable sources.
   - This recommendation is also being coordinated with MEA's development of a State Strategic Electricity Plan

Adaptation Initiatives

1. **Update the jurisdictional boundaries of the Chesapeake and Atlantic Coastal Bays Critical Areas Act to reflect current conditions, and establish a process and continuing standard for updates, possibly every ten years, to accommodate future changes in shoreline conditions and sea level rise.**
2. **Develop a unified approach to shoreline management that encompasses the entire tidal-upland interface, including the Critical Area 100-foot Buffer through a combination of executive, legislative, and programmatic actions.**
3. **Amend the Flood Hazard Management Act of 1976 to require that all Maryland counties adopt standards requiring two or more feet of freeboard (an elevation factor of safety used in floodplain management) in tidally influenced floodplains.**

Recommendations For Early Executive Action

The Commission recommends that the Governor, the Maryland General Assembly, local government and other interested parties work together in partnership to pursue the following initiatives that do not necessarily require legislation prior to the Commission's April 2008 Climate Action Plan report.

Joint Mitigation and Adaptation Initiative

State and Local Governments Lead by Example

The Governor should issue an Executive Order that builds on existing executive orders and other administrative initiatives and integrates existing programs of various State agencies to: (1) reduce the State government's GHG footprint that results from its facilities and operations; and (2) implement sound sea level rise adaptation and response measures.

Several options have been discussed by the MWG and the ARWG, including:

- Green buildings and fleets
- Clean energy
- Outreach and education
- Evaluation of projects for their GHG impacts
- Integration of policy and planning efforts of State agencies to address adaptation and response to climate change impacts on coastal areas.

The Governor and General Assembly could advocate for similar efforts by local governments.

Green Building: Montgomery Park, Baltimore, Maryland
MDE Headquarters

Mitigation Initiatives

1. Public Education and Outreach

- Partnerships should be developed to coordinate efforts to raise climate change public awareness and change behavior through education and outreach to consumers, commercial and industrial sectors, and students, including integration into P-20 (formerly K-12) school curricula.
- Initiatives could build from existing programs including those already initiated at many colleges and universities throughout Maryland.

2. Encourage Federal and International Action

The Governor and the Maryland General Assembly should aggressively push for Federal action to reduce GHGs. Global warming is a problem that requires global action. An aggressive approach to GHG reductions within the United States would have a significant effect on the international reductions needed to begin reversing global warming trends.

3. Understand Greenhouse Gas Implications from Major Projects

The State should review the procedures for environmental impact studies for major projects to insure that the GHG implications are addressed.

4. Incentives for Green Buildings Beyond Minimum Code Requirements

The State should work in partnership with the business community and other interested parties to make sure the cost-saving potential associated with the different Green Building practices, including strong energy efficiency measures, is well understood by building managers, construction companies, investors and homeowners.

Adaptation Initiative

1. **Forest Carbon Sequestration Pilot Project**

Maryland's Department of Natural Resources (DNR) should pilot a forest carbon sequestration demonstration project to: (1) reduce emissions and offset a portion of DNR's carbon footprint; and (2) replicate and transfer appropriate demonstration elements to other State agencies.

Other Recommendations

The Commission also identified several areas of potential action that it supports in concept. These include:

- Promoting enhanced carbon sequestration in forests by encouraging initiatives to allow more effective reforestation and forest management;
- Promoting Pay-As-You-Drive Insurance programs; and
- Including energy efficiency and GHG emission reduction implications as part of any efforts to analyze or revise the State's tax policies.

Policy Options Chosen for Further Analysis

Through its MWG stakeholder process, the Commission selected approximately 50 priority policy options for further analysis for its final Climate Action Plan. These policy options are in Appendix C. Through its ARWG stakeholder process, the Commission has adopted a catalog of options from which a set of priority policy options will be selected for further analysis.

Next Steps

The Commission will continue to analyze the recommendations identified above. The Commission will also continue to develop its final Climate Action Plan for presentation to the Governor and General Assembly in April of 2008. The Commission will perform additional analysis and develop a straw proposal for selected priority policy options. From these options, the suite of control programs and adaptation strategies that will allow the State to meet its GHG reduction and adaptation goals in the most cost-effective manner possible will be selected. These will form the basis of the MWG's ***Comprehensive Greenhouse Gas and Carbon Footprint Reduction Strategy*** and the ARWG's ***Comprehensive Strategy for Reducing Maryland's Climate Change Vulnerability***, called for in the Executive Order.

The Scientific and Technical Working Group (STWG) will continue to inform its sister Working Groups as their work progresses and will develop its ***Comprehensive Climate Change Impact Assessment***. The MWG will prepare an inventory and forecast of Maryland's GHG emissions. For each of the priority policy options, the MWG will quantify the GHG emission reductions and the costs or savings per ton of reduction, if possible. Similarly, the ARWG will apply quantitative metrics to evaluate the degree of climate risk reduction that can be achieved through each priority policy option. Both Working Groups will also consider non-quantitative factors such as feasibility and co-benefits for each policy option. The Commission will then evaluate and rank the policy options and make its final recommendations for legislative or other actions in the Climate Action Plan.

More information on the activities of the commission and its three working groups can be found at <www.mdclimatechange.us>

1 Addressing Climate Impacts in Maryland

Maryland's Vulnerability as a Coastal State

The Nobel Prize-winning United Nations Intergovernmental Panel on Climate Change (IPCC) concluded earlier this year that the evidence of human influenced global warming is "unequivocal." While images of melting glaciers and polar bears on disappearing Arctic Sea ice have galvanized public awareness of the reality of global warming, it is important to understand Maryland's natural environments and its citizens are also at risk. As a coastal state with extensive low-lying land on the Eastern Shore and around the Chesapeake Bay, Maryland is exceeded only by Louisiana, Florida and Delaware in the percentage of its land area vulnerable to accelerated sea level rise.

The IPCC estimated that if greenhouse gas (GHG) emissions continue to increase at the present rate, sea level will rise by over 2 feet along Maryland's 7,000 miles of shoreline during this century when the rate of regional land subsidence is taken into account. This is more than twice the rate of relative sea level rise experienced during the 20th century, a period that witnessed significant loss and diminution of Bay islands and tidal wetlands. Moreover, because the IPCC estimations do not take into account rapid changes in ice flow such as now being chronicled in Greenland, many climate scientists believe sea level rise will be greater, perhaps resulting in as much as 4 feet in Maryland by the end of the 21st century. Not only will islands and wetlands disappear even more rapidly, but human settlements from coastal communities to the oldest parts of our historic port cities will be at increasing risk, particularly during storm surges that are likely to intensify, according to the IPCC reports.

SEA LEVEL RISE: 10 MOST VULNERABLE STATES

State	Percent of Land Vulnerable to Sea Level Rise (Below 1.5 Meters Elevation)
Louisiana	21.9
Florida	8.8
Delaware	7.7
Maryland	**6.1**
New Jersey	5.6
North Carolina	4.6
Rhode Island	4.5
South Carolina	3.0
Massachusetts	1.8
Georgia	1.2

The changing global climate that the IPCC projects will have many other consequences to Maryland in addition to sea level rise and coastal storms. The Chesapeake Bay has already warmed by about 2˚F and continued warming will make our extensive efforts to restore its health that much more difficult. Examination of the detail of the global models used by the IPCC shows that, if GHG emissions continue to grow on the present trajectory, air temperatures will increase in Maryland more than the global average, resulting in average winter temperature increasing by about 8˚F by the end of the century. While this might be welcomed by some, average summer temperature would also increase by about 7˚F and the number of days with temperatures greater than 90˚F is likely to quadruple, with 25 or

"The climate crisis is real and while it threatens our shorelines today, its causes and symptoms threaten life on our planet in the generations ahead unless we act.

As a State and – I would submit to you – as a nation and a planet, there's no time to delay. We have to take control of our own future in the face of this threat.

The decisions we make today will determine, in a very real way, the future character of our state and nation."

Governor Martin O'Malley
September 26, 2007

more 100˚F days. Maryland's recent progress in reducing smog and other air pollutants could be reversed if summertime temperatures increases in this range. Precipitation during the winter and spring is likely to increase 10-15%, coming mostly in heavy rainfall events, but the summers and falls are likely to be drier as increased evaporation depletes soil moisture.

The significance of these impacts of global climate change on our own State during the lifetimes of our children and grandchildren provides substantial motivation for taking action to reduce GHG emissions. If we are able to take concerted global action and begin to achieve substantial reductions in emissions by the middle of the century, the IPCC models suggest that we can ameliorate some, but not all, of the impacts of climate change. Sea level rise might be closer to 1.5 feet and the risk of abrupt deterioration of the Greenland ice sheet significantly reduced. The number of days of extreme heat stress would only modestly increase. In short, although there will still be substantial changes in our climate to which Marylanders would have to adapt, the extreme impacts and uncontrollable and unpredictable changes to the Earth's climate system could be avoided. While Maryland can certainly not by its actions alone constrain global warming, as a prosperous, knowledge-rich society with per capita emissions that are more than five times the global average, it has a responsibility to lead in addressing the global challenge.

Creation and Purpose of Commission on Climate Change

On April 20, 2007, Governor Martin O'Malley signed Executive Order 01.01.2007.07 (the Order) establishing the Maryland Commission on Climate Change (the Commission).

The Commission's creation is based on near universally accepted science, as well as physical evidence here in Maryland, supporting the theory that the world's climate is changing and that human activities are contributing factors. It is clear that strong government action is necessary to protect the state's people, property, natural resources, and public investments from the ensuing impacts of climate change. The Commission is therefore tasked with developing a Climate Action Plan to address the drivers and consequences of climate change, to prepare for the likely consequences and impacts of climate change to Maryland, and to establish firm benchmarks and timetables for implementing the Climate Action Plan.

A number of State initiatives over the past several years provide a foundation for the Commission's work.

These include the formulation and implementation of a State Sea Level Response Strategy (2000), passage of the Healthy Air Act (2006), passage of the Clean Cars Act (2007), participation in the Regional Greenhouse Gas Initiative (2007) and the ***EmPOWER Maryland*** initiative (2007).

Structure and Membership

The Commission is supported by three Working Groups whose members were appointed by the Commission Chair, Shari Wilson, Secretary, Maryland Department of the Environment (MDE). The Working Groups are as follows: Scientific and Technical Working Group (STWG), chaired by Donald Boesch, President, University of Maryland Center for Environmental Science; Greenhouse Gas and Carbon Mitigation Working Group (MWG), chaired by George (Tad) Aburn, Director of MDE's Air and Radiation Management Administration, and co-chaired by Malcolm Woolf, Director, Maryland Energy Administration (MEA); and Adaptation and Response Working Group (ARWG), chaired by John R. Griffin, Secretary of Maryland's Department of Natural Resources (DNR), and co-chaired by Richard Eberhart Hall, Secretary, Maryland Department of Planning (MDP). These Working Groups and the technical working groups (TWGs) that support them represent diverse stakeholder interests and bring broad perspective and expertise to the Commission's work. The Commission's work is facilitated by a consultant, The Center for Climate Strategies (CCS). Membership rosters for the Commission, its three Working Groups and the TWGs are in Appendix B.

A Science-Based, Consensus-Building Process

The Commission's work is supported by the science-based, consensus-building stakeholder process of its Working Groups and their respective TWGs. Through these processes, the MWG, the ARWG and the supporting TWGs have developed catalogs of policy options for consideration by the Commission.

The catalogs build from options developed by other states with climate action plans. The TWGs add to, subtract from and fine-tune the Maryland catalogs. The TWGs support and inform their respective Working Groups on Early Action Items and priorities for further analysis and possible legislation in their respective fields of expertise. The two Working Groups evaluate the TWGs' work and, from this, develop and present recommendations to the Commission. Through this process, the Commission has developed a number of Early Action

Recovering a deep sea mooring system that had been recording changes in temperature, conductivity, and other characteristics of Arctic Ocean waters. (Source: NOAA At The Ends of the Earth Collection)

Items (EAIs) for possible legislation or executive action in the 2008 Legislative Session. The process has also enabled the Commission to select priority policy options for further analysis, which it will develop into "straw proposals" over the next several months. These will form the basis for recommendations to the Governor and General Assembly in the Climate Action Plan in April of 2008.

The STWG advises the Commission and other two Working Groups on the science and technical aspects of climate change. The group's research and conclusions will come together in a ***Comprehensive Climate Change Impact Statement*** that assesses current and future climate models and forecasts and evaluates the likely consequences to the State's agricultural industry, forestry resources, fishery resources, fresh water supply, aquatic and terrestrial ecosystems, and human health.

The MWG is tasked with development of a ***Comprehensive Greenhouse Gas and Carbon Footprint Reduction Strategy***. This Strategy will evaluate and recommend Maryland's GHG reduction goals, recommend short- and long-term goals and strategies to mitigate GHGs and offset carbon emissions, and provide an implementation timetable for each recommended strategy. TWGs for this Working Group are: Residential, Commercial and Industrial; Energy Supply; Transportation and Land Use; Agriculture, Forestry and Waste; and Cross-Cutting Issues. The goal of the MWG is to develop a comprehensive, aggressive strategy that achieves the GHG reduction goals established by the Commission using a suite of control programs whose costs will provide a net economic benefit to the State and its citizens.

PROJECTED ECONOMIC BENEFITS FROM STATE CLIMATE ACTION PLANS

State	Economic Benefit	New Jobs
Arizona	$5.5 Billion	285,000
California	$4.0 Billion	83,000
Vermont	$1.3 Billion	N/A
North Carolina	$7.5 Billion	N/A
New Mexico	$2.1 Billion	N/A

The ARWG is tasked with the development of a ***Comprehensive Strategy for Reducing Maryland's Climate Change Vulnerability***, with a strong initial focus on sea level rise and coastal hazards. Elements of the Strategy include recommendations for reducing the vulnerability of the State's resources and communities to the impacts of climate change, establishment of strategies to address short- and long-term adaptation measures, development of measures for appropriate guidance of local governments, and proposal of a schedule for development of sector-specific adaptation strategies. TWGs for this Working Group are: Existing Built Environment and Infrastructure; Future Built Environment and Infrastructure; Human Health, Safety and Welfare; and Resources and Resource-Based Industries.

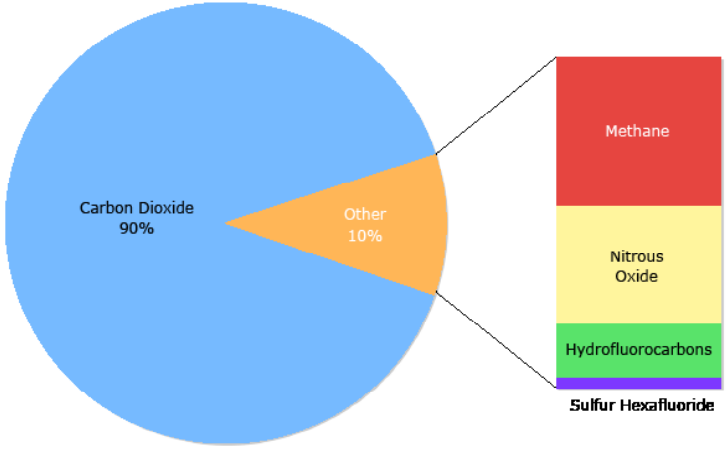
2 Emission Inventory and Forecast

The Greenhouse Gas and Carbon Mitigation Working Group (MWG), in partnership with the Scientific and Technical Working Group (STWG), has been developing a comprehensive greenhouse gas emission (GHG) inventory for Maryland as part of the work of the Commission. The Maryland GHG inventory is currently in draft form and will not be finalized until the release of the Commission's final Climate Action Plan in April 2008. Appendix D of this Report contains preliminary technical information related to the Maryland-specific emission inventory.

Some of the preliminary findings from this effort are provided below. The following figures are based upon preliminary information from the draft inventory for purposes of educating the reader of this Interim Report on the major emission sources and trends in Maryland.

What Greenhouse Gas Emissions Are Most Important in Maryland?

- Carbon Dioxide (CO_2) comprises about 90% of Maryland's GHG emissions, when considering the CO_2 emission equivalents in terms of their impacts on global warming.
- The remaining emissions, while not as prevalent as CO_2, can be more reactive in the atmosphere so it is important that they are not ignored.
- For the purposes of this analysis, most GHG emission inventory engineers use the term $MMtCO_2e$, which stands for Million Metric Tons of CO_2 equivalent - a mathematical formula that equates all GHG emissions to CO_2 to facilitate comparisons.

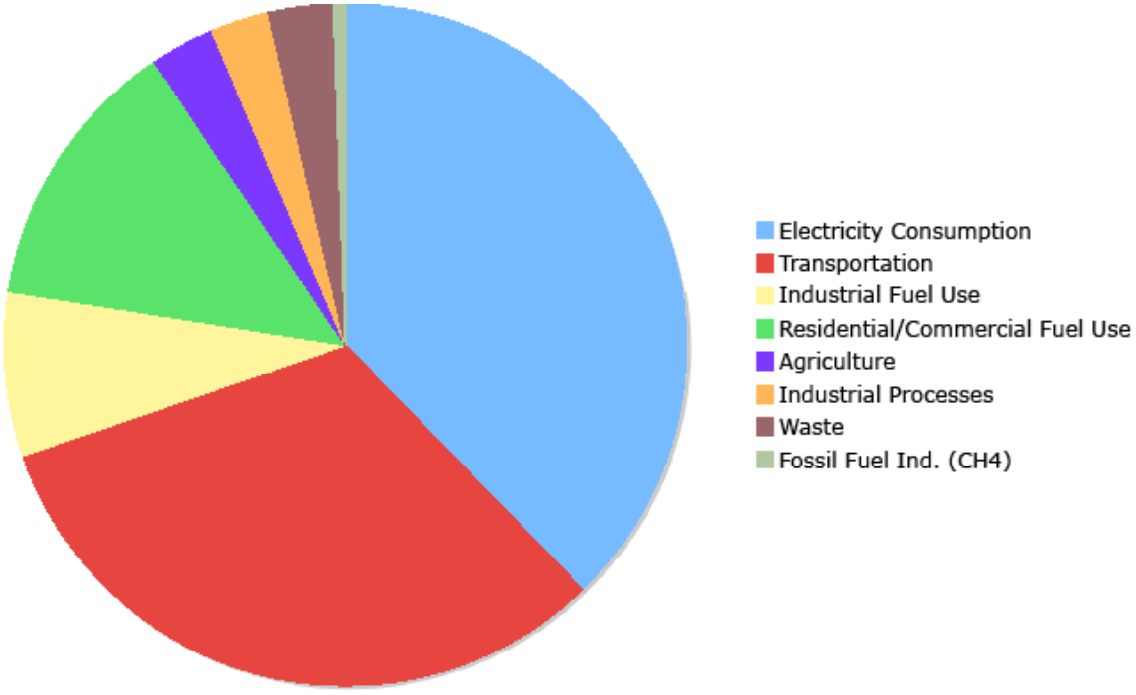


2000 Maryland Gross Emissions by Greenhouse Gas ($MMtCO_2e$ Based)

What Are the Major Greenhouse Gas Emission Sources for Maryland?

The graph below shows the GHG emissions associated with Maryland's footprint in 2007. The graph includes emissions from within the State's borders and emissions from out-of-state that are created by consumption in Maryland.

- Approximately 30% of the electricity used in Maryland is imported.
- Maryland is very similar to the national average when it comes to GHG emissions.
- The largest source sectors in Maryland are Electricity Consumption (38%) and Transportation (32%).

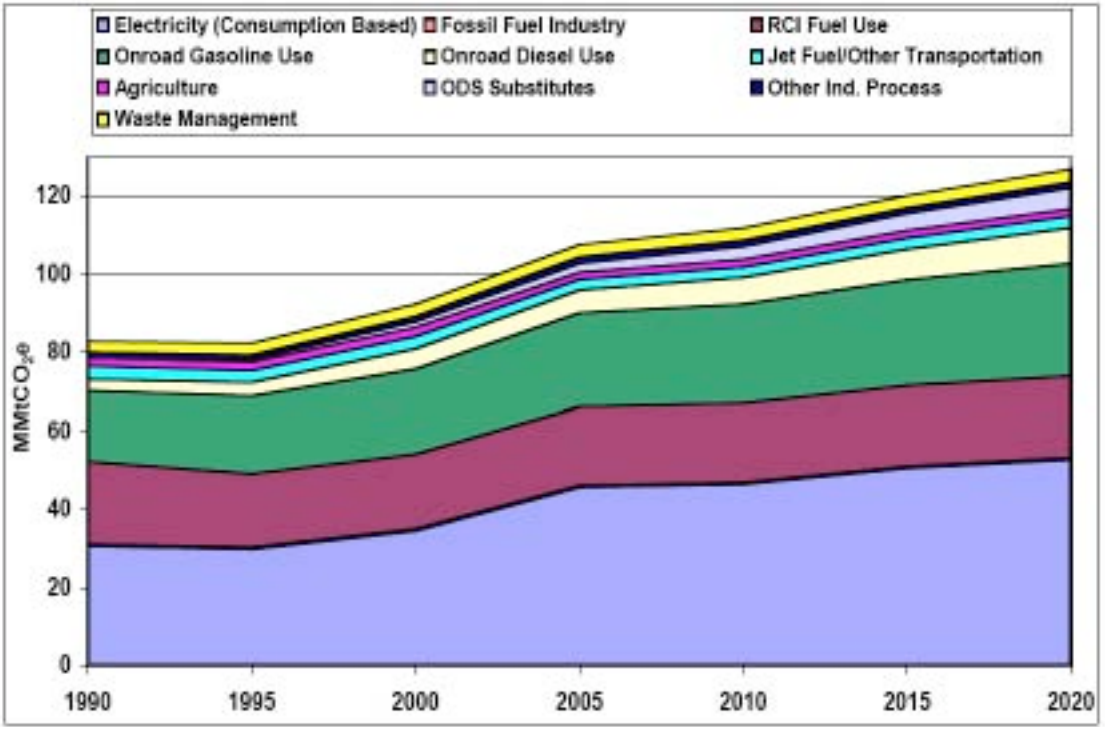


Total GHG Emissions in Maryland in 2007 = 115 MMtCO$_2$e

Are Maryland's Greenhouse Gas Emissions Growing?

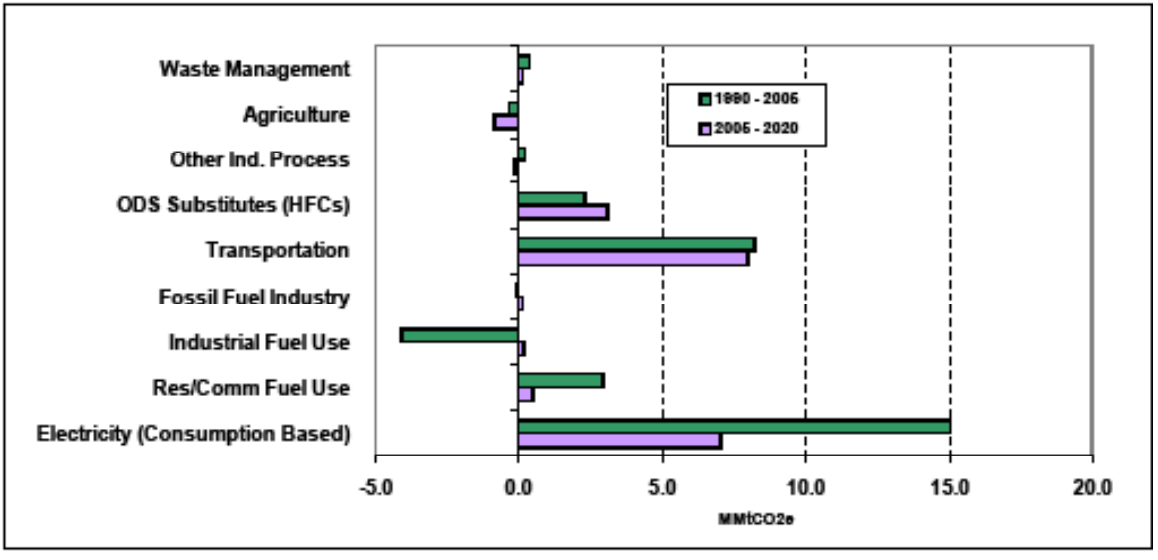
- Due to increases in population and consumption, Maryland's GHG emissions are expected to continue to grow.
- The chart shows projected growth out to 2020 in a "business as usual" scenario that does not include any programs to reduce GHG emissions.
- In total, if you take a current snapshot of 2007, Maryland's total emissions are in excess of 115 million metric tons of CO_2 equivalent.
- Based on these projections, Maryland can expect to exceed 122 million metric tons of CO_2 equivalent by 2020 without any new CO_2 reducing programs.

Maryland Gross GHG Emissions by Sector, 1990-2020



In What Sectors Are Maryland's Greenhouse Gas Emissions Growing?

- The chart below shows historical and predicted future GHG emissions by sector.
- The green bars represent historical emission trends from 1990 to 2005. The purple bars represent 2005 to predicted 2020 totals.
- A few source sectors show a net loss in future emissions growth – agriculture and industrial processes.
- Historically industrial fuel use was a decreasing emissions source, but according to projections, Maryland could expect a slight increase in emissions from that source sector.
- Overall, the two largest sources – transportation and electricity (energy supply) showed significant growth in emissions from 1990 to 2005 and are expected to continue to grow between 2005 and 2020 in a "business-as-usual" scenario.



3 Greenhouse Gas and Carbon Mitigation Working Group

The purpose of the Early Action Items recommended by the Greenhouse Gas and Carbon Mitigation Working Group (MWG) is to establish "goals" for reducing greenhouse gas (GHG) emissions levels in Maryland and to develop effective GHG reduction and offset strategies that could be implemented relatively quickly, easily and at low cost.

Introduction

Residential solar panel installation

GHG emissions are steadily rising in Maryland on both a per capita basis and by the State as a whole. The MWG is charged in the Executive Order with developing a ***Comprehensive Greenhouse Gas and Carbon Footprint Reduction Strategy*** that will recommend a suite of short- and long-term legislative and other policy options to reduce Maryland's contribution to climate-changing GHG emissions by established dates and in measurable amounts. The recommendations in this chapter focus on Early Action Items that could be implemented by legislative or executive action in 2008. Through its Technical Work Groups (TWGs), the MWG will continue to evaluate approximately 50 priority policy options it has selected for further analysis. From these it will develop the full suite of recommendations that will form the basis of its ***Strategy*** in the April 2008 Climate Action Plan.

Recommendations for 2008 Legislation

These Early Action Items are clear priorities for Maryland based on the review of the Commission. The Commission recommends that the Governor and the Maryland General Assembly work together to develop and adopt legislation in 2008.

Goals

Overview

Goals are one of the key elements of state climate action plans. Most state plans include early goals (2010 to 2015), mid-term goals (2020) and longer-term goals (2050).

Different strategies may be needed to meet the different goals. Short-term strategies are usually based upon current technologies while longer-term strategies may depend on research and development and be more "technology forcing."

The Science Behind the Goals

As synthesized by the Intergovernmental Commission on Climate Change (IPCC), the scientific evidence suggests that an increase in annual global mean surface temperature greater than 2 - 2.5°C (3.6 - 4.5°F) above pre-industrial levels is very likely to result in dangerous consequences in terms of food production, biodiversity, and initiation of uncontrollable and unpredictable changes in the Earth's climate system, such as rapid melting of polar ice caps and changes in the ocean circulation that regulates the planet's climate. To avoid reaching this level of global warming, Earth system models indicate that greenhouse gas (GHG) concentrations in the atmosphere would have to be held to around 450 ppm in CO_2 equivalents, and certainly not more than 550 ppm. To stabilize GHGs at this level requires substantial early action because it now seems that atmospheric concentrations are fast approaching, if they haven't already reached 450 ppm. Furthermore, considering the residence time of the CO_2 and other GHGs that have been and are being emitted, reductions in emissions by 60 to 85% below 2000 levels would be required by 2050 in order to reach this level of stabilization. Consequently, governments ranging from the European Union to a number of states in the United States have been adopting policies and goals based on reducing emissions at least to 1990 levels by 2020. These climate action plans call for taking immediate actions to stem the growth in emissions and then beginning to reduce them, with a heavy emphasis on energy conservation. The plans set long-term goals of achieving 75-80% reductions in emissions by 2050, relying on new energy sources and technologies that will have to be developed.

The Goal Setting Process in Maryland

The key themes used by the Commission in the goal setting process were:

- Build from the most current science available
- Demonstrate leadership and be aggressive - Maryland has a tremendous amount at risk because of climate change
- Place a high priority on cost-effective implementation strategies to achieve goals
- Incorporate innovative funding mechanisms to limit the need for new public funding

- Maryland is in a unique position to become a national leader in terms of goal setting
- Urge adoption of policies and practices to achieve the earliest possible reductions
- Include a science-based review of the goals at least every four years

The Commission closely modeled efforts in other states, including California and New Jersey, and also paid close attention to the most recent science and goal information being developed by the IPCC and the U.N.

State	Earlier Goals	Mid-Term Goals	Later Goals
California	2000 levels by 2010	1990 levels by 2020	80% below 1990 levels by 2050
Florida	2000 levels by 2017	1990 levels by 2025	80% below 1990 levels by 2050
New Jersey	N/A	1990 levels by 2020	80% below 2006 levels by 2050
Massachusetts	1990 levels by 2010	10% below 1990 levels by 2020	75% below 1990 levels by 2050
IPCC	**N/A**	**25% to 40% below 1990 levels by 2020**	**80% to 95% below 1990 levels by 2050**

Source: Center for Climate Strategies

Maryland's 6-Step Goal Setting Process

Step 1 - Should The Goals Be Based Upon "Consumption" Or In-State Generation?

- Consumption-based goals are designed to reduce emissions resulting from Maryland's footprint (the activities of Maryland and its citizens). For example, Maryland consumes more electricity then it generates. Our footprint includes the GHG emissions from all the electricity we consume.
- Generation-based approaches simply look at emissions being released within a state's geographic border.
- Most states have used consumption-based concepts in setting goals. ***The Commission's recommended goals are consumption-based.***

Step 2 - What Year Should Be The Starting Point?

- There is a tremendous amount of inconsistency on this issue.
- Many states have used 1990 as a base year. Others have used later years like 2005 or 2006, while others have used 2000.

- ***The Commission's goals are based upon reductions from a 2006 base year.***
  - These are the most recent data
  - Using an earlier year (like 1990) does not communicate the magnitude of the challenge sufficiently because 1990 to 2006 growth has been significant.
- ***Generally, in Maryland, a 25% reduction from 2006 levels by 2020 is about equivalent to meeting 1990 levels by 2020.***
  - Because so many states have used 1990 as a base year, whenever possible, Maryland will include a reference to what the equivalent reductions from a 1990 base would be.

Step 3 - Should The Goals Be Aggressive Or Bottom-Up Minimums?

- What we'd like to do or what we know we can do?
- ***As a State with a tremendous amount at risk, the Commission felt strongly that Maryland's goals need to be very aggressive to both do our fair share and to demonstrate leadership.***
- Maryland's goals not only set reduction targets to drive State programs and reductions, they are also intended to send a message about the kind of reductions that Maryland believes other states, the Federal government and the international community need to be pursuing to combat climate change.
- The Commission also included the feasibility of achieving the goals as part of the goal setting process.
  - For example, the 2020 goal includes a minimum regulatory goal of 25% reduction, but also advocates for the development of non-regulatory, market-based tools to reward reductions above 25% and achieve a 50% reduction by 2020.

COMPARING MARYLAND'S GOALS TO 1990 EMISSION LEVELS

Year	Maryland's Goals (From a 2006 Base)	Equivalent Goals (From a 1990 Base)
2012	10% Reduction - from 2006 Levels	15% Above 1990 Levels
2015	15% Reduction - from 2006 Levels	9% Above 1990 Levels
2020	25% Reduction - from 2006 Levels	4% Reduction - from 1990 Levels
2020	50% Reduction - from 2006 Levels	36% Reduction - from 1990 Levels
2050	90% Reduction - from 2006 Levels	87% Reduction - from 1990 Levels

Step 4 - For What Years Should The Goals Be Set?

- Generally states have set early goals (2010 to 2015), mid-term goals (2020) and later goals (2050/2100)
- ***Maryland has set goals for 2012, 2015, 2020 and 2050***
- The 2012 goal is intended to push very hard for early action. A key message from the science is that early reductions are critical.
- The 2015 goal is intended to strengthen and promote early reductions. Some existing Maryland initiatives, like the Clean Cars program and RGGI begin to pay dividends in this time frame.
- The 2020 goal of 25% is intended to provide a regulatory driver consistent with Global Warming Solutions type programs in other states.
- The 2050 goal is designed to provide a regulatory driver that spurs research and development of climate-neutral technologies like clean coal power plants and zero emissions vehicles.

Step 5 - Should The Goals Be Regulatory Or Should They Be Reduction Targets for The State's Climate Action Plan?

- Other states have used goals to do both.
  - California and New Jersey use their 2020 goal as a strict regulatory limit that is enforceable
  - Other states have often used the goals to guide their state action plan
- ***Maryland's goals will be used to do both.***
  - The 2020 goal of 25% reduction and the 2050 goal of 90% reduction will, like those in California and New Jersey, be used as regulatory goals
  - The other goals will be used as reduction targets for the State Climate Action Plan

Step 6 - Should The Goals Be Science-Based?

- ***Maryland's goals have been developed using the most recent scientific findings on climate change and its drivers.***
- One key theme from the science is to push for early controls
  - Maryland's 2012 and 2015 goals are intended to drive early reductions
- Recent IPCC findings encourage industrialized nations to pursue reductions by 2020 in the 25% to 40% range (from 1990) to avoid the most catastrophic consequences of climate change.
  - Maryland's 2020 goals (25% and 50%) are intended to push for this level of reduction
- Recent and earlier IPCC findings push for global reductions as high as 80% to 95% (from a 1990 base) by 2050.
- Maryland's 2050 goal is consistent with this level of reduction

Recommended Goals

The key themes used by the Commission in the goal setting process were:

- Build from the best and most current science available
- Demonstrate leadership and be aggressive - Maryland has a tremendous amount at risk because of climate change
- Place a high priority on cost-effective implementation strategies to achieve goals
- Incorporate innovative funding mechanisms as much as possible to limit the need for new public funding to implement new programs
- Maryland is in a unique position to become a national leader in terms of goal setting
- Push for the earliest possible reductions

Mid Course Reviews: ***Conduct a science-based review of the goals at least every four years***

Maryland should set early, aggressive GHG reduction goals with specific time frames as follows:

2012

- ***10% below Maryland's 2006 GHG emission levels (using a consumption-based approach) by 2012***
- ***To be used as a reduction goal for Maryland's Climate Action Plan***

2015

- ***15% below 2006 levels by 2015***
- ***To be used as a reduction goal for Maryland's Climate Action Plan***

2020

- ***25% to 50% below 2006 levels by 2020***
- ***25% used as the "minimum" enforceable, regulatory driver for the Global Warming Solutions legislation***
- ***50% used as a science-based, non-regulatory reduction goal for Maryland's Climate Action Plan***
- ***Programs to implement the legislation would reward market-based reductions above 25%***

2050

- ***90% below 2006 levels by 2050***
- ***A science-based regulatory goal in the Global Warming Solutions legislation***
- ***A driver for research and development of climate neutral technology, programs and innovations***

THE IPCC ON REDUCTION TARGETS – 2007

"Table 1 summarizes this analysis, which indicates that in order to achieve a stabilization level of 450 ppmv CO_2 eq., emissions from Annex I Parties would need to be between …

… 25 percent and 40 per cent below 1990 levels in 2020, and between 80 per cent to 95 per cent below 1990 levels in 2050."[1]

Table 1. Characteristics of greenhouse gas stabilization scenarios

Category	CO_2 equivalent concentration	Global mean temperature increase above pre-industrial at equilibrium using 'best estimate climate sensitivity [a]	Change in global CO_2 emissions in 2050 (% of 2000 emissions)	Range of reduction in GDP in 2050 because of mitigation (%)	Allowed emissions by Annex I Parties in 2020 (% change from 1990 emissions)	Allowed emissions by Annex I Parties in 2050 (% change from 1990 emissions)
I	445-490	2.0-2.4	-85 to -50	Decrease of up to 5.5	-25 to -40	-80 to -95
II	490-535	2.4-2.8	-60 to -30			
III	535-590	2.8-3.2	-30 to +5	Slight gain to decrease of 4	-10 to -30	-40 to -90
IV	590-710	3.2-4.0	+10 to +60	Gain of 1 to decrease of 2	0 to -25	-30 to -80
V	710-855	4.0-4.9	+25 to +85			
VI	855-1,130	4.9-6.1	+90 to +140			

Source: IPCC Fourth Assessment Report (AR4). Contribution of Working Group III. Columns 1-4., table SPM.5; column 5, table SPM.6, columns 6 and 7, box 13.7.

[a]According to the AR4, the best estimate of climate sensitivity is 3 degrees Celsius.

[1]From the United Nations Framework Convention on Climate Change "Synthesis of information relevant to the determination of the mitigation potential and to the identification of possible ranges of emission reduction objectives of Annex 1 Parties" Technical Paper.

July 26, 2007

Global Warming Solutions Legislation

Maryland should adopt legislation requiring the State to develop and implement programs to reduce GHG emissions by 25% by 2020 and by 90% by 2050.

Overview

This legislative initiative would build from Maryland's Global Warming Solutions bill introduced in 2007. Based on California's Global Warming Solutions Act of 2006 (AB-32), the Maryland law would encourage the development of an economy-wide cap-and-trade program or other market-based programs to help achieve the 2020 and 2050 reduction goals as cost-effectively as possible. The program would encourage market-based initiatives and include both emission reduction efforts and sequestration projects in the trading programs developed. The Commission recommends that the legislation establish an Office of Climate Change to administer the program. The fiscal impact on State agencies could be addressed by including a self-sustaining fee in the legislation.

Primary Purpose

The primary purpose of the recommended legislation is to bring about reductions in GHG emissions through a market-based mechanism that has proven effective in other situations involving emissions of air pollutants. A GHG cap-and-trade program sets an initial GHG emissions cap (baseline) based on best available data relating to current emissions; then, over time, this emissions cap is gradually reduced to achieve the desired percent reduction in GHG emissions.

The emission "cap" is set in allowances. Usually one allowance equals 1 ton of CO_2 or the carbon equivalent for other GHGs. A source of GHG can either buy allowances to cover is emissions or earn "offsets" by performing certain activities that sequester GHGs such as forest management and reforestation. These offsets can then be used in lieu of purchased or allocated allowances to cover GHG emissions from a source.

Maryland Law, Executive Orders, Initiatives

Maryland does not currently have any legislation or other institutional instruments authorizing the State to develop and implement a multi-sector GHG program. However, Maryland participates in the Regional Greenhouse Gas Initiative (RGGI) with other mid-Atlantic and New England states.

Although RGGI's program currently applies only to fossil fuel-fired electric generating utilities, its founding documents envision that RGGI may become the framework for building a more comprehensive trading program that would include other economic sectors.

Further, the Maryland Department of Agriculture is currently developing an enhanced nutrient trading program that will provide for cap-and-trade of nitrogen, phosphorus and other agricultural fertilizers. Although this program is driven by water quality goals, it could have an ancillary benefit - the sequestration of carbon and nitrogen, each a GHG constituent - particularly for those conservation practices that involve

CALIFORNIA'S AB-32

California's ***Global Warming Solutions Act of 2006*** was signed by Governor Arnold Schwarzenegger on September 25, 2006. The law establishes the first enforceable state-wide program in the United States to cap all greenhouse gas emissions from major sources.

"We simply must do everything we can in our power to slow down global warming before it is too late …

The science is clear. The global warming debate is over."

Governor Arnold Schwarzenegger

The Bill that implements the provisions of the Act, ***Air Resources Bill 32 (AB-32),*** requires that, by 2020, California's greenhouse gas emissions be reduced to 1990 levels, a roughly 25% reduction below business-as-usual estimates.

The California Air Resources Board is a state agency that is responsible for monitoring and regulating greenhouse gas emissions sources under AB-32. Implementation details will be defined in the rule-making process. The Air Resources Board has appointed a market advisory committee to make recommendations about the design of the program. Part of these recommendations are the design of flexible mechanisms for compliance similar to the *Kyoto Protocol's Clean Development Mechanism.* Efforts are already underway to establish rules for the generation of offsets via the development of a carbon project.

forested buffers. This initiative would benefit significantly, if carbon credits and enhanced nitrogen credits (recognizing its dual benefits for water quality and GHG reduction) were "stacked" onto the others as tradable commodities. The additional value from the carbon and nitrogen credits should help create the robust nutrient trading market that is needed to make the nutrient trading program a success.

Developing a Multi-Sector GHG Program

Any authorizing legislation would need to include the necessary organizational structure and resources to allow the State to implement the program. The Commission recommends that the creation of an Office of Climate Change be included in the legislation. With respect to funding, one option to consider would be a self-sustaining fee provision in the legislation to fund necessary State agency staff and programs.

If the Global Warming Solutions legislation were adopted, the State would need to develop the necessary technical data, such as inventories, and then adopt regulations to implement the cap-and-trade program or other market-based programs to meet the 2020 goal. A considerable amount of research and analysis would need to be performed to support these technical efforts and rulemaking. California has set up a Market Advisory Board to assist with this effort in its implementation of AB 32, the California law upon which Maryland's 2007 Global Warming Solutions bill was modeled.

Another barrier is funding for the management of a GHG cap-and-trade program. Authorizing legislation could include the development of a multi-sector fee system as a funding mechanism to sustain the GHG cap-and-trade program. Ideally this program would be self-sustaining and not require general funds or Federal grant monies to remain viable.

Several features might be included in addition to the use of GHG emissions offsets. For example, provisions for "banking" allowances for future use or "borrowing" allowances promised for the future might be considered. Additionally, credits could be considered for emissions reductions achieved in advance of program implementation.

Co-Benefits of a Multi-Sector GHG Program

This type of program would have the potential to significantly reduce other air pollutants associated with fossil fuel combustion such as fine particulate matter, carbon monoxide, sulfur oxides, nitrogen oxides and mercury.

Such a program would also achieve significant GHG reductions in economic sectors not covered by the RGGI program, creating greater incentives for enhanced efficiency and GHG controls across economic sectors that are significant emitters such as industry, transportation and agriculture.

Regional Approaches

Maryland should work closely with its neighboring states, the RGGI states and the Federal government to pursue a regional, economy-wide, cap-and-trade program to reduce GHGs.

By implementing cap-and-trade programs over larger regions, greater emission reductions can be achieved and more cost-effective opportunities to control can be found. In general, larger trading regions often lead to greater reductions at lower cost.

The Regional Greenhouse Gas Initiative is an example of a multi-state cap-and-trade program

HOW WOULD A GHG CAP-AND-TRADE PROGRAM WORK?

A GHG cap-and-trade program would have five fundamental elements: the cap, the allowances, allowance trading, offsets, and monitoring/enforcement.

The cap. This is the mandatory limit on the total emissions that can be released in a given period from covered sources. For this market-based system to work, the cap must be carefully calibrated. Because the cap drives the price of allowances, the overall stringency of a program depends on the cap level. A cap set well below current emissions levels will be more challenging to meet than one that allows for continued growth in emissions above current levels, but below projected business-as-usual emissions growth. The Commission is recommending a cap of 25% below 2006 levels by 2020 and 90% below 2006 levels by 2050.

Emissions allowances. These are authorizations, or permits, that entitle the holder to emit a specified quantity of the pollutant being regulated in a given time period. For programs that target GHG emissions, allowances are typically equal to one metric ton of CO_2-equivalent emissions. The cap level determines the total number of allowances issued. For example, if the cap were set at 100 metric tons, then a total of 100 allowances would be made available to the market in some fashion, either through direct allocations or via an auction. If an auction is pursued, some of the auction funds could be used to cut GHG emissions from areas where carbon markets are not expected such as incentives to reduce sprawl and reduce driving.

Trading. Sources covered by the program can buy and sell allowances from other entities. Generally, an entity will buy additional allowances (entitling it to additional emissions) if the market price of allowances is less than what it would cost the facility, at the margin, to bring emissions down to the level required by its initial allowance holdings. Likewise, an entity will sell allowances if the allowance price is higher than what it would cost to achieve the needed reductions. Every allowance purchase by one entity corresponds to an equal reduction in the allowances held by the selling entity. Thus, allowance trades do not affect total allowable emissions because they do not alter the total number of allowances in circulation. Trading ensures that the emissions cap is achieved at least cost.

The Commission has also set a very aggressive goal of 50% reduction from 2006 levels by 2020. This goal is very challenging, but recent reviews of the science have emphasized the need to include goals like this. In designing the programs to implement Global Warming Solutions legislation, the State would be asked to include provisions in the trading programs to reward over-control. More simply, the trading programs would insure a minimum 25% reduction, but also strive to achieve reductions up to the 50% level.

Offsets. GHGs have natural "sinks" or mechanisms to remove or sequester GHGs from the atmosphere. For example, reforesting areas or establishing new wetlands removes carbon dioxide from the atmosphere. Good soil and nutrient management practices also sequester carbon and another powerful GHG constituent, nitrogen, in the soil. (Excess nitrogen in soil and waterways can be oxidized and released as nitrous oxide, a GHG with a carbon dioxide equivalent of 310.) Activities such as reforestation, enhanced nutrient management plans and wetland creation and protection could be used to create GHG emission offsets. A mechanism to monitor these offsets and their efficacy is essential to the development of any cap-and-trade program that would include offsets.

Monitoring and enforcement. At the end of each compliance period, often called the "true-up", entities regulated under a system are required to verify allowances equivalent to the level of their GHG emissions. Accurate measurement and reporting of all emissions is therefore necessary to assure accountability, establish the integrity of allowances, and sustain confidence in the market. To assure compliance, a cap-and-trade program needs to include penalties for entities that do not hold a sufficient quantity of allowances to cover their emissions. The regulatory agency responsible for the program must track emissions to ensure that: (a) emissions match allowances at particular sources; and (b) overall emissions match overall allowances. Strict monitoring and enforcement requirements for any proposed offsets are essential.

Energy Efficiency

Maryland should adopt or amend legislation to increase energy efficiency.

Overview

This area is a top priority because energy efficiency is the fastest and least expensive approach available to reduce GHG emissions. In fact, according to the EPA-DOE *National Action Plan for Energy Efficiency*, energy efficiency will not only help to address GHG emissions but actions in this area can also lower energy bills, help stabilize energy prices, enhance electric and natural gas system reliability, and reduce harmful air pollutants. In fact, in some states with well-designed energy efficiency programs, these programs are saving energy at an average cost of about one-half of the typical cost of building new electric power generating sources.

This recommended initiative is being coordinated with the Maryland Energy Administration (MEA) as it develops the State Strategic Electricity Plan - the first comprehensive update of the State's energy/electricity plan since 1993. There have been drastic changes in the landscape since then that have repeatedly signaled a need for a new comprehensive plan. MEA's Plan will allow Maryland to anticipate and adapt to the constantly changing energy/electricity infrastructure while reducing GHG emissions that harm public health and the environment. Plan updates every two years would ensure that it addresses the ever-changing global marketplace and technological opportunities.

In 2007, Governor O'Malley announced one of the most aggressive energy efficiency goals in the nation: to reduce Maryland's per capita electricity consumption 15% by 2015. If successfully implemented, the ***EmPOWER Maryland*** initiative would save consumers $1.8 billion in electricity costs, avoid 25 billion kWh of electricity consumption and eliminate 35 billion pounds of GHG pollution.

Several options have been discussed by the Commission and MEA. One option is to create an Energy Efficiency Performance Standard that would require electricity suppliers to reduce consumption and peak demand by a specified amount through implementation of cost-effective programs. This approach can be complemented by also creating a publicly administered Energy Investment Fund that would focus on traditionally under served market segments, such as statewide educational and coordination efforts, low-income communities, public buildings, partnerships with financial institutions to provide reduced cost loans, and other investments with a longer payback period. Additional options include provisions to strengthen building codes and inspections in order to improve energy efficiency in buildings and systems, and provisions to improve energy efficiency in appliances and lighting.

Energy Efficiency Performance Standard

Maryland should adopt Energy Efficiency Performance Standard legislation requiring utilities to reduce electricity consumption and peak demand by a specified amount by implementing cost-effective programs targeted to consumers.

An Energy Efficiency Performance Standard (EEPS) is mechanism to encourage more efficient generation,

transmission, and use of electricity. State statutes or public utility commissions set targets for electricity demand reduction by end-users and allow the utilities flexibility to achieve the targets through programs they manage.

EEPS Elements

Successful EEPS programs typically include the following elements:

- ***Goals.*** These require utilities to reduce a specified percentage of their electricity demand through end-user demand reduction by a specified date. Typically, energy reductions are ramped up incrementally. This gives utilities the chance to develop expertise in administering programs. In Maryland, the savings target could be pegged to the Governor's ***EmPOWER Maryland*** target of a 15% per capita reduction in electricity use by 2015.
- ***Interim progress reports.*** Utilities report on the progress of their energy efficiency programs as compared to the corresponding interim benchmarks in the statute or regulation. These are conducted on a regular multi-year cycle, such as every 2 or 3 three years. Progress is measured as a percent reduction of the prior year's sales.
- ***Third party measurement and verification.*** This ensures that utilities meet energy savings goals for programs they implement and protect consumers against paying for unrealized energy savings.
- ***Incentives and disincentives.*** If utilities establish an efficiency program and it falls below a specified percentage of the savings targets, they pay a penalty. If they greatly exceed the targets, they earn a specified percentage of the net benefits.

Build on Existing Programs in Maryland

Maryland has a Renewable Portfolio Standard (RPS) which requires utilities to procure a percentage of their electricity from renewable sources on a ramped-up schedule to 2022. An EEPS could build on the monitoring and verification mechanisms already in place for the RPS program.

EEPSs in Other States

Presently, thirteen states have EEPSs and three more (New Jersey, New York and Illinois) are considering them. Studies on a number of these states have found cost-effective opportunities to reduce energy use by 20% or more. Texas's electricity restructuring law requires electric utilities to offset 10% of their demand growth through end-use energy efficiency. Utilities in Texas have had no difficulty meeting their targets and are currently exceeding them. Nevada and Hawaii recently expanded their RPSs to include energy efficiency. Connecticut and California have each established energy savings targets for utility energy efficiency programs. Vermont has specific savings goals in its performance contract with the nonprofit organization that runs statewide programs under a contract with its public utility commission. And Pennsylvania's new Advanced Energy Portfolio Standard includes end-use efficiency among other clean energy resources.

Program Implementation

The Maryland Public Service Commission (PSC) would need to develop the regulatory framework to implement the EEPS. To jump-start the utilities' programs, the PSC could develop rules directed toward getting the most cost-effective programs implemented first. A "trust but verify" regulatory approach that empowers utilities to initiate programs without extensive prior approval but holds them accountable with third-party evaluation and subsequent accountability would allow quick action and quick reaction without excessive regulatory impediments, while providing accountability if goals are not met.

Co-Benefits

An EEPS program would benefit electricity consumers by reducing their electricity costs over time as they reduce consumption. Further, it would reduce demand on Maryland's electricity supply grid, thus increasing reliability of the system and reducing the risk of brown-outs and other disruptions in service.

Publicly Administered Energy Investment Fund

A publicly administered energy investment fund is a designated revenue stream that a state can use to fund energy efficiency programs. Sixteen states use public benefit funds to implement energy efficiency and renewable energy programs through utilities or third-party contractors. Maryland should create a publicly administered energy investment fund to help the State meet the EmPOWER Maryland energy efficiency goals using revenues generated from RGGI as a starting point.

Amend State Building Codes to Improve Energy Efficiency

Maryland should amend its existing building codes to incorporate green building design, construction and operation principles and minimum energy efficiency performance standards in order to establish a green building and energy efficiency minimum (or baseline).

Target concepts that potential legislation could address include:

- Building Permit Amendments
- Building Commissioning
- Measurement & Verification Plans
- Demand Ventilation
- Ventilation and Thermal Comfort
- New & Replacement Roofs
- New Household Appliances
- Parking Requirements
- Training Building Inspectors

Existing Requirements

Currently, building codes have incorporated provisions from International Code Council documents along with riders from municipal and county governments that add or delete provisions in the reference documents to meet local needs. Many local and state governmental agencies as well as many private organizations have specified in their contracts that facilities be built to higher energy efficiency requirements for new construction. This is a trend in Maryland as well as across the country.

Barriers to High Performance Buildings

The existing building codes represent the very minimum actions necessary to construct a building. Standing alone, they do not lead to a high performance building in terms of resource and energy efficiencies. Historically, building codes were designed to ensure structural integrity of the building and to address safety concerns. Training inspectors, as well as designers, architects and developers, in green building construction and energy efficiency performance standards would improve the effectiveness of code enforcement.

The U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ encourages and accelerates global adoption of sustainable green building and development practices through the creation and implementation of universally understood and accepted tools and performance criteria.

LEED is the nationally accepted benchmark for the design, construction and operation of high performance green buildings. LEED gives building owners and operators the tools they need to have an immediate and measurable impact on their buildings' performance. LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality.

Benefits

Building code amendment would provide benefits to building owners who can expect a more energy efficient building and lower energy costs over the life of the building. Although there may be some slight increased construction cost up front, financing mechanisms could be structured to avoid such impacts.

Another Option for Maryland

In addition to promoting "green buildings," Maryland could encourage energy efficiency investments in existing and new buildings by making energy information available for homes and commercial buildings. Home buyers could determine not only if they could afford to buy the house, but also whether they could afford to live in it. Sellers would have an incentive to make energy-efficient investments in their property. The lending industry would benefit because a home buyer might be able to afford a larger mortgage if the operating costs of the home were lower.

Increase Lighting Efficiency Standards

Maryland should adopt legislation to prescribe a minimum level of operating efficiency for lighting devices by specified dates.

Primary Purpose

The primary purpose of this legislation would be to phase out less efficient General Service Lighting Devices (i.e. Incandescent light bulbs) with General Services Lighting Devices that meet a minimum energy efficiency standard in lumens per watt.

Existing Laws, Executive Orders, Initiatives

Currently Maryland does not have any legislation authorizing the State to develop and implement a program to establish minimum energy efficiency standards for general service lighting devices. At the Federal level, the Chair of the Senate Energy and Natural Resources Committee introduced a bill in September 2007, S. 2017, to phase out incandescent light bulbs by 2014.

Barriers to Establishing Minimum Energy Efficiency Standards for General Service Lighting Devices in Lumens Per Watt

The fundamental barrier to the development of any minimum energy efficiency standards for general service lighting devices is the lack of authorizing legislation. Another barrier might be the development of an adequate program to recycle spent compact fluorescent lights in an environmentally responsible manner.

CALIFORNIA LIGHTING STANDARDS

California Assembly Bill 722 set minimum energy efficiency standards for general service lamps and lighting devices. The bill gives the California Energy Resources Conservation and Development Commission responsibility for adopting the minimum efficiency standards for outdoor and indoor lighting. These efficiency standards will be phased in over several years.

Co-Benefits of a Minimum Energy Efficiency Standard for General Service Lighting Devices and Lamps

This type of program would also have the potential to significantly reduce other air pollutants associated with fossil fuel combustion to generate electricity such as fine particulate matter, carbon monoxide, sulfur oxides, nitrogen oxides, and mercury.

Tax Inefficient Vehicles

Maryland could adopt an excise tax on new motor vehicles which have the lowest fuel economy ratings. In addition to encouraging Maryland motorists to choose vehicles with higher fuel efficiency and lower GHG impacts, an excise tax could provide a significant fiscal co-benefit to the State. Preliminary analysis suggests that a 1% excise tax on this category of vehicles could raise as much as $33M in tax revenues for Maryland.

Strengthen Maryland's Renewable Portfolio Standard

Maryland should amend its Renewable Portfolio Standards (RPS) law to encourage more investment into renewable energy sources.

Overview

Several options for achieving this goal have been discussed by the Commission's MWG, including a higher renewable percentage for each company's portfolio and a smaller geographic area for eligible renewable sources.

The specific provisions of the legislation are being coordinated with MEA as it develops the State Strategic Electricity Plan. The Commission is providing input to MEA to make sure the final recommendations take into consideration the GHG impacts of any policy proposal.

Renewable Portfolio Standards

An RPS is intended to promote the development of electricity generation from renewable sources by requiring retail electricity suppliers to procure a designated percentage of their load, or customer demand, from renewable energy generators. Certified generators earn certificates for every unit of electricity they produce and can sell these along with their electricity to suppliers. Suppliers then pass the certificates to a regulatory body to demonstrate their compliance with their RPS obligations. Non-compliance payments are levied against suppliers with RPS shortfalls.

Because it is a market standard, the RPS relies almost entirely on the private market for its implementation. Those supporting RPS mechanisms claim that market implementation will result in competition, efficiency and innovation that will deliver renewable energy at the lowest possible cost, allowing renewable energy to compete with cheaper fossil fuel energy sources. Many suppliers offer the public the opportunity to purchase renewable power as part of their electricity purchase and use the money to support renewable energy projects. This method of supporting renewable energy is gaining interest from the public.

Maryland's RPS Law

Maryland is among twenty-seven states and the District of Columbia that have RPS laws. See "Summary of State Renewable Portfolio Standards" chart on the next page. Enacted in 2004 and amended in 2007 to increase the percentage requirements and to add a separate provision for solar energy, Maryland's RPS law currently requires retail electricity suppliers to obtain 9.5% of their load from renewable sources by 2022, of which 2% must come from solar energy.

Renewable sources are divided into two tiers, with Tier 1 sources including wind, solar, advanced biomass, small hydro under 30 MW in operation in 2004, landfill methane, ocean, geothermal, and fuel cells powered by biomass. Tier 2 renewables include municipal solid waste, large hydro and poultry litter. In 2006 suppliers were required to provide 1 percent of their sales in the State from Tier 1 renewables and 2.5 percent from Tier 2. Tier 1 increases by 1 percent biannually to 7 percent in 2018 and 7.5 percent in 2019, while Tier 2 is stable through 2018 and then sunsets. Compliance and verification is based on a credit trading system.

Geothermal Heating and Cooling System
Great Seneca Creek Elementary School, Germantown, Maryland

How Well is Maryland's RPS Working?

Suppliers may purchase from renewable generators located anywhere in the "PJM region" (comprised of 13 states and the District of Columbia), or a state adjacent to PJM, or elsewhere as long as the electricity can be delivered to the grid serving Maryland. The effect is that a generator as far away as Illinois can qualify for the Maryland RPS.

Maryland's RPS percentage requirements are low compared to other states' RPS, as the chart on the next page demonstrates. Maryland also has the most geographically expansive RPS region in the country. The combined effect is that new renewable energy capacity is not being stimulated in the State. Although the public is increasingly purchasing renewable power, most of the projects supported by their purchases are not occurring directly in Maryland because projects anywhere in the PJM region or adjacent states are acceptable.

MEA is also actively engaged in stakeholder processes to evaluate Maryland's RPS and recommend improvements as part of the State Strategic Electricity Plan. The Commission and MDE have worked closely with MEA to ensure that the Commission's recommendations on RPS amendments are consistent with MEA's recommended actions.

SUMMARY OF STATE RENEWABLE PORTFOLIO STANDARDS

The table on the right gives a rough summary of state renewable portfolio standards. Percentages refer to a portion of electricity sales in Megawatts (MW) of absolute capacity requirements. Most of these standards phase in over years, and the date refers to when the full requirements take effect.

EXAMPLES OF STATE RENEWABLE ENERGY PORTFOLIO STANDARDS

State	Amount	Year
Arizona	15%	2025
California	20%	2010
Colorado	20%	2020
Connecticut	23%	2020
District of Columbia	11%	2022
Delaware	20%	2019
Hawaii	20%	2020
Iowa	105 MW	Not Stated
Illinois	25%	2025
Massachusetts	4%	2009
Maryland	9.5%	2022
Maine	10%	2017
Minnesota	25%	2025
Missouri	11%	2020
Montana	15%	2015
New Hampshire	16%	2025
New Jersey	22.5%	2021

Source: U.S. Department of Energy

Options Under Consideration

The Commission and MEA are considering the following options to improve the existing RPS program:

Option 1

- Change the Tier 1 requirement to 20% by 2022
- Raise the non-compliance payment to $40/MWh
- Limit the geographic eligibility of renewable projects to include only those facilities located within PJM.

Option 2

This option is the same as Option 1, but the geographic eligibility is slightly smaller, limited to those facilities located within Delaware, Maryland, Pennsylvania, the District of Columbia, Virginia and West Virginia.

Option 3

This option maintains the current geographic eligibility and the 9.5% RPS level by 2022 but raises the non-compliance payment to $40/MWh.

Recommendations for Early Executive Action

The Commission recommends that the Governor, the Maryland General Assembly, local government and other interested parties work together in partnership to pursue the following initiatives that do not necessarily require legislation prior to the Commission's April 2008 Climate Action Plan report.

Government Lead by Example

The Governor should issue an Executive Order establishing GHG reduction programs for State personnel, facilities and operations and providing incentives for local governments to do the same.

Reduce State Government GHG Footprint; Stimulate Private Sector and Local Government Programs

Maryland State government is a vast consumer of energy. Over two years, the three branches of government and the independent agencies, such as the University System of Maryland, will spend roughly $250 million on 1.5 billion kilowatt hours of electricity. Given this significant GHG footprint, it is important for the State to take a leadership role in addressing climate change by reducing GHG emissions and adopting sustainable energy practices involving State government facilities and operations. This lead-by-example initiative would have the twin benefits of direct emission reductions as well as indirect reductions by stimulating change in the private sector and local governments. As noted elsewhere in this report, State government has already taken important steps to reduce its GHG emissions in several areas. More can and needs to be done, however. Local governments in Maryland, especially those that have already launched their own climate action plans, are watching the State with a critical eye. By reducing GHG emissions and adopting sustainable energy practices in its own house, Maryland State government will add force and integrity to the State Climate Action Plan that will call upon every Maryland citizen, business, school, government agency, and other institutions to make energy efficiency a part of everyday decision-making and change business-as-usual behavior as we transition o a sustainable energy future.

CLEAN ENERGY INITIATIVES
MONTGOMERY COUNTY, MARYLAND

In 2007, Montgomery County reaffirmed its commitment to Climate Protection by becoming a founding signatory to the Cool Counties Climate Stabilization Declaration, pledging to reduce emissions 80% by 2050. Examples of the County's actions include purchasing 10% of its electricity use from regionally generated wind power as part of an 18 government consortium. The County has committed to increase this purchase to 20% by 2010. The County implemented the Clean Energy Rewards Program <www.montgomerycountymd.gov/cleanenergyrewards> which provides an incentive for the community to purchase clean energy for their homes and businesses. Legislation was passed by County Council in 2006 establishing USGBC LEED Silver or equivalent as the requirement for new County-funded facilities over 10,000 square feet and LEED certified or equivalent as the requirement for new non-residential or multi-family construction. To encourage public transportation the County operates an extensive bus fleet, many of which are alternatively fueled vehicles.

ADDRESSING CLIMATE CHANGE AT THE LOCAL LEVEL – ANNAPOLIS, MARYLAND

The City of Annapolis developed a Clean Air educational program called "Take a Deep Breath" which has been taught to every fourth grade student in Anne Arundel County. The course was designed to educate the students about clean air and encourage them to plant trees. It also asked the students to convince their parents to commit to driving 10 fewer miles each week. Beyond the obvious environmental lessons built into the course, the children developed their math skills by computing the amount of pollution that planting a tree and driving less would remove from the atmosphere.

Mayor Moyer and friends plant a tree

Recently, the program was expanded to become "Take a Deep Breath/Give the Power Plant a Rest." In addition to the children's educational component, residents are now being encouraged to switch to compact fluorescent light bulbs and to learn about other steps they can take to reduce their carbon footprint. The new program is supported by public service announcements on local radio and television which encourage listeners to "take the pledge" to reduce their carbon footprint. Brochures with tips on cutting carbon emissions are available throughout the City. Those who "take the pledge" get a small "Cloud Nine" sticker to place in their vehicle window, letting other people know that they are sharing in the responsibility for global climate protection.

"Take a Deep Breath/Give the Power Plant a Rest" is one of several energy conservation initiatives taken in Annapolis. Other examples include:

- The City Council recently passed a resolution accepting the recommendations of the Energy Efficiency Task Force to reduce the City's carbon footprint and to encourage many public and private green building initiatives. Public Sector Projects will be at least Silver LEED certified. (For more information on LEED, see text box on page 35.)
- The City is committed to expanding City and transit vehicles with additional hybrid and alternative fuel vehicles.
- The City has made a commitment to the World Wildlife Fund's Power Switch Program to find alternative sources for the purchase of energy.
- There are now four green roofs within the City limits, and green roofs are encouraged when development permits are sought. This will be expanded through mandated code changes.
- The City currently has a 42 percent tree canopy and has committed to increasing it to 50 percent in the coming years. Over the past six years, the City has given away 500 trees annually to residents.
- The Annapolis Conservancy, a pioneering local government conservancy, has saved and created open space on some 200 acres of property inside the seven square miles of the City.

Build on Existing Executive Orders and Other Initiatives

An initiative to reduce the State government's GHG profile could build on several initiatives already in place:

- ***Executive Order 01.01.2001.02 "Sustaining Maryland's Future with Clean Power, Green Buildings, and Energy Efficiency".*** This Order requires State agencies to procure clean power and sets goals for energy efficiency, renewable energy, efficient product purchases, pollution prevention, and alternative fuel vehicles in State government.

  The Order also established the Maryland Green Building Council. In 2002 the Council reported that:

  - 20% of the energy purchased for State buildings was from renewable energy sources.
  - The High Efficiency Green Buildings Program was implemented.
- The ENERGY STAR® purchasing requirement was established.
- More than twelve public school renovation projects utilized geothermal ground source heat pump systems.

In 2007, the Maryland General Assembly passed House Bill 942, which was signed into law by Governor O'Malley on April 24. The legislation codifies and re-establishes the Maryland Green Building Council to promote high performance buildings, systems, and policies for State-owned and -leased facilities. The Council met throughout the fall of 2007 to develop a new Maryland Green Building Program and provide recommendations for the 2008 Legislative Session.

- ***State Agency Compliance Initiative***

  The Initiative resulted from multi-media inspections of State government buildings and fleets. Designated agencies are required to conduct internal environmental audits, identify deficiencies, correct non-compliances and provide to MDE a written plan that, among other things, identifies personnel to oversee and implement environmental compliance and self-audit responsibilities. The principles and practices put in place under this initiative would be transferable to one involving GHG emission reductions.

- ***EmPOWER Maryland***. Launched by Governor O'Malley in the summer of 2007 through the MEA, the ***EmPOWER Maryland*** initiative sets a target to reduce Maryland's per capita electricity consumption 15% by 2015. State government is called upon to:

  - Replace incandescent lights with compact fluorescent lights (CFLs) in State facilities
  - Expand energy performance contracting in State programs
  - Increase the State Agency Loan Program, which funds energy-efficient lighting, controls, and heating, ventilating and air conditioning (HVAC) systems
  - Require all new State buildings larger than 20,000 cubic feet to be more energy efficient

- Purchase ENERGY STAR® products
- Expand the Community Energy Loan Program, which provides low-interest revolving loans to local governments and nonprofit organizations to install energy efficiency improvements
- Ensure accountability by incorporating energy data into StateStat, the Maryland statistics-based government management process.

Climate Action Plan for State Government

The Commission's MWG has discussed a large number of options for inclusion in the executive order. These include the following:

- Develop a comprehensive State energy plan. MEA has already initiated this effort with its State Strategic Electricity Plan. The Plan is expected to be completed by early 2008;
- Establish energy efficiency goals for government operations beyond the goals in SB 267 (2006 law requiring a 10% reduction by 2010) and consistent with ***EmPOWER Maryland*** goals (e.g. 15% per capita reduction in electricity use by 2015);
- Create an Office of Climate Change;
- Insure that power purchases for State agencies equal or exceed current and any future Renewable Portfolio Standards;
- Promote the most cost-effective high performance, energy-efficient "green building" technologies in new government buildings, including K-12 (especially high schools) and the State's university system, taking into account energy efficiency pay backs of green building investments. (See text box on page 37 for an example of a LEED Gold Certified State university building in Shady Grove, Maryland.)
- Encourage energy audits in all State agencies (possibly through the ***EmPOWER Maryland*** initiative to evaluate 3,000 of the State government's buildings for energy savings that can be financed with energy performance contracts);
- Create an "Office of Energy Information" in MEA that serves as a clearinghouse for energy data and related GHG emissions;
- Designate an energy efficiency manager in each department and agency (currently being done under SB 267 mentioned above);
- Establish an annual reporting and accountability protocol for each agency, possibly built on State Agency Compliance Initiative and Managing for Results programs;
- Require ENERGY STAR® standards for systems and appliances in leased facilities;
- Require that projected energy costs are evaluated when considering new leases or lease renewals or set an energy cost per square foot maximum for new leases of office space;
- Improve efficiencies in vehicle fleets; Adopt sustainable procurement practices/preferred products

lists and remove remaining barriers;

- Encourage and remove procurement barriers for purchase of locally produced or manufactured products;
- Establish personnel incentives to achieve sustainability standards and to stimulate innovations;
- Promote Green Buildings in schools and universities;
- Launch outreach and public education campaigns to highlight the achievements of government, businesses and individuals. Develop awards programs to recognize significant contributions and stimulate public energy, interest, entrepreneurial spirit and ownership in environmental sustainability; and
- Encourage and provide technical support to local governments in Maryland to adopt similar lead-by-example energy reduction programs.

Program Co-Benefits

By reducing its own GHG emissions, State government will reduce its operating expenses, which may yield long-term savings in the State's overall budget. While there may be initial up-front costs to implement some of the Lead by Example options, the results in energy and cost savings could continue for many years. With its significant purchasing power, the State government could stimulate competition for sustainable products and services and promote greater energy efficiencies in the market.

Education and Outreach

Maryland should develop a partnership with the State University system, local governments, the private sector and other interested parties to encourage voluntary action to reduce GHG emissions.

This effort would be designed to coordinate efforts amongst interested parties, raise climate change public awareness and encourage behavior change through education and outreach to consumers, commercial and industrial sectors, and students, including integration into P-20 (formerly K-12) school curricula.

The effort could build from existing programs, including those already initiated at many schools, colleges and universities throughout Maryland.

Mitigation Working Group Could Develop an Education / Outreach Plan

The Commission recommends that the MWG establish a sub-group to draft a proposal for implementing this initiative. The tasks could be broken down into three major components:

- Climate Change Awareness and Energy Efficiency Education for Maryland Residents and Institutions
- Maryland-specific Climate Change Curricula and Energy Efficiency Education in Schools
- Media Coordination

Existing programs and policies

Maryland's major outreach and education opportunities related to climate change fall under the guidance offered by the ENERGY STAR® and ***EmPOWER Maryland*** initiatives. The success of outreach and education is currently limited by the voluntary nature of existing programs, as well as the small-scale funding and human resources relative to the need for changes in public behavior. The State Department of Education does not currently provide a climate change curriculum; its web site offers links to two curricula, but up-to-date material, Maryland-specific curriculum, and opportunities for the training of educators, are lacking.

Climate Change Awareness and Energy Efficiency Education for Maryland Residents and Institutions

Energy efficiency education goals could include the following:

- Develop a clearinghouse for climate change information specifically relevant to Maryland residents and businesses.
- Coordinate with faith communities, non-profit organizations, and other civic and social organizations (e.g. Lions Club, Rotaries, Chambers of Commerce, Boy Scouts and others), as well as science centers, zoos, and museums.
- Declare a Maryland Climate Change Awareness month; work with the media for promotion and publicity and educate media personalities on the relevance of climate change.
- Build upon legislation and programs in the areas of energy efficiency improvements, training and education for builders and

LEARNING GREEN, LIVING GREEN – FROSTBURG STATE UNIVERSITY

Under the leadership of Dr. Jonathan Gibralter, Frostburg State University is engaged in various projects and programs that support its "Learning Green, Living Green" sustainability initiative. As part of its participation in the American College & University Presidents Climate Commitment, FSU established a campus-wide steering committee that recently selected three tangible actions to fight global warming: (1) purchase at least 15 percent of the University's energy from renewable resources; (2) commit to making the purchase of Energy Star-rated appliances and products an institutional policy; (3) participate in Recyclemania, the national student competition to reduce waste. The University has also organized several educational and community events and programs on climate change.

With the help of a grant from the Maryland Energy Administration, faculty from the Department of Physics & Engineering coordinated the design and construction of a residential-scale wind turbine and solar energy project on campus. The project, dubbed WISE (Wind-Solar Energy), was highlighted during a renewable energy conference the University hosted in September, which brought together educators and vendors from across the mid-Atlantic region to discuss energy alternatives. WISE is also a source of research and study for FSU's interdisciplinary curriculum and educational outreach programs that will explore the possibilities of harvesting wind and solar energy in Western Maryland.

President Gibralter joined scores of other college and university presidents to sign the American University and College Presidents Climate Commitment.

contractors, appliance recycling pick-up programs, voluntary industry-government partnerships, and in-home energy displays.

- Conduct periodic research to determine Maryland public opinion to improve outreach effectiveness.

MEDIA PARTNERSHIPS

One notable example of effective outreach on a relatively small budget is the MEA's radio campaign to inform Maryland residents about the availability of State loans for installing solar and geothermal systems in their homes. Education and outreach initiatives could be modeled after the public-private partnership MEA has developed to finance this media campaign.

Maryland-specific Climate Change Curricula and Energy Efficiency Education in Schools

Curricula items could include the following:

- Utilize the Clean Air Partners' Air Quality Curriculum, which includes a unit on climate change and which will be finalized in November 2007. A part-time contractor will be available to schools in Maryland.
- Coordinate with the ***EmPOWER Maryland*** Clean Energy Schools program, which will be install-

ENVIRONMENTAL SUSTAINABILITY INITIATIVE – UNIVERSITY SYSTEM OF MARYLAND (USM)

Chancellor Brit Kirwan and the Board of Regents have launched the Environmental Sustainability Initiative to focus, accelerate and integrate the University System of Maryland's contributions to environmental sustainability in the 21st century, particularly society's response to the challenge of global climate change. In its multiple roles the USM will be an important resource in helping our State come to terms with the impact of climate change. Through their education and research programs, System universities will train the problem solvers of tomorrow and develop and promulgate new strategies for addressing environmental challenges. And, through commitment to best practices in energy conservation and carbon footprint reduction these institutions will serve as models of environmental stewardship. The new Camille Kendell Academic Center at the Universities at Shady Grove, Maryland's first LEED Gold certified academic building, symbolizes the System's firm resolve to address the challenges of climate change.

ing clean energy projects throughout the State in the Fiscal Year 2008. Use projects as education and outreach "teachable moments" that energy investments in green school buildings will bring returns in saved energy expenditures and will not take money away from academic programs.

- Develop professional development workshops and online and on-site instructions for educators.
- Promote research into climate change and solutions at State universities.

Co-Benefits and Feasibility

The Education and Outreach program is a relatively low-cost strategy to ensure long-term effectiveness of GHG emission reduction activities. Necessary programs and initiatives can achieve success with minimal disruption of educational infrastructure, as well as offer co-benefits of cleaner air, improved pubic health, and increases in finances available to Maryland schools. In many cases the success of emission reduction activities depends on Maryland citizens being provided with accurate information, making education and outreach a necessary tool in ensuring successful implementation of the Climate Action Plan.

Encourage Federal and International Action

The Governor and the Maryland General Assembly should aggressively push for Federal action to reduce GHGs. Global warming is a problem that requires global action. An aggressive approach to GHG reductions within the United States would have a significant effect on the international reductions needed to begin reversing global warming trends.

"THERE IS A LONG AND PROUD HISTORY OF FEDERAL LEADERSHIP ON ENVIRONMENTAL ISSUES IN THIS COUNTRY … TOGETHER, WE CAN DEVELOP NATIONAL PROGRAMS TO TACKLE GREENHOUSE GAS EMISSIONS … WE CAN TRANSFORM OUR CARBON-BASED ECONOMY INTO A GREEN, SUSTAINABLE ECONOMY"

Governor Martin O'Malley

September 2007

Understand Greenhouse Gas Implications from Major Projects

The State should review the procedures for environmental impact studies for major projects to insure that the GHG implications are reviewed and addressed. Very large local, state and federal projects such as large government center construction projects, improvements to military installations, large capacity-enhancing road construction projects and other initiatives like dredging, airport expansions and transmission lines, may have significant implications in meeting the very aggressive goals discussed earlier in this Report.

Options to Consider:

- Examine GHG emissions during the planning and approval process of any State-funded / State-approved project and ensure that alternatives to minimize fuel use and GHG emissions are considered.
- Ensure that all State-funded Environmental Impact Statements include a detailed analysis of GHG emissions.
- Request that any large-scale Federal project that requires an environmental impact statement in Maryland evaluate GHG emissions regardless of any minimal Federal requirement.
- Require projects that will significantly increase GHG emissions to offset and or mitigate all new project-created emissions and to consider a wide array of alternatives that might partially satisfy the project's purpose and need while minimizing emissions.

Barriers

- Lack of Federal enforcement of GHG policy

Incentives for Green Buildings Beyond Minimum Code Requirements

Maryland should work in partnership with the business community and other interested parties to make sure that the cost-saving potentials associated with the different Green Building practices are well understood by developers, building managers, construction companies, investors and owners. Training programs could be developed and implemented to voluntarily extend Green Building practices.

Purpose

There are a variety of Green Building practices that have potential to improve energy efficiency and environmental quality. However, it may be impractical to mandate these into code, because every building is unique. They have different environmental factors, population densities, and varying heating and cooling loads. Thus, incentives and resources like education programs could be established to encourage building owners to voluntarily implement green building practices.

Benefits

Encouraging building owners to implement green building practices beyond minimum code requirements will reduce energy consumption, improve environmental quality and save the building owner money as the cost of energy continues to increase. The owner will also receive financial benefits, as improvement in environmental quality will increase productivity.

Existing Requirements and Barriers

Currently green building education and outreach efforts in Maryland are limited.

Although information on green building practices and energy management exist, this material has not been formulated into a unified curriculum. There is also limited outreach to educate building facility operators

Highland Beach Town Hall, Edgewater, Maryland

Chesapeake Bay Foundation
The Philip Merrill Foundation Educational Center

and homeowners on energy savings opportunities, potential cost savings and appropriate operations and maintenance practices.

Implementation

Maryland could work in partnership with the business community and other interested parties to develop appropriate educational and outreach programs. Possible program funding sources could include existing tax incentives and revenues from RGGI's consumer benefit fund. Added construction costs for incorporating green practices could be financed by low-risk, low-interest bank loans premised on the borrower's lower monthly energy expenses, and tax-free savings funds to encourage citizens to save up for green building improvements.

Other Recommendations

The Commission has also identified several other initiatives that it would support should appropriate legislation be introduced. These initiatives were specifically identified by the Commission's MWG for consideration as Early Action Items. These recommendations are as follows:

Enhanced Carbon Sequestration in Forests

The Commission supports legislative initiatives to amend Maryland's current Forest Conservation Law, and initiatives to develop market incentives, to promote carbon sequestration through more effective forest conservation, afforestation/reforestation and management.

Sequestration Through Improved Forest Management

This option is designed to enhance greenhouse gas sequestration in two ways: first, through increasing the rate of carbon dioxide (CO_2) sequestration in forest biomass through healthier forests, and second, through increasing the amount of carbon stored in harvested, durable wood products.

Program Implementation

Specific actions and practices included under this option vary widely. The MWG's Agriculture, Forest and Waste Technical Work Group identified several possible areas where policies could be quickly amended to improve forest management practices in Maryland with limited controversy or legislative amendment. These options include the following:

- Provide land developers with best management practices and options to maintain forest land tracts.
- Build carbon trading into the nutrient trading program currently being developed by Maryland Department of Agriculture, with the goal of integrating the trading of sequestered carbon into an economy-wide cap-and-trade program (being considered by MWG's Cross-Cutting Technical Work Group).
- Develop a credit program for storm-water run-off reduction.
- Amend Maryland's Forest Conservation Law to increase its scope and strength. Natural regeneration is not meeting the No Net Loss forest lands goals as browsing by deer and competition from invasive species is suppressing the spread and vigor of existing forests.

Pay As You Drive Insurance Programs

The Commission supports initiatives that would promote Pay As You Drive (PAYD) insurance as an option for motorists.

PAYD insurance provides financial incentives to motorists for driving less. PAYD links auto insurance policies to mileage by converting a portion of the insured driver's annual premium into a per mile fee. The per mile fee incorporates all existing rate factors (i.e. vehicle type, driving history). Details may vary among the PAYD policies auto insurance companies are expected to offer, but the general format would likely be one where the motorist pays in advance for a predetermined number of miles, and either pays more or receives a rebate, depending on how much the motorist drives.

Vehicle insurance is a significant portion of total vehicle costs, averaging about $800 per vehicle-year in the U.S. A typical motorist spends almost as much on insurance as on fuel. It is the largest vehicle cost for many lower-income motorists. Insurance is currently considered a fixed cost with respect to vehicle use. A reduction in mileage does not usually provide a comparable reduction in insurance premiums.

PAYD insurance reflects the market principle that prices (what consumers pay) should be based on costs (the costs of providing a good or service). Research indicates that within existing price categories, annual

claims increase with annual vehicle mileage. Mileage is just one of several factors that affect crash rates. It would not improve actuarial accuracy (i.e., how well premiums reflect insurance costs for a particular vehicle) to use mileage instead of other rating factors, for example, to charge all motorists the same per-mile insurance fee. However, accuracy improves significantly if annual mileage is incorporated in addition to existing rating factors. Any other price structure overcharges low-mileage motorists and undercharges high-mileage motorists within a rate class.

PAYD Status in Maryland

Maryland does not provide any current insurance incentives to reduce vehicle miles traveled (VMT).

Implementation

Maryland could consider promoting PAYD insurance as an option for motorists. To the extent that this type of program is based on motorists' choices, the program would work in concert with other programs that support reductions in VMT. Regulatory or statutory changes may be needed depending on the type of program insurance companies choose to offer.

Maryland could consider implementing and/or building on existing programs to work with auto insurance companies to encourage them to offer PAYD insurance as an option for Maryland residents.

Maryland could consider requiring auto insurance companies to offer PAYD insurance as an option for Maryland residents.

Barriers

- Thus far, only a few insurance companies have indicated a willingness to enter the market to offer this type of insurance pricing.
- The Maryland Insurance Commissioner and the Maryland Automobile Insurance Fund (MAIF) would need to support the program.
- There may be consumer privacy issues if monitoring devices are installed on vehicles that are part of a PAYD program.

Co-Benefits

PAYD pricing could help achieve several public policy goals, including fairness, affordability, road safety, consumer savings and choice, and reduced traffic problems. PAYD makes insurance more affordable by giving drivers greater control over their premiums. Under the current system, low-mileage drivers (usually low-wage earners, seniors, carpoolers, bicyclists, and bus riders) subsidize high-mileage drivers. PAYD would give consumers a new way to save money by returning to individual motorists the insurance cost savings that result when they drive less. Motorists who continue their current mileage would be no worse off on average then they are now, while those who reduce their mileage would save money. As a result, consumers would benefit overall.

PAYD insurance is expected to reduce driving and congestion by 10 to 12%. Driving less would reduces air pollution, toxic runoff from roads, and climate impacts. Additionally, PAYD is expected to reduce accidents. A 10% reduction in driving is estimated to result in a 17% decrease in crashes.

Impacts of Maryland's Tax Policies

Over the next several years, it is expected that Maryland's tax policies will be heavily reviewed. The Commission recommends that Maryland include energy efficiency and GHG emission reduction implications as part of any efforts to analyze or revise the State's tax policies. As one example, the Commission has recommended, for Early Action legislation, a suite of energy efficiency measures which includes an excise tax on new vehicles with the lowest fuel economy ratings. (See "Tax Inefficient Vehicles" under "Energy Efficiency" on page. 26 of this Report.)

4 Adaptation and Response Working Group

The goal of the Early Action Items recommended by the Adaptation and Response Working Group (ARWG) is to reduce the vulnerability of Maryland's coastal, natural and cultural resources and communities to the impacts of climate change.

Statement of Intent

Climate change and sea level rise are putting Maryland's people, property, natural resources, and public investments at risk. To protect Maryland's future economic well being, environmental heritage and public safety, and to guide the fundamental intent of the ***Comprehensive Strategy for Reducing Maryland's Climate Change Vulnerability*** which the ARWG is charged with developing under the Executive Order, the ARWG recommends that legislative and policy actions be instituted by the Governor and the Maryland General Assembly as early as possible to:

- Protect and restore Maryland's natural shoreline and its resources (e.g., tidal wetlands and marshes, vegetated buffers, Bay islands) that inherently shield Maryland's shoreline from the impacts of sea level rise and coastal storm events.
- Promote programs and policies aimed at the avoidance and or reduction of impact to the existing built environment, as well as to future growth and development in areas vulnerable to sea level rise and its ensuing coastal hazards.
- Avoid assumption of the financial risk of development and redevelopment in highly hazardous coastal areas.

Early Action Items

Recommendations for 2008 Legislation

The Commission recommends that the Governor and the Maryland General Assembly work together and adopt legislation in 2008 for the following initiatives:

Update Jurisdictional Boundaries of Bays Critical Area Act

The State should update the jurisdictional boundaries of the Chesapeake and Atlantic Coastal Bays Critical Area Program in order to reflect current conditions, and should establish a process and continuing standard for updates, possibly every ten years, to accommodate future changes in shoreline conditions and sea level rise.

The Chesapeake Bay Critical Area Protection Act (Natural Resources Article, §8-1807) was enacted by the 1984 Maryland General Assembly as a means to reverse the deterioration of the Chesapeake Bay. The legislature added the Atlantic Coastal Bays to the Critical Area Program in 2002. The jurisdictional boundary of the Critical Area includes all waters of and lands under the Chesapeake and Atlantic Coastal Bays and their tributaries to the head of tide as indicated on the State wetlands maps, and all State and private wetlands designated under Natural Resources Article, Title 9 (now Title 16 of the Environment Article). The boundary also extends to all land and water areas 1,000 feet beyond the landward boundaries of State or private wetlands and the heads of tides, designated under the same Article.

The Critical Area Commission, established by the Act, sets forth Criteria (COMAR, Title 27) for developing detailed local management programs, approves management programs once they are developed, and reviews proposed activities for conformity with local management programs. The Critical Area Program is one of the State's primary management tools for addressing impacts associated with sea level rise. Despite a lack of reference to sea level rise in the Act or implementing Criteria, sea level rise-induced impacts are addressed through the following measures, implemented primarily through local permitting procedures with Commission oversight: establishing a 100-foot natural buffer adjacent to tidal waters and tidal wetlands; guiding development and controlling growth in valuable coastal resource areas; regulating, in conjunction with the Maryland Department of the Environment (MDE), the installation of shoreline erosion protection structures; and protecting wetlands through sedimentation and erosion control guidelines. Such measures significantly contribute to the State's overall ability to mitigate adverse impacts associated with sea level rise. Notwithstanding the many benefits of the Critical Area Program with respect to sea level rise response, specific statutory language contained in the Critical Area Act and its implementing Criteria will compromise Maryland's ability to adequately plan for sea level rise in the long-term.

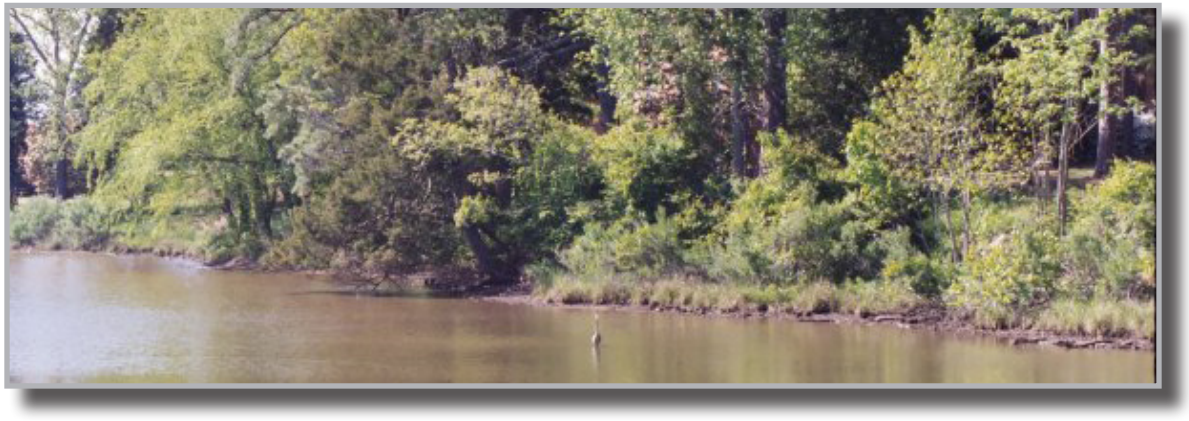
Under current statute, the jurisdictional boundaries of the Critical Area are based on the location of State and private wetlands, extending 1,000 feet beyond the landward boundaries of wetlands designated under Title 16 of the Environment Article (Wetlands and Riparian Rights Act). Under this Act, tidal wetland boundaries are established by interpreting aerial photos, in combination with field inspections, to validate vegetation and tidal association and are delineated on a series of approximately 2,000 aerial photomaps produced in 1972. The Critical Area Commission, as well as local jurisdictions, currently rely on the 1972 maps series referenced in the statute to determine the Critical Area boundary. As sea level is rising, tidal wetland boundaries are changing. There has never been a comprehensive update of the tidal wetland maps, and the Critical Area boundaries are not automatically updated in response to changes in tidal wetland boundaries.

Develop a Unified Approach to Shoreline Management

The State should develop a unified approach to shoreline management that encompasses the entire tidal-upland interface including the Critical Area 100-foot Buffer through a combination of executive, legislative and programmatic actions.

The tidal shoreline of the Chesapeake Bay is nearly 7,000 miles long. Over millennia, nearly all of the shore has eroded due to a combination of sea level rise and wave action. Present measurements indicate that at least 70% of the shore is eroding. While localized erosion rates can exceed 10 feet per year, approximately 10% of the Bay's tidal shore is eroding at a rate in excess of 2 feet per year. In response to this erosion, property owners and commercial interests have historically created hardened structures (bulkheads and revetments) to minimize the loss of property. Surveys conducted between 2001 and 2003 (Comprehensive Shoreline Inventory, Maryland Coastal Program and Virginia Institute of Marine Science) indicate that overall 12% of the State's shoreline is hardened with some urban and suburban areas exceeding 40%. One rural area of the State (Talbot County) has hardened more than 30% of the shoreline.

While hardening the shore is often viewed as appropriate from a landowner's perspective, the effects on the Bay's ecosystem are complex, difficult to quantify, and sometimes detrimental. Hardening the shore usually eliminates important beach habitats, as well as the positive aspects of shoreline erosion (sand source, etc.), and can increase wave energy and turbidity, producing negative impacts on submerged aquatic vegetation. The hardening of shorelines over the long term eliminates the landward movement of marshes as a result of sea level rise and increases impacts on adjacent shorelines. Research and development of marsh planting techniques ushered in a new era of shoreline protection measures in the early and mid 1980's with sills and groin fields and associated marsh plantings (i.e., living shorelines) being utilized in the Chesapeake Bay with a corresponding reduction in the amount of hardened shoreline structures. Where site conditions are appropriate, "living shorelines" are the preferred shore protection alternative. In addition to protecting the shoreline, living shorelines also trap sediment, filter pollution, and provide important habitats for both aquatic and terrestrial wildlife.



One of the key shoreline management measures of the Critical Area Program is the establishment of regulations to ensure the maintenance of at least a 100-foot natural buffer, comprised of natural vegetation, adjacent to tidal waters and tidal wetlands. No new development activities, with the exception of those to support water-dependent facilities, are allowed within the buffer. The 100-foot buffer provides properties located along the Chesapeake and Atlantic Coastal Bays a first line of defense against sea level rise-induced coastal erosion and coastal flooding. Furthermore, by limiting development in the buffer to uses which are classified water-dependent, the amount of infrastructure located in areas vulnerable to sea level rise will be minimized in the near-term. Regardless, current provisions which allow the installation of a shoreline protection structure (a water-dependent use) within the buffer compromises the ability of wetlands and marshes to mitigate inland as sea level rises. Wetlands, marshes, and sandy beaches located waterward of a hard shore protection structure may become permanently submerged by rising water in the long-term.

Maryland's local governments have jurisdiction in the 100-foot Critical Area Buffer. However, the local governments do not always have the technical expertise to make shore erosion decisions. Problems result when applicants do not agree with, or do not trust, MDE's recommendations for marsh creation as the preferred technique. Under the current, non-unified process, applicants can avoid State regulations by moving a shore erosion project out of MDE's jurisdiction. A unified approach would provide for State review and approval of shore erosion measures based on the actual affected area and all of its necessary components.

Shoreline management is facilitated through a network of programs housed in the Maryland Departments of the Environment and Natural Resources and also through local government Critical Area and erosion and sediment control activities. Involvement among these partners varies with respect to agency mandate, jurisdictional boundaries, and level of activity, whether through regulation, technical assistance, or project implementation. In light of the fact that sea level rise will undoubtedly exacerbate problems associated with shore erosion, there is a need to more comprehensively address shore erosion management from a State-wide perspective.

Recommended components of a unified approach to shoreline management include:

- Resolve management conflicts presented by the current statute and regulatory practice of permitting shore protection alternatives based on the Code of Maryland Regulations (COMAR), "order of preference." The ARWG recommends that the regulation be amended by establishing a rebuttable presumption that every site is capable of supporting a soft shoreline stabilization technique and that it is the responsibility of the applicant to prove that a different technique is necessary to protect the property from erosion.
- Identify legislative and/or regulatory options that will allow State and local governments to specify the type and location of shore protection alternatives. The ARWG recommends that GIS-based tools, technology and data products be used to assist with determinations for type and location of shore protection practices.
- Amend State statutes and regulations to remedy jurisdictional gaps and conflicts between State and local governments within the 100-foot Critical Area buffer.
- Modify current Critical Area buffer provisions to enhance sea level rise adaptation and response.

Options include: (1) expanding the distance of vegetated buffers in areas experiencing "significant " erosion (2+ feet per year); and/or (2) developing criteria to enable the designation of "wetland migration corridors" and "natural shore erosion areas" within Critical Area buffers.

- Reorient DNR's Shoreline and Erosion Control Program, to promote the installation of innovative shore protection techniques that maximize habitat restoration and enhancement.
- Establish a program to license and certify marine contractors that includes a requirement for a working knowledge of coastal processes, including sea level rise, and sensitivity to environmental issues, and that they apply this knowledge during selection and design of shore protection projects.

Require Freeboard Standards in Tidally Influenced Floodplains

The State should amend the Flood Hazard Management Act of 1976 to require that all counties adopt standards requiring two or more feet of freeboard (an elevation factor of safety used in floodplain management) in tidally influenced floodplains.

The Federal Emergency Management Agency (FEMA) is the primary Federal agency with emergency management responsibilities in the coastal zone. It is also the Federal agency responsible for implementing the National Flood Insurance Program (NFIP), which provides subsidized insurance for damage to structures due to flooding. Participation in the NFIP is limited to communities in states that adopt local regulations and building standards (e.g., elevation requirements) for development in areas vulnerable to flooding. To participate in the NFIP, communities must adopt, administer, and enforce an ordinance that meets or exceeds Federal floodplain management standards. These ordinances allow property owners to purchase insurance protection under the NFIP and make communities eligible for Federal disaster assistance after a major flood event. The Maryland Department of the Environment (MDE) is the agency responsible for coordinating the State's participation in the NFIP. In addition to assisting with local ordinance administration and providing general technical assistance and local program review, MDE serves as the liaison between FEMA and Maryland's 115 participating counties and towns. The Maryland Emergency Management Administration (MEMA) is responsible for coordinating the State's response to disasters and the planning or mitigation necessary to reduce future losses. As the State's NFIP coordinating office, MDE provides guidance to local governments on the day-to-day activities related to building and construction through the floodplain ordinances adoption and review process. MDE and MEMA work jointly with FEMA and local governments on these processes.

Issues associated with sea level rise are significant with respect to the scope of Federal, State, and local management responsibilities under the NFIP. Flood Insurance Rate Maps developed by FEMA designate areas of special flood risk and hazards, and insurance rates are calculated based on the level of flood risk associated with each designation. Flood Insurance Rate Maps and storm surge models prepared by FEMA, which guide State and local floodplain management efforts, do not consider sea level rise when establishing base flood elevations or storm surge risk zones. In fact, FEMA maps the 100-year floodplain as it exists at the time of the mapping effort. Future flood conditions, resulting from changes in land use, natural and human changes, or elevated flood levels due to sea level rise, are not considered.

Flooding in Annapolis after tropical storm Isabel

To account for the subsequent uncertainty and degree of error present in the current Flood Insurance Rate Maps, MDE requires all communities to adopt standards that call for all structures in the non-tidal floodplain to be elevated one-foot above the 100-year floodplain elevation. MDE's regulatory authority for construction activities within non tidal floodplain boundaries is mandated through the waterway construction regulations in COMAR. However, the State's waterway construction authority does not extend into the tidal 100-year floodplain. Freeboard requirements for activities within a tidal 100-year floodplain are governed by the local NFIP ordinance that varies for zero to three feet across the tidal floodplain limits. (Freeboard is a factor of safety usually expressed in feet above a flood level for purposes of floodplain management.) MDE encourages or recommends that local governments adopt a freeboard standard, but the governing authority currently rests at the local level.

All coastal counties except Worcester, Somerset, and Dorchester, the three most vulnerable to exacerbated flooding due to sea level rise, have adopted a one-foot freeboard standard. While one-foot of freeboard provides an added cushion of protection to guard against uncertainty in floodplain projections, it may not be enough in the event of two to three feet of sea level rise.

Flooding of low-lying areas by extreme high tides. If sea level continues its rise, such events will become increasingly common. (Source: NOAA's America's Coastlines Collection)

Recommendations for Early Executive Action: Lead by Example

Executive Order: Sea Level Rise Adaptation and Response

The Governor should adopt a Sea Level Rise: Lead By Example, Executive Order, that directs Maryland's State agencies to work together to implement sound sea level rise adaptation and response measures.

Maryland's coast is particularly vulnerable to both episodic and chronic hazards associated with shore erosion, coastal flooding, storm surge, and inundation. These hazards are both driven by and exacerbated by sea level rise, occurring in the mid-Atlantic region at a rate nearly double the global average. Historic tide-gauge records document that sea level is rising in Mid-Atlantic waters and the Chesapeake Bay at an average rate of 3 - 4 mm/year. Sea levels have risen approximately one foot in the Chesapeake Bay over the last one hundred years. Maryland is experiencing more of a rise in sea level than other parts of the world, due to naturally occurring regional land subsidence. The State's coastline may see as much as 3 feet of sea level rise by 2100, if current trends continue. Over the past ten years, Maryland has directed substantial efforts toward advancing the State's understanding of sea level rise and coastal hazard vulnerability, as well as promoting its ability to mitigate the underlying environmental and socioeconomic impacts.

Maryland is a national leader in sea level rise adaptation and response planning. Maryland was one of the first states to develop a Sea Level Rise Response Strategy and is one of the first states to address adaptation issues in a Gubernatorial Executive Order related to climate change. Maryland should continue to "lead by example" by demonstrating and implementing sound sea level rise adaptation measures on State lands and through the allocation of State fiscal resources.

Components of the executive order could include the following:

- Utilize Geographic Information System (GIS) technology to analyze areas vulnerable to sea level rise (i.e. lands below the three-foot contour, coastal high hazard floodplain areas, tidal wetlands, and significantly eroding areas) in combination with the jurisdictional and regulatory mandates of existing management programs (e.g., Green Infrastructure, Smart Growth, Resource Conservation Areas).
- Align State Smart Growth strategies to reflect population growth and development patterns in relation to areas vulnerable to sea level rise and coastal hazards.
- Direct existing land conservation programs (e.g., Rural Legacy, Program Open Space, the Conservation Reserve Enhancement Program, and the Coastal and Estuarine Land Conservation Program) to consider the use of conservation easements and other land conservation initiatives as a means to protect key coastal areas vulnerable to sea level rise and to provide sufficient lands for wetland migration.
- Evaluate natural resource management practices (e.g., tidal wetland and coastal watershed restora-

tion) at the State level; advocate means for enhanced protection through such efforts as the promotion of "living" shorelines, tidal marsh restoration (e.g., Blackwater marsh), increased vegetative buffers, Bay island restoration, and land conservation.

- Establish a directive and means to review all State-funded coastal projects to determine the cost-effectiveness of minor alterations in the setback and/or design standards based on life expectancy of proposed structures in relation to projected levels of sea level rise. Potential changes include: increasing building setbacks to accommodate a change in the shoreline position due to erosion or inundation; designing structures to accommodate a more frequent storm event (25 year vs. 100 year flood); and elevating structures in tidal floodplains two or more feet above the 100 year base flood elevation.
- Identify components of a State-level public and local government outreach campaign aimed at informing Maryland's citizens and elected officials about the coastal impacts of climate change and detailing how individual citizens can make a difference.
- Develop measurable goals and objectives for performance measurement for potential inclusion in the BayStat Program.

DNR Forest Carbon Sequestration Pilot Program

The Maryland Department of Natural Resources (DNR) should adopt a "lead by example" approach for a pilot forest carbon sequestration demonstration project to reduce emissions and offset a portion of DNR's carbon footprint; then replicate and transfer appropriate demonstration elements to other state agencies (e.g. Maryland Department of Transportation).

The ARWG has identified the need for carbon sequestration through a variety of land use management practices including agriculture, wetlands and forestry. It is in the best interests of DNR to demonstrate innovative carbon sequestration techniques and programs.

Components of DNR's pilot sequestration project could include:

- Target and estimate critical elements of DNR's carbon footprint
- Start with vehicle emissions reductions/offsets; later, energy use
- Use general benchmarking indicators to determine DNR vehicle emissions and carbon offset equivalents
- Estimate emission reduction targets through fleet management efficiencies
- Allocate offsets to afforestation; improved forest management/agricultural practices, etc.
- Identify potential funding sources and partners for the demonstration project. Funding for land acquisition and afforestation could come from a mix of sources, including:
  - RGGI budget trading program
  - Program Open Space

- Emission-related regulatory penalties
- Timber sales revenue
- MDE revolving loan fund
- Foundation matching fund grants, etc.

- Identify an afforestation site and determine the most appropriate forest management practices for capturing the carbon.
- Ensure that the proposed sequestration project is real, quantifiable, permanent, monitored and additional to what would have happened but for the action taken.
- Evaluate and select appropriate industry standards and registration protocols for both voluntary offsets and/or market-driven carbon credit sales to provide for future alternative options down the road.
- Demonstrate how long-term carbon sequestration can be achieved by using long-term forest rotations and executing product use agreements with building and furniture industries.
- Time announcement of new pilot program to complement Gubernatorial and General Assembly policy and legislative actions.

The Governor's Office could request State agencies to coordinate with the General Assembly to draft legislation for the upcoming 2008 legislative session.

Priority Policy Options

At this stage, each of the ARWG's four Technical Working Group (TWGs) has initially evaluated and approved a general catalog of policy options for reducing the vulnerability of the State's coastal, natural and cultural resources and communities to the impacts of climate change. Each TWG will now continue its policy option evaluations to further scrutinize and rank each option in its catalog.

The ARWG will vote on each option in the TWGs' catalogs to obtain a high level of consensus among voting members for priority policy options on which to move forward. The TWGs will perform additional analysis and develop straw proposals for each of the selected priority policy options. The ARWG will evaluate and rank the enhanced policy options developed and forwarded by its TWGs. The highest ranking policy options will form the basis of the ARWG's ***Comprehensive Strategy for Reducing Maryland's Climate Change Vulnerability***, called for in the Executive Order for the April 2008 Climate Action Plan.

5 Scientific and Technical Working Group

The Scientific and Technical Working Group (STWG) contributed to this Report by developing a preliminary appraisal of the likely changes in temperature, precipitation and sea level used to set the stage in Chapter 1. The STWG has also consulted with the Adaptation and Response Working Group (ARWG) on sea-level rise projections and with the Greenhouse Gas and Carbon Mitigation Working Group (MWG) and Commission on Climate Change (Commission) on the scientific basis for setting global GHG emission reduction goals and on the opportunities for carbon sequestration.

The STWG is concentrating on the technical analyses that underpin the ***Comprehensive Climate Change Impact Assessment***. These analyses are based the available record of 20th century changes in climate and sea level and on the regional scale outputs of the large number of General Circulation Models (GCMs) that were used by the Intergovernmental Panel on Climate Change (IPCC). Following the approach taken in the recently published ***Northeast Climate Impacts Assessment***, <www.northeastclimateimpacts.org>, two high and low emission scenarios are being assessed (in this case the SRES A2 and B1 scenarios). The skill of the various GCMs in replicating 20th century climatic conditions is used to screen suitably performing models, and model averages are used to yield robust projections for the 21st century.

The STWG has six subgroups responsible for retrospective and modeling assessments and for assessing impacts on the major resource sectors as follows:

1. Climate Trends and Models
2. Sea Level Rise and Coastal Storms
3. Hydrology and Water Resources
4. Forests and Agricultural Ecosystems and Resources
5. Coastal Ecosystems and Resources
6. Human Health and Urban Environments

The ***Comprehensive Climate Change Impact Assessment*** will play an important role in the work of the Commission in educating policy makers and the public about the consequences of climate change to Maryland in way that helps them determine responsible actions. Consequently, the Assessment must be both technically accurate and sound and intelligible by and accessible to lay readers. Well-illustrated summary publications and a user-friendly and resource deep web site are being planned to achieve this result.

6 Priority Policy Options Chosen for Further Review

Through the stakeholder processes of it Greenhouse Gas and Carbon Mitigation Working Group (MWG) and Adaptation and Response Working Group (ARWG), the Commission evaluated catalogs containing hundreds of policy options developed by its consultant, The Center for Climate Strategies (CCS), through its work with other states adopting climate action plans. The Commission has selected approximately fifty priority policy options forwarded by the MWG for further analysis for the April 2008 Climate Action Plan.

In evaluating the priority policy options within its purview, the Commission's MWG will apply the following criteria:

- Potential for reducing GHG emissions
- Costs or savings for each ton of GHG removed
- Co-benefits including economic, public health, and energy and environmental policy improvements
- Feasibility of implementing the policy option

In the weeks ahead, the Commission will, through its stakeholder process, select priority policy options from the ARWG catalogs for further analysis. The ARWG will apply the following criteria in evaluating the priority policy options for the final Climate Action Plan:

- Technical feasibility
- Cost effectiveness
- Level of uncertainty or severity regarding impacts
- Institutional support and available capacity
- Compatibility with current policies
- Regional issues

The MWG's priority policy options are attached in Appendix C. The full catalogs for each of the Technical Work Groups (TWGs) under the MWG and the ARWG are posted on the Commission's web site, <www.mdclimatechange.us>, on each TWG's individual web page (found under its parent Working Group's page).

7 Next Steps

Early Action Items

Maryland has been working with the Center for Climate Strategies (CCS) to facilitate the process of the Commission. As a policy center in Enterprising Environmental Solutions, Inc., CCS is equipped with the knowledge and expertise of professionals specializing in identification, analysis, and design of policies relating to climate change. Its team provides a forum for advanced discussion by stakeholders on climate strategies and solutions in an environment that is science-based, collaborative and continuously working towards consensus-based policies and plans. CCS has facilitated this process successfully in Oregon, California, New Mexico, Arizona, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, and Maine, ensuring broad support for Maryland and the fourteen other states with plans underway.

Continuing its science-based and consensus-building stakeholder process, the Commission will complete additional analysis of its Early Action Items and other recommendations, as necessary, between submission of this Interim Report and the start of the Legislative Session in January 2008. The recommendations will be evaluated by the Governor's Office and the General Assembly for suitability for draft legislation or other action in preparation for the 2008 Legislative Session.

April 2008 Climate Action Plan

The Commission will continue to develop its final Climate Action Plan for presentation to the Governor and General Assembly in April of 2008. Through the stakeholder processes of the Greenhouse Gas and Carbon Mitigation Working Group (MWG) and the Adaptation and Response Working Group (ARWG) and their respective Technical Work Groups (TWGs), the Commission will perform additional analysis and develop "straw proposals" for each of its priority policy options. Innovative funding mechanisms will be considered and developed wherever possible to limit the need for new public funding to implement chosen policy options. From these policy options, the suite of control programs and adaptation strategies that will allow the State to meet its GHG reduction and adaptation goals in the most cost-effective manner possible will be selected. Some of these may form the basis for recommendations for legislative or other action in the April 2008 Climate Action Plan. The Scientific and Technical Working Group (STWG) will continue to inform its sister Working Groups as their work progresses and will develop its ***Comprehensive Climate Change Impact Assessment***.

Greenhouse Gas and Carbon Mitigation Working Group

In evaluating the priority policy options within its purview, the MWG and its five TWGs will apply the following criteria:

- Potential for reducing GHG emissions
- Costs or savings for each ton of GHG removed
- Co-benefits including economic, public health, and energy and environmental policy improvements
- Feasibility of implementing the policy option

The TWGs will refine each of the straw proposals within their respective areas of expertise into a specific policy description. The Center for Climate Strategies (CCS) will quantify the GHG reductions and costs or savings per ton of GHG removed for each straw proposal. The TWGs may perform additional quantification related to co-benefits and feasibility on a case-by-case basis, according to need and available resources. The quantification will assist the TWGs in identifying implementation barriers to policy options, offering an opportunity to explore alternatives in policy design. The TWGs will also consider information that cannot be quantified, such as affected parties, implementation issues (lead agencies, rulemaking, etc.) and existing policies and programs that may affect the design of a particular policy option.

The MWG will evaluate and rank the enhanced policy options developed and forwarded by its TWGs. The highest ranking policy options will form the basis of the MWG's ***Comprehensive Greenhouse Gas and Carbon Footprint Reduction Strategy***, called for in the Executive Order for the April 2008 Climate Action Plan.

Adaptation and Response Working Group

In the months ahead, the ARWG will follow a similar path. Through its four TWGs, the ARWG will develop straw proposals for the each of the priority policy options it selects for further analysis. It will evaluate and rank the enhanced policy options according to the following criteria:

- Technical feasibility
- Cost effectiveness
- Level of uncertainty or severity regarding impacts
- Institutional support and available capacity
- Compatibility with current policies
- Regional issues

With technical support from CCS, the TWGs will apply quantitative metrics to evaluate the degree of cli-

mate risk reduction that can be achieved through each policy option. These include capital intensity (policy option's costs), flexibility (how readily could the option accommodate future corrective actions), and adaptive capacity. The TWGs may perform additional quantification related to co-benefits and feasibility on a case-by-case basis, according to need and available resources. As with the MWG, quantification will help the ARWG's TWGs identify implementation barriers to policy options, offering an opportunity to explore alternatives in policy design.

The ARWG will also be informed by CCS's synthesis report, currently in progress, entitled ***Maryland's Vulnerable Sector Inventory and Baseline***. This report will correlate benefits and ranked importance for each of the catalog policy options from which the ARWG selects its priority options for further analysis.

The ARWG will evaluate and rank the enhanced policy options developed and forwarded by its TWGs. The highest ranking policy options will form the basis of the ARWG's ***Comprehensive Strategy for Reducing Maryland's Climate Change Vulnerability***, called for in the Executive Order for the April 2008 Climate Action Plan.

Scientific and Technical Working Group

The Scientific and Technical Working group (STWG) will continue to advise the other Working Groups on the scientific and technical aspects of climate change as their work progresses in the months ahead. It will also continue to conduct the research that will culminate in its ***Comprehensive Climate Change Impact Assessment***, called for in the Executive Order for the April 2008 Climate Action Plan. With technical assistance from CCS, the STWG will perform an inventory and forecast of Maryland's GHG sources and sinks from 1990 to 2020, on a year-by-year basis, in order to calculate Maryland's "carbon footprint" on the environment. The STWG will investigate climate change dynamics specific to Maryland, using climate modeling and forecasts. Finally, the STWG will evaluate the likely consequences of climate change to Maryland's agricultural industry, forestry and fisheries resources, fresh water supply, aquatic and terrestrial ecosystems, and human health.

Maryland Commission on Climate Change Web site

CCS will continue to maintain the public web site it has developed to house all information and documents pertaining to the Commission's stakeholder process, located at <www.mdclimatechange.us>. This web site will display all Working Group and TWG meeting/call dates, agendas, presentations, meeting summaries, and other documents, including the TWG catalogs, catalog descriptions, and priority policy option descriptions. The web site will also include links to this Interim Report and, in April 2008, the Climate Action Plan, as well as the final *GHG* ***Emissions Inventory and Forecast*** and ***Maryland's Vulnerable Sector Inventory and Baseline*** report.

Appendices

Appendix A

Maryland Executive Order Establishing the Commission on Climate Change

EXECUTIVE ORDER
01.01.2007.07

Commission on Climate Change

WHEREAS, As reported by the United Nations Intergovernmental Panel on Climate Change (IPCC) in February 2007, there is now near universal scientific consensus that the world climate is changing, with an estimated rise in temperature between 1.98 – 11.52° F and as much as 7 to 23 inches of global sea level rise, over the next century;

WHEREAS, Human activities, including coastal development, the burning of fossil fuels and increasing greenhouse gas emissions are contributing to the causes and consequences of climate change;

WHEREAS, Maryland's people, property, natural resources, and public investments are extremely vulnerable to the ensuing impacts of climate change, including sea level rise, increased storm intensity, extreme droughts and heat waves, and increased wind and rainfall events;

WHEREAS, The effects of climate change already are being detected in Maryland, as historic tide-gauge records show that sea level has risen one-foot over the last century within State waters;

WHEREAS, Based on the current IPCC estimates and the rate of regional land subsidence, Maryland may experience an additional two to three foot sea level rise along its coast by the Year 2099;

WHEREAS, Recent State actions demonstrate Maryland's strong commitment to addressing both the drivers and consequences of climate change:

- Formulation and implementation of a State Sea Level Rise Response Strategy (2000);
- Passage of the Healthy Air Act (2006);
- Development of Maryland Transition Reports which call for State level action to address the drivers and consequences of climate change (2007);
- Passage of the Clean Cars Act (2007); and
- Participation in the Regional Greenhouse Gas Initiative (2007);

WHEREAS, It is imperative that Maryland State Government, as well as local governments, continue to lead by example in the scope and variety of services and activities that government provides and undertakes; and

WHEREAS, More must be done to reduce greenhouse gas emissions and prepare the State of Maryland for the likely physical, environmental, and socio-economic consequences of climate change.

NOW, THEREFORE, I, MARTIN O'MALLEY, GOVERNOR OF THE STATE OF MARYLAND, BY VIRTUE OF THE AUTHORITY VESTED IN ME BY THE CONSTITUTION AND LAWS OF MARYLAND, HEREBY PROCLAIM THE FOLLOWING EXECUTIVE ORDER, EFFECTIVE IMMEDIATELY:

A. Established. A Climate Change Commission is hereby established to advise the Governor and General Assembly on matters related to climate change.

B. Tasks. The Commission shall develop a Plan of Action to address the drivers and causes of climate change, to prepare for the likely consequences and impacts of climate change to Maryland, and to establish firm benchmarks and timetables for implementing the Plan of Action.

C. Membership.

(1) The Commission shall consist of up to 21 members, including:

(a) The Secretary of Agriculture, or the Secretary's designee;

(b) The Secretary of Budget and Management, or the Secretary's designee;

(c) The Secretary of Business and Economic Development, or the Secretary's designee;

(d) The State Superintendent of Schools, or the Superintendent's designee;

(e) The Secretary of Natural Resources, or the Secretary's designee;

(f) The Secretary of the Environment,or the Secretary's designee;

(g) The Secretary of Planning, or the Secretary's designee;

(h) The Secretary of Transportation, or the Secretary's designee;

(i) The Director of the Governor's Office of Homeland Security, or the Director's designee;

(j) The Director of the Maryland Energy Administration, or the Director's designee;

(k) The Secretary of Housing and Community Development, or the Secretary's designee;

(l) The Maryland Insurance Commissioner, or the Commissioner's designee;

(m) The Director of the Maryland Emergency Management Agency, or the Director's designee;

(n) The Chairman of the Public Service Commission, or the Chairman's designee; and

(o) The Chancellor of the University System of Maryland, or the Chancellor's designee;

(2) The Speaker of the House of Delegates and the President of the Senate are invited to appoint 3 members, respectively, from the House of Delegates and Senate, to serve as members of the Commission.

D. Chair. The Chair of the Commission shall be designated by the Governor from among the members of the Commission.

E. Staff Coordination. The Department of Natural Resources and Department of the Environment shall jointly staff the Commission in coordination with other State agencies as directed by the Chair.

F. Working Groups. The Commission shall be supported by Working Groups, to be established by the Chair, as follows:

(1) Scientific and Technical Working Group.

(a) Tasks. The Working Group shall develop a Comprehensive Climate Change Impact Assessment. The Assessment should:

(i) Advise the Commission, as well as other Working Groups, on the scientific and technical aspects of climate change;

(ii) Inventory Maryland's greenhouse gas emission sources and sinks;

(iii) Calculate Maryland's "carbon footprint" to measure the impact of human activities on the environment based on the State's greenhouse gas production;

(iv) Investigate climate change dynamics, including current and future climate models and forecasts; and

(v) Evaluate the likely consequences of climate change to Maryland's agricultural industry, forestry resources, fisheries resources, fresh water supply, aquatic and terrestrial ecosystems, and human health.

(b) Chair. The Scientific and Technical Working Group will be chaired and staffed jointly by the University System of Maryland, the Maryland Department of the Environment and the Department of Natural Resources.

(2) Greenhouse Gas and Carbon Mitigation Working Group.

(a) Tasks. The Working Group shall develop a Comprehensive Greenhouse Gas and Carbon Footprint Reduction Strategy. The Strategy should:

(i) Evaluate and recommend goals that include but not be limited to the reduction of Maryland's greenhouse gas emissions to 1990 levels by 2020 and 80% of 2006 levels by 2050;

(ii) Recommend short and long-term goals and strategies that include both energy and non-energy related measures to mitigate greenhouse gases and offset carbon emissions; and

(iii) Provide a detailed implementation timetable, with benchmarks, for each recommendation and strategy.

(b) Chair. The Greenhouse Gas and Carbon Mitigation Working Group shall be chaired and staffed jointly by the Department of the Environment and the Maryland Energy Administration.

(3) Adaptation and Response Working Group.

(a) Tasks. The Working Group shall develop a Comprehensive Strategy for Reducing Maryland's Climate Change Vulnerability. The Strategy should:

(i) Recommend strategies for reducing the vulnerability of the State's coastal, natural and cultural resources and communities to the impacts of climate change, with an initial focus on sea level rise and coastal hazards (e.g., shore erosion, coastal flooding);

(ii) Establish strategies to address short and long-term adaptation measures, planning and policy integration, education and outreach, performance measurement, and as necessary, new legislation and/or modifications that will strengthen and enhance the ability of the State and its local jurisdictions to plan for and adapt to the impacts of climate change;

(iii) Work with local governments to identify their capacity to plan for and adapt to sea level rise;

(iv) Develop appropriate guidance to assist local governments with identifying specific measures (e.g., local land use regulations and ordinances) to adapt to sea level rise and increasing coastal hazards; and

(v) In consultation with the Scientific and Technical Working Group, propose a timetable for the development of adaptation strategies to reduce climate change vulnerability among affected sectors, such as agriculture,

forestry, water resources, aquatic and terrestrial ecosystems, and human health.

(b) Chair. The Adaptation and Response Working Group shall be chaired and staffed jointly by the Department of Natural Resources and the Department of Planning.

(4) Additional Working Groups and/or Subcommittees to Working Groups may be created, as necessary, to accomplish the Commission mandate and Working Group Tasks.

(5) Appointments.

(a) The Chair of the Commission shall appoint Working Group and Subcommittee members who broadly represent both public and private interests in climate change, including but not limited to: Other levels of government, academic institutions, renewable and traditional energy providers, environmental organizations, labor organizations, and business interests, including the insurance industry.

(b) Working Group and Subcommittee members shall serve at the pleasure of the Commission.

(c) Working Group and Subcommittee members may not receive compensation for service.

G. Milestones.

(1) Within 60 days of the effective date of this Executive Order, the Commission shall be convened and Working Group members appointed.

(2) Within 90 days of the effective date of this Executive Order, Working Groups shall meet and establish individual work plans.

(3) Within one year of the effective date of this Executive Order, the Commission shall present to the Governor and General Assembly the Plan of Action, including the Comprehensive Climate Change Impact Assessment, the Comprehensive Greenhouse Gas and Carbon Footprint Reduction Strategy, and the Comprehensive Strategy for Reducing Maryland's Climate Change Vulnerability.

H. Reporting. The Commission shall report to the Governor and General Assembly on or before November 1 of each year including November 1, 2007 on the Plan of Action, including an update on development of the Plan of Action, implementation timetables and benchmarks, and preliminary recommendations, including draft legislation , if any, for consideration by the General Assembly.

GIVEN Under My Hand and the Great Seal of the State of Maryland, in the City of Annapolis, this 20th Day of April, 2007.

Martin O'Malley
Governor

ATTEST:

Dennis Schnepfe
Interim Secretary of State

Appendix B

Members of the Commission, Working Groups and Technical Work Groups

Maryland Commission on Climate Change

Shari T. Wilson, Secretary, Chair	Department of the Environment
Delegate Kumar P. Barve	Maryland General Assembly
Delegate Virginia P. Clagett	Maryland General Assembly
Alvin C. Collins, Secretary	Department of General Services
John Droneburg, Director	Maryland Emergency Management Agency
David Edgerley, Secretary	Department of Business and Economic Development
T. Eloise Foster, Secretary	Department of Budget and Management
Senator Brian E. Frosh	Maryland General Assembly
Nancy S. Grasmick, Superintendant of Schools	Department of Education
John R. Griffin, Secretary	Department of Natural Resources
Richard Eberhart Hall, Secretary	Department of Planning
William E. Kirwan, Chancellor	University System of Maryland
Steven B. Larsen, Chairman	Public Service Commission
Andrew Lauland, Advisor	Governor's Office on Homeland Security
Senator Paul G. Pinsky	Maryland General Assembly
Senator E. J. Pipkin	Maryland General Assembly
John D. Porcari, Secretary	Department of Transportation
Roger L. Richardson, Secretary	Department of Agriculture
Delegate David D. Rudolph	Maryland General Assembly
Raymond A. Skinner, Secretary	Department of Housing and Community Development
Ralph S. Tyler, Commissioner	Maryland Insurance Administration
Malcolm D. Woolf, Director	Maryland Energy Administration

Adaptation & Response Working Group

John R. Griffin, Secretary, Chair • Department of Natural Resources
Richard Eberhart Hall, Secretary, Co-Chair • Department of Planning
Jenn Aiosa • Chesapeake Bay Foundation
Rodney Banks • Dorchester County
Ron Bowen • Anne Arundel County Public Works
Russell Brinsfield • Agro-Ecology Center
Sherwood T. "Duke" Brooks • Maryland Association of Realtors®
Carl Bruch • Environmental Law Institute
David Burke • David Burke & Associates
Ron Cascio • Chestnut Creek
Sally Clagget • U.S. Fish & Wildlife Service, Chesapeake Bay Program
Phillip Conner • Marine Trades Association
Peter Conrad • Baltimore City Planning
Gilbert W. Dissen • Dissen & Juhn Corporation
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Appendix C

Mitigation Working Group Priority Policy Options Catalog

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Mitigation Working Group

Priority Policy Options

Approved 26 October 2007

Note: ***Numbers will be assigned to each Policy Option by its Technical Working Group. This list is not prioritized in any way, except that each option was approved by the Mitigation Working Group at its meeting in Baltimore on 26 October 2007. Duplication of Priority Options will be resolved by the TWGs.***

Agriculture, Forestry, and Waste Management

AFW-1 - Expanded Use of Forest and Farm Feedstocks and By-Products for Energy Production

AFW-2 - In-State Liquid Biofuels Production

AFW-3 - Nutrient Trading with Carbon Benefits

AFW-4 - Protection and Conservation of Agricultural Land, Coastal Wetlands and Forested Land

AFW-5 - Afforestation, Reforestation and Restoration of Forests and Wetlands

AFW-6 - Mitigation of Forest Loss Due to Insects, Disease, Pests and Invasive Species

AFW-7 - Management for Enhanced Carbon Sequestration

AFW-8 - Managing Urban Trees and Forests for Greenhouse Gas Benefits

AFW-9 - "Buy Local" Programs for Sustainable Agriculture, Wood and Wood Products

AFW-10 - Waste Management through Source Reduction & Advanced Recycling

Cross-Cutting

Note: ***The CC TWG recommends the consolidation of CC-7 and CC-12. This will be presented to the MWG at its November 30, 2007 meeting for approval.***

CC-1 – GHG Inventory and Forecasting

CC-2 – GHG Reporting and Registry

CC-3 – Statewide GHG Reduction Goals and Targets

CC-4 – State and Local Government GHG Emissions (Lead-by-Example)

CC-5 – Public Education and Outreach

CC-6 – Review Institutional Capacity to Address Climate Issues Including Seeking Funding for Implementation of MWG Recommendations

CC-8 – Promote and Participate in Regional, Multi-State and National GHG Reduction Efforts

CC-9 – Promote Economic Development Opportunities Associated with Reducing GHG Emissions in Maryland

CC-10 – Develop Tools to Explicitly Address Policy Issues in an "After Peak Oil" Context

CC-11 – Evaluate Climate Change Policy Options to Determine Projected Public Health Risks, Costs, and Benefits

CC-12 – Review Institutional Capacity to Address Climate Issues, especially Leadership Development.

Energy Supply

ES-1 - Promotion of Renewable Energy Sources, including Zoning, Siting, Incentives to Promote Centralized Facilities, Long-term Contracting and Performance-based Contracting

ES-2 - Technology-focused Initiatives for Electricity Supply (Biomass Co-firing, Energy Storage, Fuel Cells, Landfill Gas, Clean Energy Incentives)

ES-3 - GHG Cap and Trade – *Included with RCI*

ES-4 - CCSR Incentives, Requirements and/or Enabling Policies (including Administration, Regulation, Liability and Incentives)

ES-5 - Clean Distributed Generation Standards, Incentives and Barrier Removal, including Combined Heat and Power (CHP), District Heating and Cooling, Landfill Gas, Solar, Fuel Cells and others

ES-6 - Integrated Resource Planning (IRP) including Re-Regulation, if necessary, and/or a State Energy Plan

ES-7 - Renewable and/or Environmental Portfolio Standard and/or Energy Efficiency Portfolio Standard

ES-8 - Efficiency Improvements and Repowering Existing Plants

ES-9 – Carbon (GHG) Tax

ES-10 – Generation Performance Standards and/or Mitigation Requirements for Electricity

Residential, Commercial and Industrial

RCI-1 – Improved Building Codes for Energy Efficiency

RCI-2 – Demand-Side Management (DSM)/Energy Efficiency Programs, Funds, or Goals for Electricity (Including Expansion of Existing Programs and Peak Load Reduction)

RCI-3 – Low-cost Loans for Energy Efficiency improvements

RCI-4 – Improved Design and Construction in New and Existing State and Local Government Buildings, "Government Lead-by-Example", including appliances and lighting

RCI-5 – Energy Efficiency and Environmental Impacts Awareness in School Curricula – *Included in Cross-Cutting*

RCI-6 – Promotion and Incentives for Improved Design and Construction (e.g., LEED, Green Buildings, or Minimum % Improvement Beyond Code) in the Private Sector – *Work with TLU on this goal*

RCI-7 – More Stringent Appliance/Equipment Efficiency Standards (State-level, or Advocacy for Regional or Federal-level Standards)

RCI-8 – Rate Structures and Technologies to Promote Reduced GHG Emissions (Including Inverted Block Rates)

RCI-9 – GHG or Carbon Tax – *Included with ES*

RCI-10 – White Roofs, Rooftop Gardens, and Landscaping (including Shade Tree Programs) and Solar Electric Panels

RCI-11 – Energy Efficiency Resource Standard (EERS)

RCI-12 – Phase Out Incandescent Light Bulbs

Transportation and Land Use

TLU-1 – Increased Fuel Tax

TLU-2 – Land Use and Location Efficiency

TLU-3 – Transit

TLU-4 – Low Greenhouse Gas Fuel Standard

TLU-5 – Intercity Travel: Aviation, High Speed Rail, Bus

TLU-6 – Pay-as-you-Drive Insurance

TLU-7 – VMT Reductions

TLU-8 – Bike and Pedestrian Infrastructure

TLU-9 – Pricing Measures

TLU-10 – Off-Road Engines/Vehicles

TLU-11 – Evaluate the GHG Emissions Impacts of Large Local, State and Federal Projects in Maryland

Appendix D

Maryland Emissions Inventory Information

Maryland Emissions Inventory Information

The Center for Climate Strategies (CCS) prepared for the Maryland Department of the Environment (MDE) a preliminary assessment of the state's greenhouse gas (GHG) emissions from 1990 to 2020. The inventory and forecast estimates serve as a starting point to assist Maryland, as well as the Maryland Greenhouse Gas & Carbon Mitigation Working Group, with an initial comprehensive understanding of Maryland's current and possible future GHG emissions, and thereby inform the identification and analysis of policy options for mitigating GHG emissions.

Maryland's anthropogenic GHG emissions and anthropogenic sinks (carbon storage) were estimated for the period from 1990 to 2020. Historical GHG emissions estimates (1990 through 2005)[1] were developed using a set of generally accepted principles and guidelines for state GHG emissions, relying to the extent possible on Maryland-specific data and inputs. The reference case projections (2006-2020) are based on a compilation of various existing Maryland projections of electricity generation, fuel use, and other GHG-emitting activities.

The inventory and projections covers the six types of gases included in the US Greenhouse Gas Inventory: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Emissions of these GHGs are presented using a common metric, CO_2 equivalence (CO_2e), which indicates the relative contribution of each gas, per unit mass, to global average radiative forcing on a global warming potential- (GWP-) weighted basis.

Preliminary estimates of Maryland's GHG emissions for 1990 to 2020 are illustrated in Figure ES-1 and shown numerically in Table ES-1. Maryland's gross GHG emissions are rising at a faster rate than those of the nation as a whole (gross emissions exclude carbon sinks, such as forests). Maryland's gross GHG emissions increased by about 30% from 1990 to 2005, while national emissions rose by 16% from 1990 to 2005. Activities in Maryland accounted for approximately 108 million metric tons (MMt) of *gross*[2] carbon dioxide equivalent (CO_2e) emissions (consumption basis) in 2005, an amount equal to about 1.5% of total US gross GHG emissions (based on 2005 US data).[3] Estimates of carbon sinks within Maryland's forests, including urban forests and land use changes, are about 12 $MMtCO_2e$ in 2005. This leads to *net* emissions of 96 $MMtCO_2e$ in Maryland in 2005.

There are three principal sources of GHG emission in Maryland: electricity consumption; transportation; and the residential, commercial, and industrial (RCI) fuel use sectors. In 2005, electricity consumption contributed 43% of gross GHG emissions in 2005. Transportation accounted for 30% of Maryland's gross GHG emissions in 2005, while RCI fuel use accounted for 19% of Maryland's 2005 gross GHG emissions.

Figure ES-2 illustrates the state's emissions per capita and per unit of economic output. On a per capita basis, Maryland residents emitted about 17.3 metric tons (Mt) of gross CO_2e in 1990, lower than the national average of about 25 $MtCO_2e$ in 1990. Per capita emissions in Maryland increased to 19.3 $MtCO_2e$/yr by 2005, while the per capita emissions for the US have decreased slightly to 24.5 $MtCO_2e$/yr. As with the nation as a whole, economic growth

[1] The last year of available historical data varies by sector; ranging from 2000 to 2005.
[2] Excluding GHG emissions removed due to forestry and other land uses.
[3] The national emissions used for these comparisons are based on 2005 emissions; (http://www.epa.gov/climatechange/emissions/usinventoryreport.html).

exceeded emissions growth throughout the 1990-2005 period (leading to declining estimates of GHG emissions per unit of state product). From 1990 to 2005, emissions per unit of gross product dropped by 27% nationally, and by 13% in Maryland.[4]

Under the reference case projections (2005-2020), Maryland's gross GHG emissions continue to grow, and are projected to climb to about 127 $MMtCO_2e$ by 2020, reaching 53% above 1990 levels. As shown in Figure ES-3, the transportation sector is projected to be the largest contributor to future emissions growth in Maryland, followed by electricity consumption and substitutes for ozone-depleting substances (ODS).

Some data gaps exist in this analysis, particularly for the reference case projections. Key refinements include review and revision of key emissions drivers that will be major determinants of Maryland's future GHG emissions (such as the growth rate assumptions for electricity generation and consumption, transportation fuel use, and RCI fuel use).

[4] Based on real gross domestic product (millions of chained 2000 dollars) that excludes the effects of inflation, available from the US Bureau of Economic Analysis (http://www.bea.gov/regional/gsp/). The national emissions used for these comparisons are based on 2005 emissions, http://www.epa.gov/climatechange/emissions/usinventoryreport.html.

Figure ES-1. Maryland Gross GHG Emissions by Sector, 1990-2020: Historical and Projected

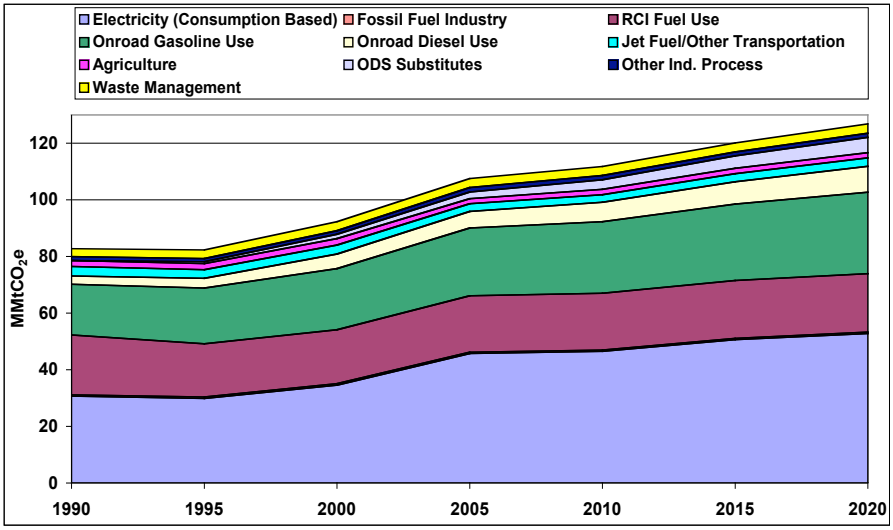


Table ES-1. Maryland Historical and Reference Case GHG Emissions, by Sector[a]

$MMtCO_2e$	1990	2000	2005	2010	2020	Explanatory Notes for Projections
Energy Use (CO_2, CH_4, N_2O)	**76.5**	**84.0**	**98.6**	**101.8**	**114.8**	
Electricity Use (Consumption)	**30.7**	**34.6**	**45.7**	**46.5**	**52.8**	
Electricity Production (in-state)	21.6	25.9	29.7	32.0	38.8	Based on USDOE regional projections
Coal	*20.5*	*24.5*	*26.1*	*28.8*	*35.3*	
Natural Gas	*0.98*	*1.23*	*0.36*	*0.30*	*0.37*	
Oil	*0.13*	*0.15*	*3.10*	*1.81*	*1.87*	
Wood	*0.00*	*0.00*	*0.06*	*1.00*	*1.23*	
MSW/LFG	*0.00*	*0.00*	*0.01*	*0.01*	*0.01*	
Imported Electricity	9.06	8.68	16.07	14.53	13.96	
Residential/Commercial/Industrial (RCI) Fuel Use	**21.1**	**19.1**	**20.0**	**20.1**	**20.6**	
Coal	5.5	2.1	3.4	3.4	3.4	Based on USDOE regional projections
Natural Gas	8.2	9.8	9.7	10.1	11.0	Based on USDOE regional projections
Petroleum	7.3	7.0	6.8	6.4	6.1	Based on USDOE regional projections
Wood	0.08	0.10	0.08	0.08	0.07	Based on USDOE regional projections
Transportation	**24.2**	**29.9**	**32.5**	**34.8**	**40.9**	
Gasoline	17.9	21.6	23.9	25.3	28.8	Based on MDE VMT projections.
Diesel	2.9	5.1	5.9	6.8	9.2	Based on MDE VMT projections.
Marine Vessels	1.4	1.3	1.2	1.1	1.3	
Natural Gas and LPG	0.53	0.22	0.20	0.21	0.23	
Jet Fuel and Aviation Gasoline	1.5	1.7	1.3	1.3	1.4	
Fossil Fuel Industry	**0.46**	**0.49**	**0.40**	**0.45**	**0.52**	
Natural Gas Industry	0.46	0.49	0.40	0.45	0.52	
Industrial Processes	**1.4**	**2.8**	**3.9**	**4.9**	**6.9**	
ODS Substitutes	0.01	1.53	2.31	3.32	5.39	EPA 2004 ODS cost study report
Semiconductor Manufacturing	0.003	0.002	0.001	0.001	0.000	Based on national projections (USEPA)
Electricity Transmission and Dist.	0.50	0.27	0.25	0.17	0.10	Based on national projections (USEPA)
Cement Manufacture	0.86	0.86	1.27	1.27	1.27	Assumed no growth beyond 2005
Limestone and Dolomite	0.00	0.09	0.07	0.07	0.07	Assumed no growth beyond 2005
Soda Ash	0.05	0.05	0.05	0.05	0.05	Uses national 2004 and 2009 projections
Agriculture	**2.1**	**2.3**	**1.8**	**1.9**	**1.9**	Based on historical trends (except swine)
Enteric Fermentation	0.47	0.38	0.35	0.33	0.33	Based on projected livestock population
Manure Management	0.34	0.33	0.30	0.32	0.32	Based on projected livestock population
Agricultural Soils	1.3	1.6	1.1	1.3	1.2	Based on 1990-2005 emissions growth
Agricultural Burning	0.01	0.01	0.01	0.01	0.01	Based on 1990-2005 emissions growth

Table ES-1. Maryland Historical and Reference Case GHG Emissions, by Sector (Continued)[a]

$MMtCO_2e$	1990	2000	2005	2010	2020	Explanatory Notes for Projections
Waste Management	**2.8**	**3.2**	**3.1**	**3.2**	**3.3**	
Waste Combustion	0.00	0.00	0.00	0.00	0.00	Emissions included in the electric sector
Landfills	2.2	2.5	2.4	2.4	2.4	Based on historical MD landfill emplacement rates.
Wastewater Management	0.58	0.67	0.70	0.75	0.85	Based on 1995-2005 emissions growth.
Residential Open Burning	0.03	0.03	0.03	0.03	0.03	Based on 2000 data with no growth.
Gross Emissions (Consumption Basis, Excludes Forest Sink)	**82.7**	**92.3**	**107.5**	**111.8**	**126.8**	
increase relative to 1990		*12%*	*30%*	*35%*	*53%*	
Forestry and Land Use	**-7.8**	**-11.3**	**-11.5**	**-11.8**	**-12.2**	
Forested Landscape	-2.1	-8.9	-8.9	-8.9	-8.9	
Urban Forestry and Land Use	-5.7	-2.4	-2.6	-2.9	-3.3	
Net Emissions (Consumption Basis, Includes Forest Sink)	**75.0**	**81.0**	**96.0**	**100.0**	**114.7**	
increase relative to 1990		*8%*	*28%*	*33%*	*53%*	

[a] Totals may not equal exact sum of subtotals shown in this table due to independent rounding.

Figure ES-2. Maryland and US Gross GHG Emissions, Per Capita and Per Unit Gross Product

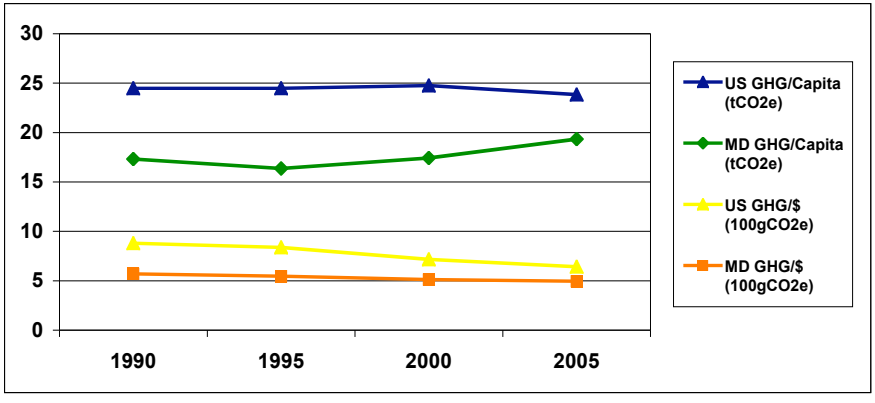
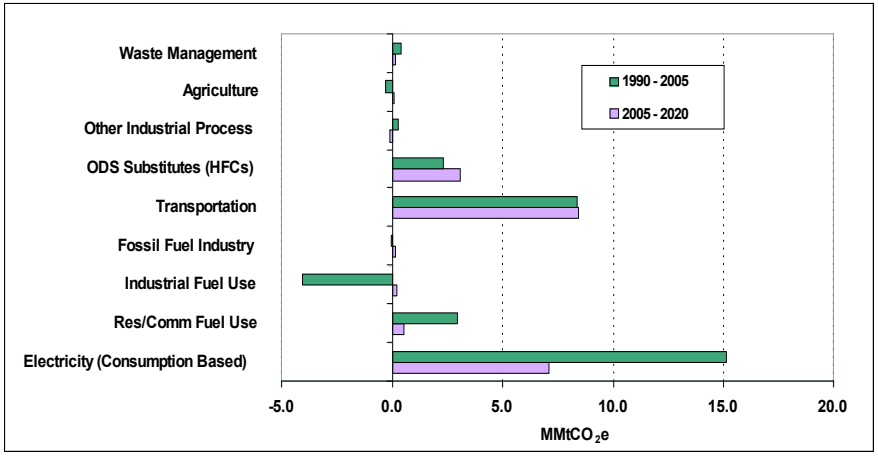


Figure ES-3. Sector Contributions to Gross GHG Emissions Growth in Maryland, 1990-2020: Reference Case Projections



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